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Watering the Desert: Environment, Irrigation, and Society in the Premodern Fayyum, Egypt

Author
Haug, Brendan James

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Watering the Desert:

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By

Brendan James Haug

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of the

University of California, Berkeley

Professor Todd M. Hickey, Chair

Professor Susanna Elm

Professor Maria Mavroudi

Professor Carlos Noreña

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Abstract

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Through a study of its natural environment and irrigation system, this dissertation investigates the evolution of the landscape of Egypt's Fayyūm depression across sixteen centuries, from the third century BCE to the thirteenth century CE. From the evidence of Greek papyri, Arabic fiscal documentation, early modern travel literature, archaeology, and contemporary scientific work, I chart the changes in human relationships with earth and water over time, changes which constantly altered the inhabited and cultivated regions of the Fayyūm. My main argument throughout is that it was local agency and not state governments that continuously remade the landscape.

The history of the Fayyūm after the fourth century CE has long been viewed by ancient historians as one of decline from its ancient heights due to the failure of the late Roman and Muslim successor states to properly manage its irrigation system. I locate the genesis of this narrative within nineteenth century perceptions of the docility of nature and the belief that ancient governments had achieved centralized control over the Nile and the Egyptian environment. This anachronistic retrojection of the characteristics of the modern irrigation system has had a considerable afterlife in historical scholarship on Egyptian irrigation.

Eschewing a narrow focus on the state, this dissertation argues that that nature is a potent agent in its own right. Ancient farmers could not control nature so they adapted to it, creating four distinct irrigated sub-regions in the Graeco-Roman Fayyūm, each tailored to the particulars of the local environment. Our papyri stem from only one of these sub-regions, the water-scarce margins, which lay at the tail end of the irrigation system. Here, inadequate irrigation and fertilization progressively led to soil salinization and degradation, which helped to spur the eventual abandonment of these areas. By the medieval period, only the central floodplain remained inhabited. Only here was sustainable agriculture under the regime of premodern technology possible.

Although the Roman state coordinated local labor on the canals, nothing could bind Fayyūm villagers to the degrading margins in perpetuity. Fourth century papyri hint that some cultivators had moved to other nomes and were prospering. Still later documents of the sixth to eighth centuries CE reveal greatly increased settlement density in the central Fayyūm. Thus, it was local cultivators who made and remade the landscape of the Fayyūm over the centuries according to their own needs. Government could both guide and benefit from this local labor but it could never fully control it.

For my family.

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Last but not least, my family. Mom, Rhys, and Mariana, you have always been there for me and I know you always will be. I love you guys. Unfortunately one member of our little group can't be here with us. Yes, he would laugh derisively at the ceremony and have a few choice words about the attire and the endless speechifying. But I know he'd still be proud.

INTRODUCTION

> *Nature is thoroughly mediate. It is made to serve. It receives the dominion of man as meekly as the ass on which the Savior rode. It offers all its kingdoms to man as the raw material which he may mould into what is useful. Man is never weary of working it up. He forges the subtile and delicate air into wise and melodious words, and gives them wing as angels of persuasion and command. One after another his victorious thought comes up with and reduces all things, until the world becomes at last only a realized will—the double of the man.*
>
> --Ralph Waldo Emerson, *Nature* (1836)

This project has its genesis in an oft-repeated narrative in papyrology. As the most recent formulation puts it, "[I]n the Fayyūm, one of the major areas in which papyri have been preserved, irrigation systems fell into disrepair in late antiquity and some villages in some parts of this region became depopulated as the desert reclaimed previously cultivated land."[1] First appearing in the earliest days of papyrology, this thesis has never been truly argued, let alone proved. Nonetheless, the decline of the Fayyūm, the ancient Arsinoite nome, remains a fundamental part of the intellectual landscape of Graeco-Roman Egypt and appears in one form or another throughout the literature.

Present in papyrological scholarship since its beginnings, this narrative is very much a creature of its time. It was deeply informed by the belief that Egypt and other parts of the Arab world had declined from their ancient heights, their supposedly degraded and desertified landscapes but the mangled remains of lands subjected to centuries of Arab predation. This dogmatic element of European colonial thought was already well established long before scholars began to excavate and publish papyri in great numbers and even the particular narrative of Fayyūm decline long predates the birth of "scientific" papyrology. In 1840, for instance, English political economist John Bowring wrote that "a large European land proprietor in the Fayoum told me he did not think the land so good as that of the Delta, and regretted that he had fixed himself in this part of Egypt. Compared with very remote times, there is little doubt that this portion of the country, so well known as the garden of Egypt, has lost much of its fertility."[2] An earlier world geographical dictionary similarly states:

> Fayoum now suffers severely from the want of watering; and the sands of the desert, wafted by the winds, have rendered some spots of it entirely unproductive. These physical evils are aggravated by the predatory inroads of the Arabs who roam through the western deserts...From all these causes Fayoum no longer displays its former blooming and fertile aspect.[3]

Papyrology swallowed and regurgitated this tale in its entirety, and the repetitions of it that continue to appear with regularity thus owe a considerable debt to the assertions of 19th century writers who saw the Arab world through the prism of a lamentable decline from the heights of pharaonic and Roman power.

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[1] Kelly (2012), 23. This formulation is more restrained and less gloomily evocative than earlier variants. Nevertheless, the sources cited do not prove the narrative but are merely alternative wordings of it. To his credit, the author also cites Keenan (2003), the single most important study yet published to challenge this traditional story.

[2] *Report on Egypt and Candia* (W. Clowes and Sons, London), 15.

[3] *The Edinburgh Gazetteer or Geographical Dictionary*, Vol. II (Longman , London, 1827), 643.

The durability of this narrative in the papyrological literature is due first and foremost not to lingering arabophobia but simply to the character and research agenda of a discipline that has developed around the transcription, translation, collation, and detailed study of thousands of documents. These papyri permit a proximity to life in the ancient world unparalleled in other types of source material from antiquity. Papyrologists have dissected accounts and the workings of private and public economies (the two sometimes deeply entwined), they have studied Graeco-Egyptian families across multiple generations, examined the mechanics and effects of ancient government on the ground, and delved into questions of ethnicity, gender, and religion, all at a level of detail that has made the study of Graeco-Roman Egypt arguably the most fruitful and viscerally stimulating subdiscipline in the entire panoply of ancient studies.

Yet the very nature of the papyrological sources, those of the Fayyūm in particular—their frequent concern with parochial, village-level matters—simultaneously works to inhibit a perspective broad enough to offer a full-throated and convincing challenge to the received wisdom on the Fayyūm's decline. In contrast, papyrologist James G. Keenan's brief but superlative 2003 critique of the narrative—"Deserted Villages: From the Ancient to the Medieval Fayum"[4]—drew upon underutilized medieval Arabic source material has clearly revealed the pressing need to step outside the bounds of traditional Graeco-Roman papyrology in order to gain a greater appreciation of a region that we know well at the level of the country village, but whose workings at a regional level and whose broader historical trajectory remain obscured by the same sources to which we owe so much.

This is in no way meant as a criticism of papyrology but rather as a simple commentary on the limitations of its source material. As ancient historians after all, we should be used to limitations. Yet these expected and unsurprising limits are not the only factor hindering our ability to convincingly dismantle the traditional narrative. For at another level, the narrative retains its potency thanks to its seemingly unproblematic Occam's razor simplicity: in the irrigated desert of the Fayyūm the failure of the canal system and the subsequent cutoff of the water supply would have obviously proved disastrous. Eschewing appeals to *luxuria*, corruption, moral decline, barbarians, or lead poisoning the thesis simply reminds us of the fundamental and indisputable connection between water and life, particularly in arid desert regions. The effects of the supposed collapse of the irrigation system are also plainly inscribed upon the landscape for all to see in the form of empty mud brick villages swallowed by the pitiless Libyan Sahara: "[W]hat man abandoned the desert quickly reclaimed with its blowing sands."[5]

Yet this simplicity is deceitful, for environmental narratives are often more political than factual. In the case of the Fayyūm, the narrative subtly conceals strong connections to powerful currents in earlier European colonial thought. First, earlier iterations of the narrative more explicitly stress the late Roman government's alleged negligence and the subsequent failure of the system, thus giving the central state pride of place in Egyptian water management.[6] Second, and relatedly, the narrative's foregrounding of government inaction puts humanity squarely in the driver's seat, placing nature under the "dominion of man," thus denying it any meaningful agency in the alteration of the Fayyūm's landscape.

Whence these assumptions and why the focus on the collapse of state support for the irrigation system? The intellectual milieu is critical, and we must take note of a *fin de sìecle* obsession with the transformative power of state-directed large scale irrigation projects that

[4] Published in the *Bulletin of the American Society of Papyrologists* 40, 119-39.
[5] Lewis (1983), 108
[6] E.g. Sijpesteijn (1964), 83, Turner (1968), 44, Bonneau (1979c), 65

surrounded the late 19th century adoption of the decline narrative by papyrologists. During this period, a fascination with the much-publicized achievements of hydraulic engineers in India and Egypt informed much contemporary thinking about human life in arid landscapes. The obsession was so profound that it was even projected onto Mars in 1895 by amateur American astronomer Percivall Lowell, who alleged that a massive network of irrigation canals crisscrossed the entire surface of the Red Planet, the monumental achievement of a wise and ancient race, centrally organized and united in pacific harmony by their need to survive in a harsh and ever-degrading desert environment. In another era this dimly observed, extraterrestrial landscape geometry might have provoked alternate explanations. Yet at the height of the hydraulic era contemporary concerns were transported to the stars and an alien world was humanized.[7]

A central tenet of this state-centric hydraulic obsession was the belief that nature was docile and "thoroughly mediate," and both could and should be conquered and controlled. Nineteenth century colonial environmental thought placed great stress—and, indeed, moral worth—upon the supposed ability of powerful and enlightened states, such as the High Roman Empire was imagined to be, to harness the very elements and to tame the mightiest rivers. The blame for the alleged decline of environments like that of the ancient Fayyūm was thus placed at the feet of the supposedly degenerate and inept later Roman state, though Muslims—the Arab and Ottoman imperial successors—received far greater and more ruthless condemnation. These unenlightened, backward states had proved incapable of putting to full and productive use the blessings that nature had bestowed upon them. Their ignorant incapacity, it must be noted, justified foreign control over the natural resources that the uncivilized peoples of the world could not hope to use to their full potential.[8] In a very real way then, the continued and uncritical repetition of this ostensibly prosaic and non-judgmental narrative betrays the fact that "we have entered the twenty-first century still divided by a way of thinking inherited from the nineteenth."[9]

This will no longer suffice. We need a more complex and nuanced approach. Instead of regarding man as the supreme or, as Emerson would have it, semi-sublime arbiter of all things natural, this dissertation seeks to offer an approach to the history of the Fayyūm's landscape that regards nature as a potent historical actor in its own right. I will argue that the story of the Fayyūm is not one of the collapse of a once total command of the elements. Rather, it is a story of human interaction with the natural world and of productive adaptation to insuperable natural realities. It is a story of water, of human attempts to control its flow, and of the effects of these attempts. In short, it is a story of long-term human adjustment to the environmental ramifications of a massive intervention in the region's natural hydrology. At heart, this is a history of the creation and recreation of an environment over time in the unending search for an enduring socionatural relationship with water.

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[7] Drawn from K. Maria D. Lane's new cultural history of the popular Martian irrigation controversy and the popular fascination with large-scale hydraulic projects: *Geographies of Mars: Seeing and Knowing the Red Planet* (Chicago, 2011). See also the review by Andrew H. Knoll, "The Mapping of Mars," *TLS* 23 August 2011.

[8] Such thinking has a long history. According to legal historian Aziz Rana, much seventeenth century colonial thought "defined civilization in large measure according to land use and also served to reinforce narratives about the lawlessness of [American] Indians and the legitimacy of discretionary power over them." John Locke's *Second Treatise on Government*, for instance, defines property as the fruit of labor. As such, the Native American had no legitimate title to the "wild woods and uncultivated waste of America, left to nature, without any improvement, tillage or husbandry" (5.37). Aziz Rana, *The Two Faces of American Freedom* (Harvard, 2010), 33-5, quote at 33.

[9] Mitchell (2002), 1

This is not the type of history that can be written only from texts or from archaeology or from the science of the landscape. Rather, as colonial engineer Robert Hanbury Brown wrote of the ancient Fayyūm's Lake Moeris (now Birkat Qārūn), it is a history that requires "an alliance between a palaeontologist, an archaeologist, an Egyptologist, a geologist, and a hydraulic engineer."[10] While no single scholar can truly master all of these fields, the history of the Fayyūm's landscape is nevertheless a subject that demands an attention to all of these subject areas, as well as a broad perspective that follows humans and water over the *longue durée*, charting the changes that manifest themselves across the centuries.

The available source material is thankfully well suited for such a project. The texts from the Ptolemaic and early Roman periods are abundant and informative. A small and long ignored collection of 6th-8th century CE papyri from the capital of the region, Medīnat al-Fayyūm (ancient Arsinoe) offers a glimpse at overall settlement spread that bests even the more robust earlier documentation. A 13th century Egyptian fiscal survey, the *Tārīkh al-Fayyūm* by the Ayyūbid functionary Abū 'Uthmān al-Nābulusī, offers a wealth of detail on medieval irrigation and settlement patterns and illustrates the problems and possibilities of irrigated Fayyūm agriculture better than any other written source. Lastly, the voluminous writings of scientists and engineers, both colonial Europeans and contemporary Egyptians, are a valuable resource for the historian of the landscape. The work of these specialists offers considerable insights into water and earth in the Fayyūm, the underlying natural structures that support human life in this fragile, desert region.

The dissertation begins with a discussion of the colonial intellectual milieu in which the Fayyūm's decline narrative entered papyrological discourse. Then-contemporary thought viewed the great empires of the past as the masters of the Nile and colonial engineering was meant to restore Egypt to this former glory. The engineers modeled their imaginative depictions of the ancient Egyptian state upon the strict state centralization that their own projects had created. The view that the pharaohs, the Ptolemies, and the Roman emperors had at one time fully mastered the Nile was thus an anachronistic retrojection of the realities (and desires) of modern irrigation technology upon the ancient past. In truth, the ancient landscape was characterized by great fragmentation and diversity. As such, a convincing study of human relationships with water in ancient Egypt must resist generalizations and focus more closely upon socionatural relationships with the environment at the regional level. Chapter two elaborates just such an approach by adopting the Fayyūm as a case study and taking account of the effects both human and natural agents have had upon the development of the landscape over a period of many centuries.

Chapter three illustrates in some detail the basic natural-environmental characteristics of the Fayyūm, illustrating the natural setting and the raw materials with which cultivators are compelled to work in this singularly unique region. It also details the fundamental limitations of the Fayyūm's desert landscape, the hardships involved in delivering and draining irrigation water as well as the poor quality of the region's marginal soils. This sets the stage for chapter four, an examination of the functionality of the canal system first inaugurated by the earliest Ptolemies. We will see that this system operated differently throughout the depression. The local characteristics of the various subregional divisions of the Fayyūm and the way in which water flowed within and through them informed the creation of four distinct agro-ecological zones. Only one of these zones, the water-scarce and marginal desert fringe, has preserved

[10] Brown (1892), 56

papyrological evidence in great amounts. Because the villages located here were subject to unique environmental pressures, it is dangerous to make assumptions about environmental conditions, agricultural productivity, or demography in the rest of the Fayyūm, or indeed the whole of Egypt, based upon their evidence alone.

Chapter five takes what little evidence survives for the social relations of irrigation in these same border regions and places it within a comparative context. I argue that the natural setting of the border regions and the fundamental problem of water scarcity made water rights and apportionment a fraught proposition. Water theft and conflict were thus endemic in these villages, which represented the tail end of the Fayyūm's irrigation system. These were the settlements that received the leftovers, in other words. The second portion of this final chapter examines the maintenance of the canal network. I argue that while the state did indeed play a role, most notably in the Roman period, canals and drains were managed by those who used them and state mobilization of labor represents an institutionalization of extant communal practices, not, strictly speaking, a despotic corvée. In conclusion, I reverse the traditional narrative of Fayyūm decline, seeing abandonment as the cause of the irrigation system's eventual failure, not the effect.[11]

This project thus seeks to sketch in broad strokes the general trajectory of the Fayyūm's landscape over sixteen centuries, from the period of the Ptolemaic reclamation in the 3rd century BCE through the medieval period. In general, I consider the history of the Fayyūm over this long period to be a long-term pursuit of balance, of a sustainable equilibrium. We will see that the borders of the cultivated Ptolemaic and Roman Fayyūm did indeed reach an extent unrivaled until the late nineteenth century. After the early Roman period, the Fayyūm undeniably began to contract and by the thirteenth century, if not earlier, it had reached a size that it managed to maintain until European engineers revolutionized Egyptian irrigation and allowed cultivation in the Fayyūm to expand once again, returning it to the borders it had abandoned in antiquity.

But bigger is not always better. On its own, the gross size of the Fayyūm tells us nothing about its the success of agriculture within its borders. In fact, along the far-flung margins of the ancient Fayyūm, life was precarious. The villages here were subjected to progressive land degradation promoted by the inefficiencies of the irrigation system and the continual need to produce a crop for taxation purposes. These were not regions that were conducive to sustainable intensive agriculture over the long term. Over the centuries, Fayyūm farmers left these regions in search of better lands and eventually created a smaller but considerably more stable Fayyūm in the more productive central regions of the depression. Well-watered and fertile, this smaller Fayyūm represents the successful achievement of a relatively sustainable equilibrium, not a long and dreary decline from previous glory.

This is not to say that change is always painless. I do not seek to adopt the sometimes over-sanguine language of certain advocates for late antiquity who seek to efface the pain that often accompanies change, replacing it with smooth and painless "transformation." The fourth century CE archive of Aurelius Sakaon of the western village of Theadelphia does indeed betray the frustration and hardship of living in a dying village from which the Roman state still demanded revenue. Yet while Sakaon and the Theadelphians may at times have suffered greatly, the minute detail that this archive offers compels us to see only gloom and the pain of transformation. Its parochial concerns obscure a wider picture, one that reveals the slow birth of an altered Fayyūm that would retain its more compact shape until Egypt's dislocating encounter

[11] In this I am greatly influenced by Christopher Fisher's (2010) work on the "population—land degradation fallacy" and the degradation of landesque capital in Lake Pátzcuaro Basin in Mexico.

with nineteenth century "modernity." Great detail can thus at times conceal more than it reveals, for "if a victory is told in detail, one can no longer distinguish it from a defeat."[12] The goal of this dissertation is thus to step back from Sakaon, to step back for the narrow perspective of late antique abandonments and to observe sixteen centuries in the life of an ancient landscape and an environment whose history is still being written on the ground.

[12] Sartre, *The Devil and the Good Lord* (*Le diable et le bon dieu*), Act 1

CHAPTER 1
DREAMS OF MASTERY
Colonial Engineering and Egypt's Imagined Past[1]

> *This world is a great wiggly affair. Clouds are wiggly, waters are wiggly, plants are wiggly, mountains are wiggly, people are wiggly. But people are always trying to straighten things out! But the real world is wiggly wiggly wiggly.*
>
> --Alan Watts

1.1: INTRODUCTION

Karl August Wittfogel's 1957 work *Oriental Despotism: A Study in Total Power* has been consistently disparaged since the very moment it appeared. Inspired by Marx's Asiatic mode of production, Wittfogel's environmentally deterministic "hydraulic hypothesis" argued that ancient states naturally evolved centralized and totalitarian governmental structures to manage the large-scale irrigation systems upon which their agriculture depended. As was noted in even the earliest reviews, the thesis was very often at odds with basic historical facts, particularly in the case of Chinese history, which formed the book's central argumentative pillar.[2] In the case of ancient Egypt, the absence of any centralized water bureaucracy rendered his theory dubious at best.[3] While Wittfogel remains today little more than a straw man, it has become *de rigueur* to mention his work in any study of irrigation and society, if only to acknowledge the existence of this bizarre, ponderous scholarly landmark and to affirm that its thesis will not impose itself upon the project at hand. Having disposed of despotism the writer may then discuss an irrigation system free from unwelcome ideological baggage.

I argue here that this ritual is insufficient when writing on Egyptian irrigation. Even those who eschew Wittfogelian despotism still often privilege the state and the attendant notions of power and control in their discussions of Egyptian water management. A relatively recent contribution to the study of the Ptolemaic Fayyūm, for instance, opens by matter-of-factly stating that the "control of the Nile flood, with the irrigation and drainage works that this necessitates, has always been of crucial importance for whoever controls the land of Egypt."[4] An earlier

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[1] This chapter was initially inspired by Keenan (2003). I have borrowed the phrase "dream of mastery" from Paul Wapner's *Living through the End of Nature: The Future of American Environmentalism* (MIT Press, 2010). Wapner contrasts the so-called "dream of mastery," the vain belief than humans can control every aspect of the natural world, with its equally unattainable inverse, the "dream of naturalism," in which pure and inviolate nature can be both restored and perpetually protected from human influences.

[2] See, e.g., Joseph Needham in *Science and Society* 23 (1959) at 58 and 61: "[I]nstead of a mature and deeply-thought out contribution to scholarship, we now find in our hands a political tract which later generations will only be able to understand in the context of the "cold war" period....[O]ne feels that Professor Wittfogel has lost all touch with reality and has taken up his abode in a realm of schematic analogies which no facts would ever be allowed to modify." Cf. Alfred Toynbee in *The American Political Science Review* 52 (1958) at 198: "[H]is present book is, in my opinion, something of an aberration and still more of a menace."

[3] The comments of Hassan (1997) at 69 are representative: "The emergence and maintenance of Egyptian civilization was not a function of centralized management of irrigation. Egypt probably survived for so long because production did not depend on a centralized state." Cf. Manning (2002), 616 and, in general, Manning (2012).

[4] Thompson (1999a), 107

author, writing on the agricultural policies of the modernizing *khedive* Muḥammad (Mehmet) ʻAlī more evocatively reproduces the same sentiment:

> The Nile not only determines the existence of Egypt itself, but it also in many ways fixes the type of government and institutions the Egyptian people can have. For example an incontrovertible fact of Egyptian life is that there must always exist a highly centralized administration to direct the distribution of water from one end of the country to the other…[T]he welfare of all depends upon maintaining the unity of the central government so that the economic structure of the country is not destroyed.[5]

Though the despot himself is absent, these descriptions nevertheless remain despotic in their conviction that Egypt's fundamental nature necessitates the firm hand of a powerful and interventionist state. Owing nothing to Wittfogel, this state-centric perception was developed by nineteenth and twentieth century French and British hydraulic engineers (and often part-time antiquarians), beginning with Napoleon's *savants*. Rather than regarding irrigation as an expression of local relationships with the Nile, these engineers (recently dubbed "the leading purveyors of the idea of progress and mastery over nature"[6]) depicted it in their writings as a homogeneous and fully integral element of the Egyptian landscape, a wholly natural "system" stripped of human agency and conducive to the same sort of control and mastery they hoped to exert over the Nile itself. Strong centralized control of irrigation was thus regarded as the only rational and productive relationship with the river. In this reading, Egypt's wealth had always been closely tied to the amount of control exerted by her government over the water supply and the great empires of antiquity—the pharaohs, the Romans—were believed to have achieved perfect mastery over the irrigation system. When their grip slackened, Egypt fell into destitution.[7]

This practitioners' history of Egyptian irrigation was not conjured out of thin air, nor was it drawn from careful readings of the available ancient evidence. Instead, it was modeled upon the ideology and the functionality of the modern irrigation system these same engineers were creating, itself inspired by the theoretical approaches hydraulic engineering taught in contemporary military engineering academies throughout Europe. This curriculum produced "engineers...ready to be at once the doctors and surgeons for water," who viewed free-flowing rivers as defective, dangerous, and in need of restriction to straight and clearly defined channels. As Johann Gottfried Tulla, the engineer in charge of the Rhine's first so-called "rectification" in 1817 wrote, "no stream or river, the Rhine included, needs more than one bed; as a rule, multiple branches are redundant."[8] To rectify the Nile, the power and resources of the state were to be

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[5] Rivlin (1961), 1

[6] Burke (2009), 98

[7] Cf. the comments at p. 95 of Ostrom and Gardner's (1993) programmatic study of irrigation and the commons: "The theoretical presumption that an external, central government is necessary to supply and organize forms of collective action, such as providing irrigation works, has been reinforced by the colonial experience....The resulting centralization of governmental power over the supply of irrigation water has been continued, in most instances, by the governments that were created as colonial powers left the scene...From this viewpoint, national governments become the only agency that should or could invest in constructing and managing irrigation systems. This orientation toward the necessity of central authority is intensified by a second presumption that supplying irrigation requires considerable technical expertise, which is unlikely to be found locally."

[8] Drawing on Cioc (2009) at 168-9. He notes also the strong martial overtones of Renaissance, Enlightenment, and nineteenth century hydraulic engineers. Tulla wrote of his planned rectification of the Rhine as a "general operational plan" for a "defense against [Rhine] attack," a project later praised by a German official as "a war strategy against the Rhine's waters." One may compare the career of the father of William Willcocks, Englands

deployed to implement perennial irrigation on a grand scale. This state-constructed hydraulic infrastructure created the first true irrigation "system" in Egypt, abolishing the discrete, locally-managed basin irrigation tradition famously described by M.P.S. Girard in his contribution to the *Description de l'Égypte.*[9] By linking these local basins together into a single nationwide hydraulic network, the Egyptian state created for itself a new role as Egypt's ultimate water authority.[10] This system sought both to dominate every inch of the Nile and "to locate all authority and control, over the distribution and supply of irrigation requirements, firmly at the top and [to] remove any meaningful authority and involvement at the local level."[11]

When the earliest engineers to study Egyptian irrigation had witnessed the hyperlocalism of water control and the virtual absence of the khedival state on the ground, they interpreted this state of affairs as an historical aberration, the failure of the current Egyptian government to fulfill its natural and proper role. The goal of later British engineering was to abolish this abject disorder and to restore the centralization and efficiency of antiquity. It was an oddly Janus-faced venture, one that proposed to use the science and technology of European modernity to resurrect the ancient past.

The effects of this sort of colonial thinking upon the study of ancient irrigation have not gone entirely unnoticed in the scholarly literature. Brent Shaw has already written of French schemes to resurrect the Roman-era North African waterworks that had allegedly acted "as a sort of *deus ex machina*, responsible for the transformation of the economic basis of the countryside."[12] In order to be restored, of course, these supposedly sophisticated systems had to be located in the landscape. And yet, "colonial preconceptions and demands dominated the methodology employed in the investigation of the role of irrigation and other water control systems in the development of the rural economy during the Roman period."[13] Any waterworks that appeared to European eyes to be too large, too complex or of too uniform a design to be the result of native industry were ascribed to Romans colonists and engineers who alone possessed the requisite technical and hydraulic expertise.[14]

By contrast, the influence of British colonial scientific thought upon Egyptian historiography is rather more subtle though it remains pervasive and consequential. Unlike the

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most prolific hydraulic engineer. His father, an army volunteer, eventually ended up in India. During peacetime he was posted to the irrigation division of the Public Works Department and became a self-trained engineer (Willcocks [1935], 13-4).

[9] Manning (2010), 36-7, referring to M.P.S. Girard, "Memoire sur l'agriculture, l'industrie, et le commerce de l'Égypte," *Description de l'Égypte, État Moderne,* Vol. 2, Part I, 496-502. On the localism of basins, see Girard at, e.g., 497-8: "Ces digues, dirigées ordinairement d'un village à l'autre, servent de communication entre eux pendant l'inondation, et sont entretenues par leurs habitans" ("These dykes, ordinarily controlled from one village to another, serve as communication between them during the flood, and are maintained by their inhabitants").

[10] Burke (2009), 101: "The confirmation of the [Egyptian] state's responsibility for the development of the irrigation infrastructure was perhaps the most important consequence of the widespread adoption of perennial irrigation."

[11] Kalin (2006), 8, quoting page 33 of a 1994 Oxford DPhil thesis by Lufti Salem Radwan entitled *Irrigation and Social Organisation in Egypt*, a text that I have been unable to obtain. The Cairo-based central administration controlling Egypt's water supply has been in continuous existence since 1836, undergoing numerous name changes. Beginning as the Public Works Department. it is has since 1999 been referred to as the Ministry of Water Resources and Irrigation. During the British period it was the Administration (later, Ministry) of Public Works. Source: Egyptian Ministry of Water Resources and Irrigation, http://www.mwri.gov.eg/En/background.html. Accessed January 1, 2012.

[12] Shaw (1984), 128

[13] *ibid,* 124

[14] Shaw (1984), 124-7. He notes that many of these "Roman" waterworks were later revealed to be medieval or early modern creations.

French and the Italians, the British did not identify themselves as the cultural and racial heirs of Rome returning *en masse* after a long historical interlude. Nor were there English equivalents to such French government-sponsored publications as the 39 volumes of the *Exploration scientifique de l'Algérie* (1844-67) or the numerous fascicles of the *Enquête administative sur les travaux hydrauliques anciens en Algérie* (1897-1911). That is, there was no large body of pseudo-scientific, heavily ideological "documentation" of the decline of Egypt's irrigation in English upon which early British papyrologists and historians could draw. Even the impact of the famous *Description de l'Égypte* upon British intellectual communities appears to have been wholly negligible.[15] Rather, in combination with a broader "environmental declensionist narrative"[16] that had crystallized by the mid-nineteenth century, British engineers independently popularized a technocratic worldview in which despotic centralization was both necessary and natural, a perspective that encouraged monocausal, environmentally-deterministic interpretations of Egyptian history: absent the firm hand of the state, Egypt's irrigation "system," like the river itself, descends into chaos as nature's innate tendency toward irrational disorder takes hold. This view has remained so stubbornly entrenched that it has taken on a life of its own in the popular imagination, such that a new history of water in world civilizational perspective claims that Gamāl 'Abd al-Nāṣir's High Dam at Aswān (completed on 15 January 1971) represents "a renewal of Egyptian control over the Nile like that exerted by the Pharaohs of its bygone ancient civilization."[17]

1.2: THE DECLINE OF ANCIENT ENVIRONMENTS

1.2.1: North Africa and Palestine

The connections between ancient history and colonialism are already reasonably well known.[18] In an important 1996 survey article David Mattingly explores the ideology of French and Italian colonial officials and scholars, who treated their occupation of North African nations as a reestablishment of Roman/European power.[19] As Italian national poet Giovanni Pascoli put it:

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[15] This is not to discount entirely the possible influence of its particular declensionist outlook as the selections from Bowring and the *Edinburgh Gazetteer* quoted in the introduction indicate. For the reception of the *Description* in nineteenth century Great Britain see in general Bednarski (2005). While some subscribers and recipients (both individual and institutional) of the *Description* are known, the extent of its intellectual influence is difficult to discern. In general, Bednarski documents the availability of the *Description* at various institutions in Britain but also finds numerous complaints about its inaccessibility. He concludes at p. 95 that "evidence suggests that the corpus failed to make any direct, visibly large, scholarly impact on the academic or literary communities in Britain. Yet despite its lack of use, the work was still recognized by various segments of British society, as it was mentioned across a range of periodicals, each with different goals, political biases, and formats."

[16] Borrowing the phrase of Diana K. Davis used throughout e.g. Davis (2007).

[17] Solomon (2010), 240

[18] Egypt has not been totally ignored in these discussions. Bagnall (1997) and Bowman (2002) offer useful discussions, though neither touch upon the issues at play in this chapter. Bagnall discusses the problems and pitfalls of utilizing the scholarship of modern European colonialism as a heuristic for understanding government and society in Ptolemaic Egypt. He notes at 238 that direct comparisons are often deeply fraught, though much good can come "from an imagination informed by knowledge of the colonial world. " Bowman's richer and more far-reaching contribution addresses perceptions of Egypt, both ancient and modern, and focuses upon the strict divisions drawn between the "classical" and the "oriental" and the need to enrich our understanding of cultural interplay in antiquity.

[19] Republished and lightly emended in Mattingly (2011), including English translations of the French and Italian sources quoted. The work of Phiroze Vasunia is also indispensible in this regard. See, e.g., "Greek, Latin, and the Indian Civil Service," *The Cambridge Classical Journal: Proceedings of the Cambridge Philological Society* 51 (2005), 35-71 and "Virgil and the British Empire, 1760–1880," in *Lineages of Empire: The Historical Roots of*

> We were there already, we left signs that not even the Berbers, the Bedouins and the Turks could erase.[20]

The Roman identity of French colonists was equally well expressed by the early epigraphist Louis Renier, who when asked by a local sheikh if he could read a Latin inscription, said "'Oui, je la comprends et je l'écris: car c'est la miene aussi. Regards ce sont nos lettres, c'est notre langue."[21] Any claims the native peoples of North Africa had on their own lands and territory had to be erased and their dependence upon European authority stressed:

> La tragedia della storia del popolo berbero è rappresentata da questi due estremi: essi non sono mai riusciti a costituirsi a nazione e non hanno maivoluto subire il dominio dello stranieri.[22]

North Africans could not appreciate the richness of their cultural patrimony and required European assistance to fully understand it. Of course, this cultural richness owed nothing to native genius but to the immigration of great numbers of Romans to the country in antiquity, in clear parallel to the arrival of modern European colonizers:

> C'est par milliers que les familles romaines viennent dans le pays. Cependant l'agitation [des indigenes] continue, et c'est au milieu des insurrections ...l'épée d'une main et la charrue de l'autre, que Rome porsuit ... son travail colonial et civilisateur sur la terre d'Afrique.[23]

More pressing for my concerns here are contemporary declensionist perceptions of the natural environment, for this was the outlook that framed colonial projects of environmental restoration. It was widely believed that a vast array of waterworks had helped to turn Roman North Africa into a heavily wooded landscape: "les texts anciens formels nous montrent le bord du Sahara comme une espèce de grande jungle," as one author put it.[24] Yet this woodland had seriously degraded by the modern period: "n'était ni déboisée, ni dépeuplée comme nous la voyons aujourd'hui...elle était le grenier d'abondance de Rome et d'Italie: *Romam magna ex parte sustenabat Africae fertilitas*."[25] Arab nomads drew much of the blame, for it was said that they could not abide the existence of trees; they cut them down to open up space for pasture, to make tent stakes, and even from simple malice. As one arboriculturalist claimed, "sur le terres fertiles, ou covertes d'arbres...l'Arabe est un fléau, il le fut toujours, historiquement, et il le sera

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British Imperial Thought (2009), edited by Duncan Kelly (*Proceedings of the British Academy*, 155), 83-116. See also in general *Classics and Colonialism,* edited by Barbara Goff (Duckworth: London, 2005), particularly Vasunia, "Greater Rome and Greater Britain," at 38-64.

[20] Mattingly (1996), 50

[21] *ibid.* "Yes, I understand it and can write it, because it is my language also. Look, these are our letters, this is our language."

[22] "The tragedy of the history of the Berber people is represented by these two extremes: they have never succeeded in creating their own nation and they have never submitted willingly to the rule of the foreigner." *ibid.* 51, quoting from p. 251 of A. Piccioli (1931) *La porta magica del Sahara Itinerario Tripoli-Ghadames* (Tripoli).

[23] "Roman families came to the land by the thousands. However, native unrest continued, and it was in the middle of insurrections that Rome, the sword in one hand and the plow in the other, pursued her colonial and civilizing work in the land of Africa." *ibid.* 52, citing p. 288 of the 1906 *Guides Pratiques Conty, Algérie –Tunisie*. Paris.

[24] "Ancient texts show us the Saharan coast as a sort of grand jungle." Shaw (1984), 125, quoting Coudray la Blanchare, *L'aménagement de l'eau et l'installation rurale dans l'Afrique ancienne* (Paris, Imprimerie nationale, 1895).

[25] "It was neither deforested nor depopulated as we see it today…it was the abundant granary of Rome: the fertility of Africa in large part sustained Rome." From Davis (2007), 61.

encore; le civilisation doit l'en extirper, parce qu'il est là contre la destinée providentielle."[26] Under the tutelage of a French "administration supérieure" the "gloire ancienne" destroyed by this Arab plague could be cured.[27]

The colonial environmental history of Palestine is replete with similar self-serving declensionist elements. The combination of Arab mismanagement, ignorance, and malice had produced degraded environments whose renewal would benefit all, both local Arab and Jewish settler alike. Such was the argument in a scene from Theodor Herzl's 1902 novel *Altneuland:*

> Just look at that field! [exclaims local Arab leader, Rashīd Bey] It was a swamp in my boyhood. The New [Zionist] Society bought up this tract rather cheaply, and turned it into the best soil in the country. It belongs to that tidy settlement up there on the hill. It is a Moslem village—you can tell by the mosque. These people are better off than at any time in the past. They support themselves decently, their children are healthier and are being taught something. Their religion and ancient customs have in no wise been interfered with. They have become more prosperous—that is all.[28]

Written for lay audiences, books such as *Palestine: Land of Promise* (1944) by Berkeley-educated soil conservationist Walter Lowdermilk popularized the declensionist narrative for later generations.[29] Supported by "historical data and archaeological finds" we are informed that Palestine had known great fertility and productivity and had supported a much larger population until the beginning of its decline in the 7th century.[30] A first decline occurred at this point, followed by utter ruin during the Crusades and a second Arab invasion. Arabs brought "an entirely different and much more primitive culture...from the grazing lands of the desert." These nomads and their ravenous goats stripped many cultivated areas, leaving them barren wastes.[31]

As in French and Italian North Africa, this narrative was deeply political and was deployed to help justify the acquisition and retention of territory. In 1947 Zionist representatives to the United Nations urged that the upcoming partition of Mandate Palestine should include the southern Negev desert in the forthcoming Jewish state:

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[26] "For land that is fertile or covered with trees...the Arab is a plague; he has always been so and he will be in the future; civilization must annihilate him, because he exists against providential destiny." François Trottier (1876), *Boisement et Colonisation: Rôle de l'Eucalyptus en Algérie* at 24. Quoted in Davis (2007), 61.

[27] Davis (2011) 65, quoting Jean André Naopoléon Périer (1847), *Exploration scientifique de l'Algérie pendant les années 1840, 1841, 1842* at p. 29-30. On-the-ground effects of this ideology were profound, including widespread afforestation and the subsequent curtailment of traditional pastoralism, since the nomads' goats were held responsible for the alleged loss of considerable vegetative cover. Such was the rather ugly birth of an "environmental consciousness" and "conservation." Davis (2007) is a survey both of the ideology of French "environmental history" and its actual effects on the inhabitants of French-occupied North Africa. For an account of the colonial and neocolonial aspects of nature reserves and conservation in Sub-Saharan Africa, see Robert H. Nelson, "Environmental Colonialism: 'Saving' Africa from Africans," *The Independent Review* 8.1 (2003), 65-86. For a survey of the conflict between native peoples expelled from their land and conservationists in various world regions including American, Africa, India and Thailand see Mark Dowie, *Conservation Refugees: The Hundred-Year Conflict between Global Conservation and Native Peoples* (MIT Press, 2009).

[28] Quoted in Neil Caplan (2010), *The Israel-Palestine Conflict: Contested Histories*, at 69.

[29] Published in 1944 by Harper Brothers (New York and London). So too American newspapers: see for instance the identically-titled article in the September 24, 1922 edition of the *New York Times* "Palestine Land of Promise: Farms Thriving, Trade Picking Up, New Cities Rising in Former Waste Places."

[30] Lowdermilk, *Palestine*, 57

[31] Lowdermilk, *Palestine*, 69-70

> The largely uninhabited, derelict territory could be developed only by means of bold and comprehensive irrigation schemes, which we alone were ready and able to undertake. Handing over the Negev to Arabs...meant abandoning it to eternal neglect and desolation. Only the Jews, who were prepared to invest their full energies and resources in the Negev with no commercial intent, could redeem the vast arid expanse and uncover buried mineral deposits.[32]

1.2.2: The Decline of Egypt's Irrigated Environment

In Egypt, the declensionist narrative had already begun to take root during the brief Napoleonic expedition (1798-1803). The monumental *Description de l'Égypte*—the product of surveyors, scientists, and engineers rather than historians—had commented upon the supposed decline of Egypt's irrigated landscape since antiquity.[33] Armed with visions of unsurpassed ancient prosperity the *savants* were shocked at the apparent disorganization and irrationality of contemporary Egyptian peasants, noting that "instead of subjecting the Nile to suit the demands of their agriculture [they] calibrated their crop cycles and planting patterns according to the time of the flood and its extent."[34] In his *Préface historique* to the *Description*, mathematician Jean-Baptiste-Joseph Fourier claims:

> Les travaux agricoles consistent principalement dans les irrigations; aujourd'hui la répartition des eaux est irrégulière et imparfaite. Les canaux qui les apportent, sont tracés sans réflexion et sans art; elles arrivent dans certains lieux avec une abondance superflue, tandis que d'autres terrains demeurent exposés à une longue stérilité.[35]

Yet while the basic tools of Egyptian agriculture appeared to contributor Gaspard de Chabrol (an engineer and graduate of the École Polytechnique) to be unchanged since pharaonic antiquity, he nonetheless saw the practice of irrigation as degraded:

> Les Égyptiens modernes, à l'instar de leurs ancêtres, emploient les irrigations à la culture des terres: mais ce procédé ingénieux, que les anciens avaient porté à un si haut point de perfection, a bien perdu sous les modernes de son utilité. Au reste, la charrue est encore à peu près la même; celle qu'on a trouvée peinte dans les hypogées."[36]

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[32] Caplan*, op. cit.* n. 26 at 70-1, quoting David Horowitz, *State in the Making* (New York: Alfred A. Knopf, 1953). The idea is firmly rooted in Locke's conception of the creation of property through productive labor briefly discussed in the introduction. In some contemporary Israeli historiography the narrative has lost none of its justificative power. Military historian Martin Van Creveld's 2010 history of Israel opens with a section tellingly titled "A Terrible Land." Over 16 pages Van Creveld simply recapitulates the declensionist narrative in full: before its reclamation, Palestine was a waste, degraded by centuries of poor Arab husbandry. The laziness of the natives and the incapacity of a rapacious but incompetent government are stressed, but once again, goats receive their fair share of the blame. Arab nomads and their hungry herds left nothing in their wake and "visitors to the area were surprised to learn that, in the entire country, there was not a single forest" (p. 5). As the land was destroyed, so went the people: "Probably no other country has to many place names starting with *Hirbet* [*sic*], Arabic for 'ruins of' [and] the first prerequisite for making an area fruitful again, was, and is even today, to fence it so as to keep the goats out" (p. 6).

[33] Kalin (2006), 45. On the authors of the *Description,* Harten (2003) at 37: "It was the engineers, Napoleon's *savants*, rather than the learned Orientalists, who came to speak on behalf of Egypt."

[34] Kalin (2006), 30

[35] At page xxx of his *Préface* to vol. I of the *Description,* miscited in Kalin (2006), 27-8: "Agricultural labors consist primarily of irrigation; today the distribution of waters is irregular and imperfect. The canals which bear them are plotted without thought and without skill; they arrive in certain places with an unnecessary abundance, while other lands remain exposed to a long barrenness."

[36] "The modern Egyptians, in the manner of their ancestors, employ irrigation for the cultivation of the land. But this ingenious procedure, which the ancients had brought to such a high point of perfection, has under the moderns

The khedival interim between the Napoleonic expedition and the British occupation saw the beginnings of a revolution in Egyptian water control. Alan Mikhail dates the beginnings of this historical rupture to the second decade of the nineteenth century and the construction of the Maḥmūdiyya canal. A 300,000-strong peasant corvée, a third of whom died during the work, was conscripted to construct a forty-five mile long waterway to link the western Rosetta (Rashīd) branch of the Nile to Alexandria and bring a continuous supply of freshwater to the city. For Mikhail, the failed Maḥmūdiyya project marks the "end of an imperially coordinated system of hyperlocalism" and the beginnings of a new type of statist relationship with water.[37]

Two additional projects were also undertaken during roughly this period, both attempts to increase crop production during the summer, the traditional harvest season. Beginning in 1820 Lower Egypt's *seifī* or "summer" canals were dug up to twenty feet deeper in the attempt to channel more Nile water onto fields during this low-water season. Like the Maḥmūdiyya canal, the deeper *seifī* canals proved useless and the project was abandoned in 1825. The weakly sloped canals silted up rapidly and demanded the constant attentions of a conscripted labor force in order keep them even remotely functional. While the labor required to prepare an old-style basin for the flood might at times have been arduous, "it was quite another [thing] to spend the summer months of intense heat in arduous labor extracting the sediment from the canals in order to water the fields of landed estates."[38]

Of greater and more lasting importance was the Delta Barrage, a series of dam-like structures at the apex of the Nile Delta, whose purpose was to retain floodwaters behind the barrage as the inundation subsided. The water would then be channeled into the canals of the Delta to ensure greater perennial cotton production. Construction began in 1843 and lasted until 1861, yet the completed barrage's foundations were weak and shifting and the structure was not made sound until the repair work of later British engineers was completed in 1890.[39]

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lost its usefulness. Besides, the plow is still roughly the same as that which is found painted in tombs." *Essai sur les mœurs des habitans modernes de l'Égypte*. Vol. 2.2 (1822), at 512.

[37] For the Maḥmūdiyya, see chapter 6 of Mikhail (2011a), 242-90. The canal was eventually a failure. It silted too rapidly and the constant influx of sea water made its undrinkable.

[38] Collins (2002), 139. See also Alleaume (1999) at 339. On the nature of these "landed estates" see Mitchell (2002), 54-79.

[39] *ibid.*, Tvedt (2004), 20-1. See also Robert Hanbury-Brown's 1902 survey *The Delta Barrage of Lower Egypt* (National Printing Department: Cairo).

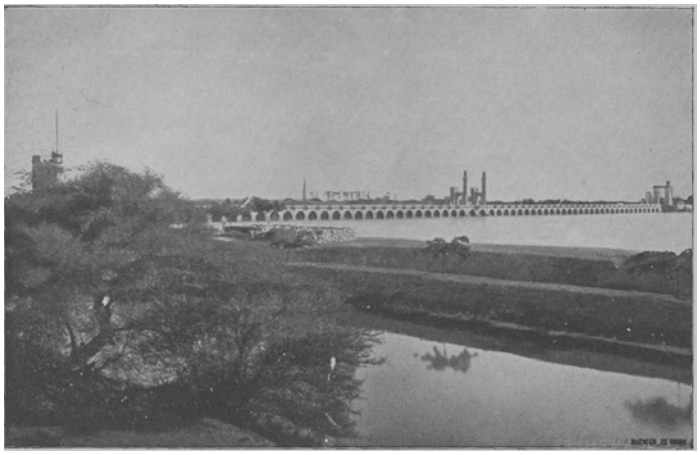

Fig. 1: View of the Rosetta Branch barrage from downstream, ca. 1895.[40]

While the experiments in *seifī* irrigation were being conducted in the Delta, far more significant developments were taking place in the Valley. These changes would have considerable effects not only upon crop production but also upon modern understandings of ancient Egyptian basin irrigation. During this period, the small, locally-managed canals and inundation basins long characteristic of ancient Egyptian irrigation began to be linked together to create massive, interconnected basin "chains." These immense supra-regional structures began to erode the localism and small-scale heterogeneity of Egyptian irrigation as visually depicted in the *Description*'s atlas and as recorded in demotic documents of the Ptolemaic period from upper Egypt.[41] Perhaps more accurately described in Arabic as "columns of basins" (*a'midat al-hīdān*), these new homogenizing structures were served by a large central channel (*tur'at al-wārid*) that flowed parallel to the river from south to north, feeding the successive smaller sub-basins comprising the larger "column."[42] It was this then-contemporary modern structure that was depicted by British engineers in their treatises on Egyptian basin irrigation, illustrations in turn occasionally adopted by historians of premodern Egypt and presented as visual descriptions of ancient basin irrigation.[43]

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[40] Frontispiece of Robert Hanbury-Brown, *History of the Barrage at the Head of the Delta of Egypt* (F. Diemer: Cairo: 1896).

[41] In 1888, there were only 212 basins in the whole of Upper Egypt, covering some 1.43 million acres. The Delgāwī basin at the end of the Sohagia system alone covered 50,000 acres while the Koshēsha basin at the end of the Bahr Yusuf coverd 75,400 acres. Willcocks and Craig (1913), 305. See Andrews (1992) for the demotic evidence from the Pathyrite nome in Upper Egypt. In contrast to the massive and homogenous basin structures of the nineteenth century she describes the more complex, small-scale Pathyrite landscape at p. 30 as "watered by a great system of canals with attendant dykes and watercourse which ran parallel with the river and were themselves crossed at various point by lesser canals and channels running transversely to the Nile." For small-scale, local irrigation in the Ottoman period see Mikhail (2011) at 38-81.

[42] Alleaume (1992), 306-8

[43] Among ancient studies see, e.g., p. 75 of Alan Lloyd's commentary on Herodotus II.1-98 and Karl Butzer's entry "irrigation" in K.A. Bard *ed.* (1999) *Encycolpedia of the Archaeology of Ancient Egypt* (Routledge: New York) at 457, where the latter states that "functional examples of basin irrigation were documented in Egypt during the 1880s, prior to the construction of barrages and high-lying canal systems that increasingly changed the topography." See also Borsch (2004) at 458, discussing 14th century Egypt, as well as Ibrahim and Ibrahim (2003) at 73. The depictions of a "typical inundation basin" presented by all these authors are clearly based upon the drawing appearing on page 306 Willcocks and Craig (1913). Again, the system(s) documented by Willcocks in the late 1880s represent not true ancient basins but the "column basin, "a medial stage between the premodern period and contemporary perennial irrigation.

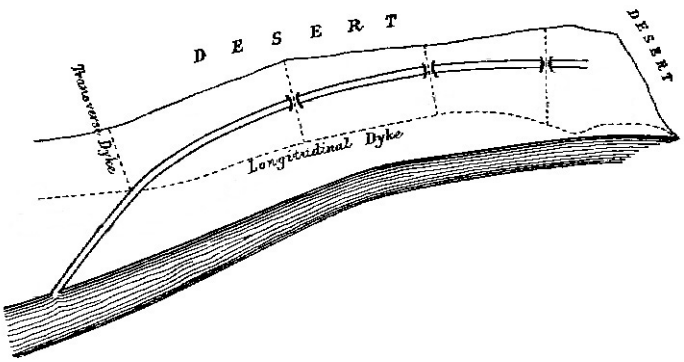

Fig. 2: Diagram of a typical large nineteenth century "column" basin.. Willcocks and Craig (1913), 306.

The nineteenth century development of massive column basins, barrages, and deep summer canals created a new role for the Egyptian state, requiring a strong central administration, a corps of trained experts, and the large-scale conscription and deployment of rural labor simply to keep the system running.[44] Yet when such management was not forthcoming or there was a reduction of or considerable resistance within the corvéable population, the system began to fray.[45] These strong new connections between state and irrigation deeply influenced contemporary understandings of the historical relationship between water and state power in Egypt. French engineer Julien Barois, for instance, projects onto the distant past the undeniable difficulties the nearly bankrupt Egyptian government faced in maintaining her newly modernized irrigation system in the years before the 1882 British occupation:

> But the works of irrigation, located generally at low points, built upon a soil of mud and of little resistance, have very soon been ruined by giving way of dikes or by the changes of the Nile. Their outlines have been lost during the long centuries of neglect and misery which have so often prevailed in Egypt, and their débris, engulfed by the water of submerged under beds of mud, have disappeared; their position is no longer indicated even by an eddy of the river or an undulation of the soil.[46]

The comments of Antoine Barthélemy Clot, chief surgeon to the *khedive* Muhammad ʻAlī and a teacher of medicine and anatomy in Cairo, in his *Aperçu général sur l'Égypte* (1840) are also

[44] Alleaume (1990), 75. See the whole for a survey of the development of the professional "engineer" in modern Egypt. *Muhandis* (engineer) became during this period and remains today a term of respect for an educated professional man. An entire new city named *Medīnat al-Muhandisīn* (The City of the Engineers), now part of the greater Cairo megalopolis, was later built on the west bank of the river.

[45] On distress within the peasant population and problems with the new large-scale corvée see Cuno (1992), 121-4.

[46] So the English translation by one Major A.M. Miller: Barois (1887), 7. To his credit, however, Barois was not, completely convinced that the past could be recovered so easily simply be reading the contemporary landscape: "[D]ans l'état actuel de la science, vouloir remonter plus haut serait une enterprise pleine de difficultés et d'incertidudes, car les generations disparues nous ont laissé bien peu de choses comme vestiges d'anciens travaux hydrauliques, comme traditions ou comme vieux usages, pour nous aider dans de pareilles recherches" (In the present state of science, wishing to go further back would be a task rife with difficulties and uncertainties, since previous generations have left us very lfew remains of ancient hydraulic works, traditions, or ancient customs to aid us in such research). Introduction to Barois (1904), ii.

representative, and they find themselves in part echoed in the assertions of Helen Rivlin quoted at the outset of this chapter:

> La vie pour l'Égypte, c'est le Nil: la mort, c'est le desert; le Nil l'a créée...La prospérité de l'Égypte et le augmentation du nombre de ses inhabitants dépendent du ménagement des eaux du Nil; elles sont solidairement attachées au développment et à l'entretien des irrigations. Or, pour donner à des intérêts si importants une surveillance constante et des soins assidus, il faut une pensée et une force gouvernementales toujours une. L'Égypte est donc le pays qui demande le plus à être gouverné; son existence matérielle, la conservation de son sol et partant de sa population, réclament de la vigueur et de la continuité dans l'exercice du pouvoir qui la dirige. Mais, par un ironique fatalité, aucune contrée n'a été, depuis mille ans, plus mal gourvernée; aucune n'a vu se succéder, pendant de courts espaces de temps, des pouvoirs aussi barbares, aussi destructeurs dans leurs instincts, aussi paresseux, aussi inintelligents dans leur administration.[47]

While the ideology of the *Description* and other French writers on Egypt has been explored in some depth,[48] later British manifestations of the declensionist narrative in Egypt have not.[49] Picking up where the abortive French colonial project left off, British engineers in Egypt (as in India and Mesopotamia as well) earnestly embarked upon a grand mission to reverse the supposedly advanced state of hydraulic decline. William Willcocks, perhaps the empire's greatest engineer and certainly the most outspoken, captured the contemporary *Zeitgeist* in his aptly titled *The Restoration of the Ancient Irrigation Works on the Tigris or the Re-Creation of Chaldea* (1903), grandly claiming that "modern science will touch this region with her magic wand, and the waste places shall again become inhabited, and the desert shall blossom as a rose"—modernity in the service of antiquity.[50]

Indeed, like many of his colleagues Willcocks never tired of quoting the claim of Nubar Pasha, the Armenian first Prime Minister of British Egypt, that "the Egyptian question is the irrigation question," thus reducing the whole of the nation to a simple problem of water management.[51] Though engineers often couched their interventions in altruistic terms, as a major creditor of a deeply indebted Egypt Britain had considerable interests in increasing Egypt's productivity and the value of her agricultural exports. Both the British government and

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[47] At pp. 204-5. Cited from Kalin (2006), 48. "Egypt's life is the Nile; the desert is death; the Nile created it...The prosperity of Egypt and the increase in the number of its inhabitants depends upon the management of the waters of the Nile; they are jointly attached to the development and to the management of irrigation. Yet in order to serve such important interests with constant supervision and assiduous care, there must be one thought and one governmental force, always unified. Egypt is thus the country which most demands to be governed; its material existence, the conservation of its soil, and thus of its population, calls for vigor and continuity in the power which directs it. But, by an ironic fate no country has been more poorly governed for the last one thousand years; none have seen in such succession, in such short periods of time, such barbaric powers as destructive in their instincts as sluggish and unintelligent in their administration."

[48] Edward Said already commented on aspects of the *Description* in 1978's *Orientalism*. More recent works that I have already cited here are Godlewska (1995), Harten (2003), and Kalin (2006). Readers may consult the bibliographies of these studies for additional sources.

[49] The only relevant articles of which I am aware are Gilmartin (1994) and (2006), and Derr (2011). Gilmartin's work focuses on India but is nonetheless offers much insight into the thinking of British engineers, particularly Willcocks. Derr's study was published only in December of 2011, while this chapter was already in progress. Esmeir (forthcoming) covers matters relating to irrigation and environmental ideology but from the perspective of law and so-called "juridical humanity."

[50] Willcocks (1903a), 9

[51] E.g. in the dedication of Willcocks (1913), at xv and in his posthumously published memoirs, Willcocks (1935) at 88.

private lenders were so obsessed with Nile water that throughout the 1880's that *The Times* consistently reported on its discharge levels.[52] After occupying the country in 1882, engineers set out to increase the water available to Egyptian agriculture, particularly the cotton-growing large estates, upon which Lancashire's massive textile industry depended. They repaired and enhanced the modern canals and barrages by the French engineers during the reigns of the Muhammad 'Alī (1805-49) and Isma'īl (1863-79), which had been much neglected by the cash-strapped *khedival* state. British engineers also constructed many new works throughout the country, crowning their new irrigation system with Willcocks' Aswān Low Dam, which opened on 10 December 1902.[53] Their work revolutionized Egypt's relationship with the Nile by abolishing the seasonality of inundation irrigation and replacing it with a perennial system dependent upon artificial fertilizer that allowed year-round productivity. Although the engineers were well aware that the dam and even perennial irrigation itself were modern innovations, they nonetheless argued that a resurrection of antiquity was to be seen in the restoration of central control over the irrigation system.

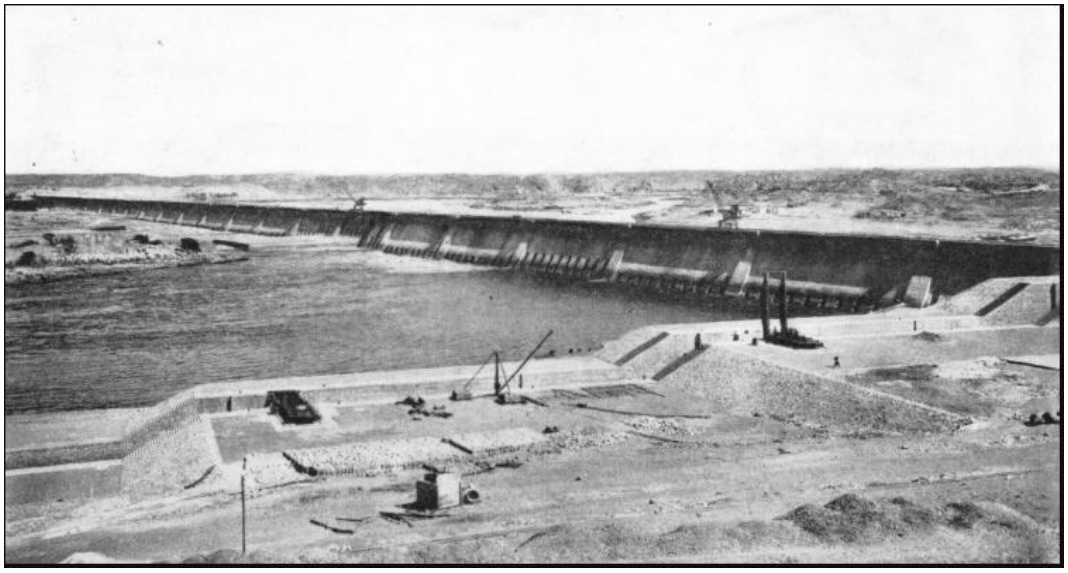

Fig. 3: The Aswān Low Dam in the early twentieth century.

Unsurprisingly, these author-practitioners began with an outlook that broadly reflected earlier French thinking. As described by journalist and later civil servant Donald Mackenzie Wallace in his 1883 *Egypt and the Egyptian Question*, the proper relationship between irrigation and the Egyptian state is much of a piece with Clot:

> Egypt is essentially an agricultural country which derives the greater part of its budgetary income from the land revenue. The quantity and quality of the crops depend on the way in which the fields are watered, and the way in which the fields are watered depends on the administration, so that in Egypt the Government plays the part which in most other countries is assigned to weather-controlling Providence. If the government continues to show the ignorance, negligence, which it

[52] Tvedt (2004), 21

[53] The dam was largely designed by William Willcocks, upon whose writings I draw frequently below. Gilmartin (2006) at 90-103 offers a convincing overview of Willcocks' thinking on water and the state. For a description of the dam itself see Tvedt (2004) at 74-5. On the dam's creation of a new Egyptian "agricultural geography" see Derr (2011).

> has hitherto displayed...the productivity of the land will decrease, the land revenue will fall into arrears, the peasantry will sink deeper into debt, [and] the existing popular discontent will increase...It is in this sense that the Egyptian Question is a question of irrigation.[54]

And so it had always been. This state-centric and ultimately self-serving understanding of Nile irrigation is transformed into the central element of the whole of Egyptian history in a 1920 study of contemporary Egypt by botanist and former Anglo-Egyptian agricultural civil servant Lawrence Balls:

> When glancing through the History of Egypt we have seen how repeatedly the country has gone to ruin because the irrigation system was allowed to deteriorate, and how quickly the country again became prosperous when a strong ruler took the irrigation system in hand. The country was always prosperous, even under utterly unsympathetic rulers, so long as the irrigation system was maintained in good working order. The history of the Egyptians themselves...is largely a history of the water supply.[55]

Though they occasionally differed on minor matters of detail, this ideology was broadly shared by all the engineers who wrote on Egypt's water supply. In a brief 1892 description of the Fayyūm, for instance, Colin Scott-Moncrieff, then former Undersecretary of Public Works, argued that the province had been well cared for by "Pharaoh and Ptolemy, Caesar and Arab Khalif, until Mameluke misrule and Turkish brutish ignorance let it fall into decay."[56] Of Egypt more generally he states elsewhere that "there was no branch of the administration in a more corrupt and inefficient condition than that on which the very life of the country depended, the irrigation [*sic*]."[57] So too Justin C. Ross, an Inspector General of Egyptian Irrigation. Heavily influenced by the observed neglect or failure of recent and experimental Franco-Egyptian irrigation works in the country, he asserts in his introduction to the 1889 first edition of William Willcocks' *Egyptian Irrigation*: "there can be no manner of doubt that up to 1882, Egyptian irrigation was going downhill." It was slowly returning to a state of nature, as "drains were abandoned or became useless, and canals became less of artificial and more of natural channels wholly influenced by the natural rise and fall of the Nile." All had sunk into "a dead conservatism" as the "absence of repairs, so common to all Mohamedan countries" took their toll upon the once great system.[58] In Willcocks' own estimation this neglect had drastically reduced from their Roman heights both Egypt's cultivated acreage and its population, which he extravagantly claims to have stood at 20 million in 700 CE but a mere 2 million by 1800.[59] Yet

[54] *Egypt and the Egyptian Question* (Macmillan and Co., London), 477-8.
[55] Balls (1920), 128
[56] Preface to Hanbury-Brown (1892), v
[57] Scott-Moncrieff (1910), 425
[58] Quotes from pages vi and vii of the introduction. Thanks to Chiara Meccariello (Università di Pisa and Oxford) for providing me with a scan of Oxford's copy of this inaccessible work.
[59] Willcocks (1913), 299 and 302 for his population "estimates," the source for which he does not note. In fact, population numbers were probably rather similar in the late nineteenth and early twentieth centuries to the Roman period. Ancient estimates put the population in Roman times between 3 and 8 million. While the population in 1800 is recorded at ca. 3.8 million (likely a gross underestimate) it may have reached 8.7 million by 1890. Census counts for 1882, the beginning of the British occupation, put the number at 6.8 million, reaching 11.3 million in 1907, six years prior to the publication of the third edition of Willcocks' *EI*, from which his assertions are drawn. Modern estimates and census figures are drawn from W.C. Robinson and F.H. El-Zanaty (2006), *The Demographic Revolution in Modern Egypt* (Lexington Books). Rathbone (1990) at 108 estimates Roman population at 5 million, Bagnall and Frier (1994) at 56 and 103 give a wider range between 4 and 5 million, while Scheidel (2002) at 246 argues on the basis of nineteenth century data that a yet wider range of between 5 and 7 million is safe. For an

he hoped—indeed fully expected—that after the completion of British reclamation projects the Delta would again be cultivated to the extent reached during the Roman period, returning Egypt to its place as all the world's granary.[60]

In the hands of the engineers, ancient Egyptian irrigation could also take on a similarly technocratic air. For Ross, the imagined productivity of the past had not simply been a matter of more complete political control and superior organization. He further attributes past achievements to ancient engineers of talent and skill, men clearly modeled upon himself and his colleagues:

> It is certain that in the old days there must have been native engineering talent of the very highest order, and when we read of such and such a king restoring public works in a long and glorious reign, there must have existed a continuous supply of good engineering talent which had *carte blanche* from the ruler of the day. But owing to many causes the native talent has sunk so low that without modern scientific aid the Egyptians could not work their own canals.[61]

His sentiments were echoed by the consul-general of Egypt Evelyn Baring (Lord Cromer) in his *Modern Egypt* (1908):

> The Pharaohs, it would thus appear, used their [engineering] talent according to the best of their lights. The Turks, who ultimately succeeded them, hid theirs in a napkin, with the result that Nature, indignant at the treatment accorded to her, minimised the value of her gifts and exacted penalties for the neglect of her laws. In later Mohammedan times, no serious efforts were made to avert drought or inundation.[62]

But the technical details of the system overseen by ancient experts remained elusive. As Ross comments in an 1893 article, "we have not yet found a mummy of an engineer who was so much attached to his science as to have his *aide mémoire* buried with him."[63] Still, the lack of a mummified graduate of Thomason College of Civil Engineering, Roorkee (the *alma mater* of many a British civil engineer[64]) did not prevent Ross and others from arguing that so-called "scientific" irrigation was already well developed by the earliest period of recorded Egyptian history and fully "taken under royal protection."[65] Indeed, Ross offers a fanciful description of the earliest "engineer," the legendary pharaoh Menes, who was the first to "train" the Nile. In

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excellent new discussion of all the various scholarly approaches to estimating population in Graeco-Roman Egypt, their strengths and weaknesses, see now Monson (2012), 33-49.

[60] Willcocks (1903b), 47 (granary), 66 (level of Delta cultivation). Cf. Sidney Peel, "British Administration and Irrigation in Egypt," *Political Science Quarterly* 20.3 (1905), 513-34 at 517: "In Roman time, before the Mohammedan invasion (*sic*) A.D. 700, the whole of Egypt (6,250,000 acres) was cultivated…but during the centuries of misrule that followed, as the population decreased, the basins in the northern part of the Delta were allowed to fall into decay; the land became waste and salted; and when Mehemet Ali came as viceroy in 1810 only about half the Delta was cultivated."

[61] In his introduction to the 1st ed. of Willcocks *Egyptian Irrigation*.

[62] Evelyn Baring (Lord Cromer), *Modern Egypt* (London: Macmillan) 1908 at 457-8.

[63] Ross (1893), 174. See now, however, the reedition of the archive of the early Ptolemaic engineer Kleon by Bart Van Beek (2006).

[64] The college was established in 1847 and produced numerous Anglo-Indian engineers (William Willcocks among them) who were guaranteed positions in the Public Works Department upon graduation. It is now the Indian Institute of Technology Roorkee.

[65] This is the phrasing not of Ross but of Carrier (1928), 44-5. So skilled were the earliest pharaohs that Carrier even credits them here with the construction of the Baḥr Yusuf, the natural side channel of the Nile that feeds the Fayyūm.

this telling, once Menes had conquered and unified the whole of Egypt, he set about to scientifically harness the life-giving power of the river. Ross attributes to the pharaoh a keen eye for topography: Menes was aware that since "the slope of the country is 1/10,000, this would give a bank at every 10 kilometres."[66] Ross credits the pharaoh with all the planning, oversight, and execution of all construction, maintenance and operation. It was Menes who oversaw the construction of river banks, the filling of basins, the draining of water: "[T]he King would see that the last basin of the series should be very much larger than any other, so as to act as a compensating reservoir which could hold a large quantity of water without breaking."[67] So too Willcocks, who praises the genius of the pharaoh who "made his first dyke when the Egyptian nation was in its infancy."[68] Menes' wisdom was demonstrated in "the resolve of [his] engineers to confine their attention to one bank of the river alone," part and parcel of their methodical and systematic approach to the establishment of scientific irrigation.

But if the pharaohs of the first dynasty had inaugurated the system, it reached perfection during the biblical period, the era of the patriarch Joseph in particular. Arabic tradition does, in fact, attribute considerable achievements to Joseph during his time at pharaoh's right hand. In an 1887 article detailing the early results of British engineering, Egyptologist Frederick Cope-Whitehouse drew upon this tradition as recorded by medieval author Murtaḍā ibn al-Khafīf (1154/5-1237) who writes that it was Joseph himself who first reclaimed land in the Fayyūm at Pharaoh's command, in order to provide an estate for the monarch's daughter (hence the Arabic name of the main canal, the Baḥr Yūsuf).[69] In addition to saving Egypt from famine by interpreting Pharaoh's dreams, Joseph "had added the Fayoum, with its virgin soil of inexhaustible fertility, imposed a water-tax upon the shêkhs of the Delta, and provided the best possible insurance fund by storing grain. It was a change similar to that which converted the morasses of the Batavians into the Holland of the Dutch."[70] Even if all the achievements attributed to Joseph in the Arab tradition beggared belief, Cope-Whitehouse appeals to the so-called Augustan Age for an historical parallel: "Augustus found Rome of brick and left it marble...[these achievements] were fathered upon [Joseph] who was primarily, or at least to the

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[66] Ross (1893), 174

[67] *ibid.* 175

[68] Willcocks (1913), 299-300. For Herodotus' description of the pharaoh see 2.99 with Alan Lloyd's commentary to II.99-182 at pp. 6-13. We may usefully compare these sentiments with earlier interpretations of the imagery on the so-called Scorpion Macehead, an artifact probably dating to the very end of the Predynastic period. It shows the king holding a hoe and standing near some sort of watercourse. It was long held to represent the ruler as the supreme organizer of irrigation, much like Ross' and Willcocks' imagined Menes. For a brief discussion of the mace-head see Stan Hendricks and Frank Förster, "Early Dynastic Art and Iconography," in Lloyd's *Companion* at 838-9.

[69] Little is known of the author Murtaḍā ibn al-Khafīf other than that he was an historian resident in Cairo. His sole known work survives only in a 17th century French translation by Pierre Vattier and a later English re-translation from 1672. The latter is known as *The Egyptian history, treating of the pyramids, the inundation of the Nile, and other prodigies of Egypt, according to the opinions and traditions of the Arabians written originally in the Arabian tongue by Murtadi, the son of Gaphiphus, rendered into French by Monsieur Vattier and thence faithfully done into English by J. Davies.* The full English text is available online from the University of Michigan: http://quod.lib.umich.edu/e/eebo/A51638.0001.001?view=toc. Accessed December 28, 2011.

[70] Cope-Whitehouse (1887), 422. He presents at 421-2 a translation of the relevant passages from Murtaḍā ibn al-Khafīf that is much more readable than the earlier 1672 English although he gives no indication of the source of the translation. This tradition is also recounted in al-Nābulusī's *Tārīkh*, 3-4.

popular eye, identified with this golden age. There was an Octavianus styled Augustus, who was neither architect nor author."[71]

To Ross, Willcocks, and their contemporaries, the rulers of ancient Egypt were "masters of engineering, mathematics, agriculture, civil government, and organisation of masses of men."[72] Willcocks' fulsome praise leaves no doubt as to his estimation of ancient engineering: "the lessons to be learned from the river regulation and control of the ancients are writ large over all their undertakings—thoroughness, combination, and continuity. The farther we go back in the world's history the more thorough was the work."[73] So thorough, indeed, that in a 1903 lecture he claimed that "on the eve of changing the whole Nile Valley into perennial irrigation we are just where the Pharaohs of the 12th dynasty were."[74] Once described by a colleague as resembling "Joseph of old,"[75] Willcocks later backtracked somewhat in his *From the Garden of Eden to the Crossing of the Jordan* (1919) and reemphasized the nearly unsurpassable achievements of antiquity:

> In Joseph's day, the Pyramids were standing, the basin irrigation of the Nile valley had been functioning for some 3500 years, the low lands of the Delta had been reclaimed 600 years before, and all this wealth had been insured against inundation by the Lake Moeris escape, one of the wonders of the ancient world. We to-day have not succeeded in reclaiming one-tenth of the lowlands of the Delta, and that tenth is uninsured against inundation. Three thousand five hundred years ago the Egyptian question was the irrigation question, even more thoroughly than it is in our day.[76]

Still, these unrivaled accomplishments could not stop some from dreaming of greater mastery yet to come, dreams that reached beyond the simple resurrection of the imagined past and into the realms of pure fantasy. In his memoirs Cromer grandly proclaimed that "when, eventually, the waters of the Nile, from the Lakes to the sea, are brought fully under control, it will be possible to boast that Man—in this case the Englishman—has turned the gifts of nature to the best possible advantage."[77] Willcocks' 1903 pamphlet *Egypt Fifty Years Hence* more specifically envisioned such totalizing control, imagining that within a half century the *Sudd*—the massive White Nile swamps of southern Sudan—would be eliminated and replaced "from Lado to Khartoum [with] one unbroken stream about 500 metres in width of pure and wholesome water," while the entirety of the Nile would finally be brought completely to heel and

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[71] *ibid.,* 422. Compare these sentiments to an editorial in the June 5, 1907 edition of the New York Times on the then-current plans to raise the Aswān Low Dam by an additional 23 feet. Entitled "Mastery of the Nile," the brief piece regrets the immanent destruction of the site of Philae, which would have accompanied the heightening of the dam. The authors ask: "but will the twenty-three additional feet to the summit of the wall, which will forever bury Philae, complete the work? Will the man at the button in the great white house [the dam's control center] ever have the power that JOSEPH had to direct, increase, or diminish the flow of the river? JOSEPH had no Assouan dam, and no shutters to manipulate by the pressure of a button. In what, therefore, did his power to make Egypt perennially fertile consist?"

[72] Ross (1893), 178-9

[73] Partially cited in Gilmartin (2006), 94. Extracts of the quoted text, an address given by Willcocks at the National Drainage Congress in Savannah, Georgia on 24 April 1914, are reprinted in *Engineering and Contracting* 41 (1914), 534-5.

[74] Willcocks (1903b), 61

[75] So described by Hanbury-Brown in the introduction to Willcocks (1913), xvii

[76] Cited from Derr (2011), 141-2

[77] Cromer, *Modern Egypt* II.461

"regulated like an ordinary canal."[78] Fantasy finally reached its acme in a brief section of Lawrence Balls' study entitled "Romance":

> Not less impressive than the cliff of masonry at Assuan [i.e. the Low Dam] is the idea of a lone white man sitting in the heat of Africa, ordering machines to move sluices in accordance with telegraphic instructions flashed up from headquarters 4,000 miles down-stream, and thus setting free water which, more than a month later, will reach its destination on the land of some peasant who would otherwise have lost his crop.[79]

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Constrained by an inflexible worldview that saw only chaos and irrationality in free-flowing water, the engineers were unable conceive that prosperity could ever be achieved without a strong central authority "taking the Nile in hand."[80] While employed as a government advisor in Mesopotamia between 1908 and 1911, Willcocks even went so far as to scold his Turkish employers for the grotesque inefficiency they tolerated by allowing "two mighty rivers flowing between deserts to waste themselves in the sea for nine months in the year, and desolating everything in their way during the remaining three."[81] The engineers' ethos is perhaps best represented by the Menes that Ross and Willcocks construct. He is the literal embodiment of the engineers' ideal state, a synthesis of both traditional political power and the authority of modern science, exercising total control not only over a nation but also over nature.

This brief summary does scant justice to the engineers' voluminous literary output; I have merely attempted to outline the main features of their state-centric, technocratic history of Egyptian irrigation. It justified the increased central control over Egyptian agriculture that accompanied the introduction of perennial irrigation by construing this revolutionary development as a restoration of proper and effective Egyptian government and, to adopt the contemporary idiom, resource management. As we will see below, this ideology filtered into the writing of ancient historians and has helped to shape scholarly understanding of water management in the Graeco-Roman period.

1.3: SCHOLARLY APPROACHES: PAST AND PRESENT

A classic history of Graeco-Roman Egypt describes Egyptian irrigation as follows:

> The maintenance of this irrigation system was a constant and crucial preoccupation; dykes needed to be repaired annually, silted channels needed to be unclogged and machinery kept in good working order. Much of this was ensured through the imposition of compulsory labour obligations on the able-bodied males of the rural population. This is only one indicative aspect of the way in which manpower was systematically organized by the state to maximise efficiency of production.[82]

We may compare this to a recent recapitulation of the Fayyūm's decline narrative:

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[78] Willcocks (1903b), 46-7

[79] Balls (1920), 146. Cited from Esmeir (forthcoming).

[80] A phrase of Colin Scott-Moncrieff's, cited from Tvedt (2010b), 4. The phrase itself or variants upon it were popular expressions of the engineers: Tvedt (2004) at 28 and notes 61 and 62. Cf. Ball's use of a variant in the passage quoted above. Cioc (2009) notes at 169: "Common to all European [engineering] textbooks was the notion that rivers were in need of being 'domesticated,' 'tamed,' or 'harnessed.'"

[81] Willcocks (1935), 254, quoting from the report he submitted to the government.

[82] Bowman (1986), 19-20

> Because the Fayum was irrigated by a canal network, unlike the flood basins of the Nile Valley, the maintenance of these canals (which flow at very gentle gradients for much of their course) was central to the usability of most of the land. Perennial irrigation also made it a logical zone for extensive planting of vineyards and orchards, and gardens. Failure to maintain the canals led to the desertification of arable land, however, and some villages went through periods of abandonment when their water supply failed.[83]

Though far more subtly in Roger Bagnall's case, both of these descriptions view irrigation through the prism of the state and its control over water and population. Like the writings of the engineers, both suggest that without a firm guiding hand, Egyptians were incapable of taking proper care of the irrigation infrastructure and that the state was central to the mobilization of the rural workforce. The desertification and extinction of certain Fayyūm villages referenced by Bagnall, their sites now evocatively marooned in patches of desert, is eloquent visual testimony to the pressing need to maintain a tight grip upon Egypt's water supply. Of course, there is much to be disputed here. In particular, it is telling that the student will find no unambiguous support for the Fayyūm decline narrative in the literature cited by Bagnall.[84] As I will discuss in detail in chapter four, he simultaneously reveals that there is a strong tendency to equate ancient Fayyūm irrigation with its modern perennial counterpart. For the moment, however, I confine myself to elaborating the connections between ancient historical scholarship and the environmental declensionst state-centrism of the engineers' writings.

The environmental narrative figures prominently in early writing about the later Roman empire, functioning as the grim environmental setting to certain authors' equally grim outlooks on Late Antiquity. Harold Idris Bell's 1917 article "The Byzantine Servile State in Egypt" perhaps best captures French colonial environmental history, epitomizing the narrative in a single evocative sentence: "all through the Byzantine period whole districts were falling waste; and in Africa, for example, the sands of the Sahara now blow over many a tract which at the beginning of our era was occupied by populous cities or fertile fields."[85] Speaking specifically of Egypt, Mikhail Rostovtzeff does much the same: "the predominant features of Egyptian life in the third century were the gradual depopulation of the land, the decay of the irrigation system, and the increase of waste and unproductive land."[86] In support of these sweeping statements, both Bell and Rostovtzeff point to the fourth century CE archive of Aurelius Sakaon, a leading villager and liturgist living in the last days of the village of Theadelphia. But for both authors Sakaon's troubles were simply part of the larger narrative. Bell cites a single papyrus, *P.Cair.Masp*. III 67313 (6th CE), which records an inheritance dispute between two brothers involving a field in the Fayyūm village of Arabon. Before the eventual resolution of the conflict the brothers propose abandoning the land at issue and leaving it uncultivated: "that the idea of simply abandoning the land should ever have occurred to the disputants and should be mentioned

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[83] Roger Bagnall, "Fayum," in *Late Antiquity: A Guide to the Post-Classical World.* G.W. Bowersock, Peter Brown, and Oleg Grabar *edd.* Harvard, 1999, at 448.

[84] Bagnall cites only Rathbone (1991) and Van Minnen (1995). If anything, the careful reader will come away from Rathbone's work with a far greater appreciation for the tenuousness of life on the desert margins of the Fayyūm, a useful antidote to over-optimistic appraisals of earlier Fayyūm productivity and its precipitous decline. As for Van Minnen's article, he first discusses Soknopaiou Nesos, a village he acknowledges as atypical. Indeed, it was entirely unconnected to the Fayyūm's irrigation system. He also relies heavily upon a dubious interpretation of a single Karanis papyrus, *P.Haun* III 58 (439 CE), which I discuss below in chapter 5.

[85] *JEA* 4 (1917), 86-106 at 96.

[86] M. Rostovtzeff, *SEHRE* (1957^2), 428.

in so natural a way shows how familiar the desertion of land must have been."[87] Citing a then-unpublished papyrus from Philadelphia (now *P.Wisc.* II 86 [245-7 CE]) Rostovtzeff compares Theadelphian misery to the problems of some Philadelphian landowners whose fields had been erroneously assessed as larger and as more productive than they in fact were—a clerical error transformed by Rostovtseff into evidence of the widespread agricultural decline that was supposed to be afflicting the landscapes throughout the Middle East and North Africa in this period.[88]

As for state-centrism, there is perhaps no clearer indication of the debt owed to the totalizing ideology of the engineers than a section from Dorothy Crawford's (now Thompson) 1971 study of the Fayyūm village of Kerksosiris:

> The Egyptian question," as his Excellency Nubar Pasha once said, "is the irrigation question", and control of the irrigation system, of the dykes and channels, of the height of the flood and the extent of cultivation has always been a characteristic operation of any successful Egyptian government. So with Cleopatra away in Rome and a low flood in 48 Egypt soon fell into famine conditions; when Augustus took over the government of the country one of his first act was the clearance of canals and drains. At the end of the second century B.C. weakness in the central government is reflected in the crop returns and land reports of Kerkeosiris.[89]

Crawford draws upon the 1913 third edition of William Willcocks' opus *Egyptian Irrigation* for the remark of Nubar Pasha and, in support, footnotes a section of a letter of Napoleon:

> The Government has no influence on the rain or snow which falls on Beauce or Brie, but in Egypt the government has direct influence on the extent of the inundation which takes their place.[90]

Accepting this assertion as fact, Crawford adds that "an efficient administration with control over the working and mobility of the labour force is the most successful in such an irrigation economy," an assertion she has restated in the 1999 article quoted at the outset of this chapter. In fairness, Crawford's immediate point of reference is the deeply troubled latter half of the second century BCE, when the Ptolemaic kingdom was riven by civil war and strife, whose effects on the landscape and population were surely at times quite detrimental. The dossier of Menches, a late Ptolemaic village scribe (*kōmogrammateus*), upon which her study of Kerkeosiris is based

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[87] Bell, *op. cit.* at 96

[88] *SEHRE*, p. 480-1. For a review of recent thinking on the so-called "third century crisis," in which context Rostovtzeff places this papyrus, see Ziolkowski (2011). On the famous *agri deserti*, the abandoned fields of the later Roman lawcodes, see Whittaker (1976) and more recently Cam Grey, "Revisiting the 'problem' of *agri deserti* in the late Roman empire," *Journal of Roman Archaeology* 20 (2007), 362-76. For a concise example of the sea change in the interpretation of these "deserted fields" see Peter Heather, *The Fall of the Roman Empire* (Oxford, 2006) at 114f.: "More generally, the term 'deserted lands' (*agri deserti*) was coined in the fourth century to describe lands from which no tax was being collected. It carries no necessary implication that land so labelled had ever previously been cultivated, and certainly the large tract of North African territory [3000 mi.^{2}] referred to in the law of 422 consisted mostly of desert and semi-desert hinterland where normal agriculture had always been impossible." While the idea of empire-wide agricultural and environmental decline has been shown to be untenable, it remains entrenched in some circles. Bryan Ward-Perkins, though something of a standout, remarks on the basis of rather little evidence that "it is much more likely than not that the post-Roman period saw a marked decline in agricultural productivity, and therefore in the number of people that the land could sustain. This was decline at the baseline of human existence." From *The Fall of Rome and the End of Civilization* (Oxford, 2005), 146.

[89] Crawford (1971), 106.

[90] Crawford (1971), 106 at note 3.

reflects the aftermath of this period of protracted chaos.[91] Still, it is dangerous to allow the atypical conditions of the period to bias the viewer in favor of the notion that Egyptian irrigation over the *longue durée* depended wholly upon the state.

But Crawford is far from the first to focus upon to the government's supposedly paramount role in Egyptian water control. This privileging of the state has long been a feature of the ancient historical scholarship on Egypt. Indeed, the state is the protagonist of a 1919 survey article "The Development of the Irrigation System of Egypt" by papyrologist William Linn Westermann (published while he was serving in the American delegation to Versailles as a "Specialist in Western Asia").[92] In his wide-ranging history of Egyptian irrigation, Westermann refers to the alleged development in the third millennium BCE of a "great, organized, and unified method of controlling the inundation for irrigation purposes."[93] As a whole, the article is perfectly of a piece with its contemporary intellectual milieu, for it is essentially a record of the achievements of state-controlled irrigation. Quoting from Breasted's *Ancient Records of Egypt*, for instance, Westermann references a long inscription from the eighteenth Dynasty detailing the duties of the *vizir*: "In the reign of Thothmes III the oversight of the water supply of entire [*sic*] Egypt was centralized in the hands of the vizier of Egypt. The vizier had a corps of officials working under his direction in this department."[94] Westermann has clearly added a rather heavy layer of contemporary technocratic language upon the passage in question, which in Breasted's translation reads simply "it is he [sc. the vizir] who dispatches the official staff to attend to the water supply in the whole land."[95]

But apart from the pharaonic period the management of irrigation during the early Roman period has been of consistent interest. Naturally, it has long been thought that the system was well in hand under the early emperors and numerous authors, like Crawford above, make much of a sentence in chapter 18 of Suetonius' *Vita Augusti*:

> *Aegyptum in provinciae formam redactam ut feraciorem habilioremque annonae urbicae redderet, fossas omnis, in quas Nilus exaestuat, oblimatas longa vetustate militari opere detersit.*
>
> After Egypt had been reduced to the form of a province, in order that he might make it more productive and more suitable for the city's [Rome's] grain supply, with the aid of the soldiery he [Augustus] cleaned all the canals into which the Nile rushes, which had silted up with great age.

In his 1898 *A History of Egypt under Roman Rule* Joseph Grafton Mill, citing only this passage, interprets Augustus' alleged work as evidence that Egyptian agriculture was in so poor a state as to "diminish the amount of land available for cultivation."[96] Similarly, Westermann comments in a 1917 article that "the use of the soldiery on this fatigue duty is sufficient proof of the large and organized scale upon which the work was conducted. The necessity of this large enterprise presupposes gross neglect of the irrigation system under the lax administration of the later

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[91] For an examination of social and administrative trouble in the Arsinoite nome as reflected in the Menches papyri see Arthur Verhoogt, *Menches: Komogrammateus of Kerkeosiris* (Leiden, 1998) at chapter seven, "Menches and his Time," 149-76.

[92] On Westermann's ultimately inconsequential role at the conference see John Milton Cooper Jr., "William Linn Westermann at the Paris Peace Conference of 1919" in *Classical Antiquity and the Politics of America: From George Washington to George W. Bush*, Michael Meckler, ed. (Baylor, 2006), 83-94.

[93] Westermann (1919), 159

[94] *ibid.* 161

[95] *Ancient Documents* Vol. II, sec. 698 at p. 279

[96] (Publ. Charles Scribner, New York), p. 19

Ptolemies."[97] Much later, Steven Sidebotham, in his *Roman Economic Policy in the Erythra Thalassa* (1986), describes Augustus not as simply cleaning canals but as having "greatly *improved* Egypt's irrigation network by redigging old canals" (emphasis mine).[98] By 2010, Augustus had, it appears, wholly "reorganized the irrigation system of Egypt."[99]

The passage in Suetonius bears striking and rather suspicious resemblance to a section of the *Vita Probi* (9.3-4) included in the *Historia Augusta*, to which Westermann also draws attention:[100]

> *In Nilo autem tam multa fecit, ut vectigal frumentarium solus adiuverit. Pontes, templa, porticus, basilicas labore militum struxit, ora fluminum multa patefecit, paludes plerasque siccavit atque in his segetes agrosque constituit*
>
> On the Nile, moreover, he did so much that, by himself, he greatly benefitted the grain levy. He constructed bridges and temples, porticos and basilicas with the labor of the soldiers, he opened up many river-mouths, and drained many marshes, and established in these places grain-fields and farms.

I do not wish to claim that these texts are total fantasies and that there was nothing wrong with Egyptian irrigation during the earliest period of Roman control or the later third century CE. To be sure, the latter days of the Ptolemaic period were not the most peaceful that Egypt had ever seen, and there may indeed have been considerable flight from the land and the subsequent neglect of its irrigation infrastructure. So too during the later third century CE. Egypt had briefly fallen to the Palmyrene Zenobia (269-74 CE), after which it was retaken by the emperor Aurelian (reg. 270-5 CE). The reign of Probus (276-82 CE) was perhaps also hard upon the land. In his short time on the throne he oversaw a campaign against the southern Blemmyes, who had captured cities in the Thebaid (Upper Egypt) as far north as Koptos and Ptolemais (near modern Sohag).[101] Instead, then, of seeing these passages as representative of normal state-rural society relations in Egypt, it is more reasonable to view them as necessary restorations after the protracted and dislocating chaos of war. Indeed, to portray Nile Valley irrigation—a series of discrete inundation basins managed at the local level—as a "system" in dire need of "reorganization" wholly adopts the technocratic understanding of Egyptian irrigation common in the writings of the engineers.[102]

This mode of thinking is very common in the literature on the Fayyūm and its late antique history. A reviewer of the first edition of Aurelius Sakaon's fourth century CE archive, published in 1911 as *Papyrus de Théadelphie* by Pierre Jouguet, refers to Sakaon's Theadelphia as a "populous and flourishing village in the early Roman period...ruined by the neglect of the irrigation canals."[103] Westermann is more evocative, gloomily pronouncing that "competent engineering and an effective system of irrigation had given [Fayyūm villages] hard upon 600

[97] Westermann (1917), 239
[98] Publ. Leiden: Brill; pp. 118-19
[99] Livia Capponi, "The Roman Period," in Alan Lloyd ed. *A Companion to Ancient Egypt, Vol. I* (Wiley-Blackwell, 2010), 184-5.
[100] Westermann (1919), 163
[101] Robert B. Jackson, *At Empire's Edge: Exploring Rome's Egyptian Frontier* (Yale University Press: New Haven, 2002), 152 and Pat Southern, *The Roman Empire from Severus to Constantine* (Routledge: London, 2001), 130.

[102] So Michel (2005), 256 in reference to the irrigation practices documented by the *savants* in the *Description*: "Cette organiisation ne peut être appelée un système" (This organization cannot be called a system).
[103] *JHS* 31 (1911), 325.

years of life. The decline of this system gave them back to the desert."[104] But it is Arthur Boak who offers the clearest indications of the debt owed by scholars of Greek and Roman Egypt to colonial thinking on irrigation. For Boak, although Augustus' "renovation of the irrigation system ushered in an era of material prosperity that lasted for over two centuries," failure eventually befell the Arsinoite:

> With the failure of the border canals, the cultivated area shrank until it was restricted to the old Nile alluvial deposit in the central part of the Faiyûm. And so it remained throughout the period of Arab and Turkish rule until *the revival of the irrigation system in the nineteenth century* (emphasis mine).[105]

Clearly, like the near-contemporary British engineers, Boak viewed the British expansions of Egyptian irrigation not as revolutions but as revivals of past prosperity. Tellingly, he closes with a brief section titled "The Modern Parallel," in which he states that British engineering, "the real modern revival of irrigation...offers a parallel to what happened in the revivals under the early Principate and the Empire."[106]

This narrative of governmental neglect-*cum*-decline in the Fayyūm, although never subjected to serious study, became embedded in the scholarship early on and remains a *topos*. In his 1964 study of the Roman-period dyke-work system (the *penthēmeros*), P.J. Sijpesteijn closes by evoking both the environmental declensionist narrative as well as the alleged failures of the state:

> We do not find any more πενθήμερος certificates after 218 A.D....This is not surprising because the decline of the larger part of the empire sets in about this time...[F]or Egypt, too, the third century A.D. spells a period of decline and fall. Numerous complaints reach us from the papyri about the depopulation of Egypt, the deterioration of the irrigation system and the steady increase of untilled acreage. The decline of the πενθήμερος has also undoubtedly contributed to this situation.[107]

So too Eric Turner's famous *Greek Papyri: An Introduction*, which refers briefly to Fayyūm decline, casting it as something of a choice or pattern of willful neglect:

> Through the documentary papyri, we can watch [the Fayyūm villages'] birth...and also their slow strangulation in the fourth century after Christ, as the irrigation works ran down until the desert was allowed to engulf village after village...In the Fayyûm, then, when irrigation was neglected beyond a *critical* stage, areas that were only cultivable by artificial means had to be abandoned (emphasis in original).[108]

Roger Bagnall picked up on the notion of choice in a famous 1985 article. Here, he claims that "the papyri contain numerous tales of woe about the failure of the water supply" yet cites only a single papyrus, *P.Sakaon* 35 (332 CE), a text I will discuss in more depth in chapter five.[109] In this text, Sakaon complains of water theft by the upstream villages of Narmouthis, Hermoupolis and Theoxenis and Bagnall asks, "[W]hy did the authorities *allow* the water distribution to get

[104] Westermann (1919), 164.
[105] Boak (1926), 362 and 364
[106] *ibid.*
[107] Sijpesteijn (1964), 83
[108] *Greek Papyri: An Introduction* (Oxford, 1968), 44.
[109] Bagnall (1985), 296.

into such a bad shape that water stealing went on?" (emphasis mine), again placing the onus entirely upon the state, whose negligence had caused Theadelphia's distress.[110]

Finally, a 2001 article recapitulates everything that came before:

> Bisogna inoltre tener presente che a partire dalla seconda metà del III secolo d.C. si assiste ad un progressivo degrado del sistema di irrigazione del Fayyum, fenomeno che contribuì all'abbandono di non pochi villagi e città della regione. Theadelphia e le sue zone limitrofe, tra il III ed il IV secolo d.C., a causa della progressiva desertificazione vengono via via abbandonate. A Bakchias ed in molte altre zone del Fayyum il degrado subito dai sistemi di irrigazione contribuì allo spostamento della popolazione in zone più ricche d'acqua.[111]

The only authorities cited here are the entries for Theadelphia and Euhemeria in A. Calderini's *Dizionario dei nomi geografici e topografici dell'Egitto* as well as a brief passage in the introduction to Grenfell, Hunt, and Hogarth's 1900 edition *Fayum Towns and their Papyri* (*P.Fay*.). On page sixteen of their introductory remarks the authors simply note in passing the names of the abandoned villages that they had briefly surveyed and studied: Bakchias, Philadelphia, Euhemeria, Karanis, and Tebtunis and other minor, unnamed sites. They provide nothing else. This recourse to *P.Fay.* has a long tradition: both Westermann in 1919 and Boak in 1926 include the same footnote.[112] Obviously, there is no hard data in the introduction to *P.Fay.* to substantiate any far-reaching claims of irrigation failure and population migration. But, in truth, none is needed. The parlous state of late antique environments and the waning control of the Egyptian state over the Nile have become axiomatic.

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I do not wish to claim unfairly that no expert in the Graeco-Roman period has yet investigated Egyptian irrigation beyond the prism of state-centrism. Indeed, the recent theoretical work of Joseph Manning is doing much to reorient the perspective of papyrologists and historians of the Graeco-Roman period away from the rarified atmosphere of the central state.[113] But it is the work of the late Danielle Bonneau, the leading writer on irrigation and the papyri, that most stands out in this regard. While much of her work was concerned with the interactions between state administration and the water supply, a reflection of the nature of the papyrological material itself, Bonneau was simultaneously attentive to issues of climate, topography, agricultural productivity, and the effects of these non-human actors upon irrigated Egyptian agriculture.[114] In her assessment on the Fayyūm's "decline," for instance, Bonneau wrote:

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[110] *ibid.*

[111] "It must also be borne in mind that since the second half of the third century AD there was a progressive deterioration of the irrigation system of the Fayyūm, a phenomenon that contributed to the abandonment of many villages and towns of the region. Theadelphia and its surrounding areas was gradually abandoned between the third and fourth centuries AD due to the progressive desertification. At Bakchias and in many other areas of the Fayyūm the damage done to irrigation systems contributed to the movement of the population into the better-watered areas." Flavia Ippolito in *Atti del XXII Congresso Internazionale di Papirologia*, Firenze, 23—29 agosto 1998, Vol. II, "I tessitori del Fayyum in epoca greca e romana: le testimonianze papiracee," 701-15 at 706. Cited in the same context by Keenan (2003), 122, n. 10.

[112] Westermann (1919), 164 and notes 4 and 5; Boak (1926), 364 and note 16

[113] Manning (2002) and (2012) in particular. See also Manning (2010) at 36-45.

[114] The titles of her monographs *Le Fisc et le Nil* and *La Régime administratif de l'eau du Nil dans l'Égypte greque, romaine et byzantine* reflect her generally statist outlook. But her articles on the Fayyūm's marshes and salt-lands, Bonneau (1982) and (1989), are models of the combination of papyrology and an attentiveness to natural-

> La culture de ces terres était encouragée par l'État; le soutien venant à manquer, elles retournent au désert. La suppression du soutien ne peut être due qu'à une raison que se situe au niveau de l'État, et comme le rendement fiscal était le motif des encouragements accentués du II^{e} siécle, la raison d'être du désintérêt de l'État serait fiscale.[115]

Heavily statist, clearly enough. But Bonneau nonetheless concludes here that the maintenance of the canals was simply not worth the effort, arguing that Fayyūm agriculture was too underproductive relative to the labor required to keep the water running to its most far-flung reaches. While I will dispute the cause-and-effect particulars of this argument at the end of chapter five, it remains the case that Bonneau's work was far ahead of anyone else in the field in her understanding of the difficulties inherent in Fayyūm agriculture. It was, as we shall see, highly fragile and underproductive in places, a fact not conducive to its long-term sustainability.[116] Still, the tide is turning. Papyrologist James Keenan's 2003 study has pointed the way toward a different, long-term approach to landscape change in the Fayyūm, one that eschews apocalypticism in favor of following the landscape through time. It is just this sort of project that this dissertation attempts.

1.4: A FRAGMENTED WHOLE

I have sought here to contextualize the Fayyūm's particular decline narrative within a mode of viewing and constructing the natural environment of Egypt developed during the colonial period. It is not my intention in this final section to simply enumerate the ways in which Middle East-North African environmental declensionist narratives have grossly misrepresented the history of these landscapes, a subject that the reader may readily pursue elsewhere.[117] Instead, I will close first by elaborating upon the ramifications of colonial environmental knowledge for the study of Egyptian irrigation. Secondly, I will briefly introduce an alternative approach to the Nile and Egyptian irrigation, one which will I will elaborate in the following programmatic chapter.

In a recent critique of contemporary development studies of Egypt, political theorist Timothy Mitchell notes that virtually all such publications open with similar geographical overviews of the Nile Valley that depict a circumscribed Egypt with "arithmetical certainty", enumerating the land area, population, and resources of this "object of development," a precisely delineated set of variables which in turn determine the nature of the solutions to be applied. This rhetorical stance positions such studies as objectively rational and wholly external to the object of analysis they purport to describe dispassionately. Yet, Mitchell rightly observes that "objects of analysis do not occur as natural phenomena, but are partly formed by the discourse that describes them. The more natural the object appears, the less obvious this discursive manufacture will be."[118]

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environmental phenomena. See also her 1964 monograph *La Crue du Nil, Divinité Égyptienne* for a cultural-historical approach to the Nile and Egypt from the Hellenistic period to the Arab conquest.

[115] Bonneau (1979c), 65: "The cultivation of these lands was encouraged by the state; should support be lacking, they return to the desert. The suppression of support could only be due to causes at the state level, and since the tax yield was the motive for increased encouragement in the second century, the reason for the states disinterest was fiscal."

[116] See Monson's forthcoming article for a general overview of ancient Fayyūm agriculture and underproductivity, issues summarized in Monson (2012), 55-8.

[117] For North Africa, see Davis (2007) at 177-86. The various essays in Davis and Burke *edd.* (2011) provide perspectives from various parts of the Middle East.

[118] Mitchell (2002), 210

This critique should be brought to bear upon studies of ancient Egypt, which are often similarly prefaced by evocations of the river and the desert, of life and death, of an Egypt "predicated on a bare geographic fact."[119] This objectified landscape is the "gift of the Nile," a single entity shaped and determined by the endless tension between a slender ribbon of green and the pitiless desert—*la vie pour l'Égypte, c'est le Nil: la mort, c'est le desert; le Nil l'a créée*—a perspective that tends to overlook the vibrancy of ancient desert life as revealed by archaeology in recent years.[120] While to view Egypt as a δῶρον τοῦ ποταμοῦ[121] is obviously not solely a modern conceit, I have shown above that the engineers' reduced the river and the country to an object in need of control. With the powerful technologies at their disposal, they attempted to create a single, homogenized Egyptian landscape. Predictable, perennial water available at all times in all places served to efface regional diversity and local human relationships with flowing water, transforming Egypt into a single entity watered by a river-*cum*-canal regulated by the state at Aswān.[122]

The ideology of the engineers also collapsed any and all distinctions between time and place, transforming Egyptians into features of the natural environment and equating them with "their surrounding nature, [with] what nature has given them…Nature, the Nile in particular, is solely responsible for the making of Egyptians."[123] By naturalizing the Egyptians, the irrigating of crops becomes a organic cycle, an irrigation "system" seamlessly integrated into the life and rhythms of the river system itself.[124] The timeless and environmentally-determined cycle of filling and draining riverside inundation basins is endlessly repeated across the millennia by mindless automata, their chaos and inefficiency practically crying out for control and rationalization. In this way, observed changes in the Egyptian landscape merely reflect the historical ebb and flow of state power and the degree of central control exercised over this naturalized and dehumanized irrigation "system."

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[119] So Brent Shaw in his review of Horden and Purcell's *Corrupting Sea* in *JRA* 14 (2001), 419-53 at 444.

[120] Drawing from Bartolémey Clot, *op cit.* n. 45. Archaeological work in the deserts is doing much to amplify our understanding of life in ancient Egypt outside the Nile Valley. Steven Sidebotham's recent summary of work along the eastern desert road from Koptos to the Red Sea port of Berenike, *Berenike and the Maritime Spice Route* (Berkeley, 2011) is an excellent starting point. See also Marijke Vander Veen, with S. Hamilton-Dyer, "A life of luxury in the desert? Food and odder supply to Mons Claudianus" *Journal of Roman Archaeology* 2, 1998, 101-116.

[121] Herodotus, *Histories* II.5

[122] Uniformity and predictability is the essence of modern agriculture and is not at all unique to the Egyptian landscape: "In its short, shameless history, big agriculture has had only one big idea: uniformity. The obvious example is corn. The U.S. Department of Agriculture predicts that American farmers — big farmers — will plant 94 million acres of corn this year. That's the equivalent of planting corn on every inch of Montana. To do that you'd have to make sure that every inch of Montana fell within corn-growing parameters. That would mean leveling the high spots, irrigating the dry spots, draining the wet spots, fertilizing the infertile spots, and so on. Corn is usually grown where the terrain is less rigorous than it is in Montana. But even in Iowa that has meant leveling, irrigating, draining, fertilizing, and, of course, spraying...Nature is puzzling. Corn is stupefying." Verlyn Klinkenborg, "The Folly of Big Agriculture: Why Nature Always Wins," *Yale Environment 360*, 9 April 2012: http://e360.yale.edu/feature/the_folly_of_big_agriculture_why_nature_always_wins/2514/.

[123] Esmeir (forthcoming)

[124] In her work on the new agricultural geography of Egypt created by the Low Dam at Aswān, Jennifer Derr has reached conclusions resembling my own. I quote her here at length to acknowledge the similarities between our work: "The effect of this [colonial-era] reading of the Egyptian landscape was to renaturalize Egypt's landscape despite the existence of complex historical practices tied to irrigation and cultivation...A similar imagining of the agricultural population complemented this naturalization of basin irrigation. Descriptions of irrigation and agriculture were curiously devoid of human actors...Agricultural communities, harvest, and consumption were absent, as they would have exposed the dynamism of this agricultural geography and the weakness of a static map" Derr (2011), 144-5.

To begin to understand the shifting landscapes of premodernity we must do away with the supposed homogeneity of the landscape (still more scholarly conceit than reality[125]) and break Egypt into pieces and focus our gaze upon local landscapes and local relationships with water.[126] Water is always in motion yet remains fundamentally local at every point.[127] That is, its flow and the ways in which it can be and was used by Egyptians were profoundly influenced by the specificities of place.

This is not to deny similarity and connectivity within the country. Indeed, it has long been recognized that throughout premodernity the ease and speed of transport along the Nile created a communication corridor that permitted a greater degree of intraregional connectivity than other parts of the ancient world. But human connectivity and the relative homogeneity of Egyptian Nile culture is not the same thing as landscape connectivity and homogeneity. Any study of Egyptian irrigation must therefore acknowledge considerable and consequential physical variation throughout the country. The annual rate of evaporation of standing water, to cite but one factor, varies significantly, a matter of incalculable importance when considering the problems and possibilities of irrigated agriculture.[128] Egyptian environments, or any environment, for that matter, are thus best seen as offering a vast array of opportunities and challenges that constantly inform human actions. Local natures do not determine those actions, but instead help to determine the outcome of our choices, a situation that prompts yet further adjustment and adaptation. In consequence, what we call "the environment" is always in flux, endlessly subjected to innumerable pressures and demands, both human and natural. It ever remains a work in progress.

This chapter is not intended as an argument for abandoning the state and its role in shaping the environment. Rather, in order to comprehend the history of environments and landscapes we must take account as far as possible of all the varying inputs, the often conflicting demands that society, nature and, yes, the state make upon a local environment. In the following chapter I will expand upon these ideas and propose a *longue durée* approach to irrigated environments in Egypt that will help us to ask not why the Fayyūm and its irrigation system declined from some static ideal, but how and why it was made and remade over sixteen premodern centuries and beyond.

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[125] Egypt resists totalization even at the crudest macrolevel and can be divided into nine agro-climatological zones: Coastal, Central Delta, Desert Delta, Giza, 29º-27.5º N, 27.5º-26º N, Dakhla area, Kharga area, Aswān area. From Moustafa (2007) at 1 and the map on 2. See also "The Regional Structure of Egypt" in Ibrahim and Ibrahim (2003) at 57-66. For the reality of the multiple overlapping agents of water control in the contemporary state—bureaucrats, farmers, international donors, etc.—who all participate in the complex process of "governing flow," see in general Barnes (2010).

[126] See the work of Terje Tvedt for these varying perspectives upon the river and upon water. The monograph Tvedt (2004) studies the whole of the British period while (2010b) discusses the importance of embracing the whole basin when approaching Nile hydropolitics. The programmatic article Tvedt (2010a) argues for a water-centric, comparative approach to environmental history, one which has informed my own work.

[127] Applying to rivers Bruno Latour's observations on railroads in *We Have Never Been Modern,* trans. Catherine Porter (Harvard, 1993) at 117: "Is a railroad local or global? Neither. It is local at all points, since you always find sleepers and railway workers, and you have stations and automatic ticket machines along the way." Cited in this context by Hugh Raffles, *In Amazonia: A Natural History* (Princeton, 2002) at 181: "It is by transgressing the conventions of human space that rivers reveal the poverty of scalar categories. They are, as Bruno Latour has written of railroad tracks, 'local at all points,' while being, definitively, unstoppably translocal."

[128] 1900 mm/y in the Fayyūm (Meshal and Morcos [1984], 142) and 3000 mm/y around Lake Nāṣir (Belal et al. 2009], 33).

CHAPTER 2

WATER AND TIME
Irrigated Landscapes in the Longue Durée

> *[I]t is necessary to study both how water is mediated through society and vice versa, and this cannot be properly done without grasping that water exists independently from cultural ways of knowing it.*[1]

2.1: INTRODUCTION

This chapter introduces a *longue durée* approach to the study of irrigated landscapes and argues for the need to account for the multiple variables that work to shape the development of a landscape over the long term. While I have strongly criticized statist approaches to premodern Egyptian irrigation in the previous chapter, the state nonetheless remains a potent actor, and its role will not be ignored. Yet we must also pay equally close attention to those who "never cease from labor and sorrow by day," the local farmers on the ground. Through this ceaseless labor and their daily contact with water and earth, they come to know the needs and limits of the environment in a way that no distant state ever could.[2] Their perpetual dialogue with this ever-changing environment necessitates constant adjustments to the irrigation system(s) upon which they depend.[3] Therefore, we must also be similarly attentive to the effects of the surrounding natural environment in which an irrigation system and its appropriators are embedded.

The earlier understandings of Egyptian irrigation discussed in the previous chapter have overlooked these complexities and focused only on one variable, the state. By drawing upon an oversimplified, totalizing picture of the Nile and the Egyptian landscape, this state-centrism transforms an irrigation system into a simple object that is either functional or broken. Such a perspective compels the researcher to look for a point at which some*thing* went awry, where maintenance failed and the object broke. Rather, all irrigation systems are at heart complex entanglements of nature and culture[4]: they are composed of natural elements made to perform in sometimes wholly unnatural ways and may be regarded as natural-artificial constructs that exist in symbiosis with human communities.[5] This more nuanced approach to irrigation permits us to

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[1] Tvedt (2010a), 148

[2] Hes. *WD* 176-7: οὐδέ ποτ᾽ ἦμαρ παύονται καμάτου καὶ ὀιζύος.

[3] This description is not meant to portray peasant agriculture as a "primitive, idyllic state of nature." Rather, following Alan Mikhail (2011a) at 34, I seek merely to reinforce the important role played by local farmers in the management of local environments and resources.

[4] Adopting the terminology of Matt Edgeworth, who refers to rivers as "entanglements of nature and culture," drawing upon the work of Bruno Latour. See in general the introduction to Edgeworth (2011), at 11-32. Cf. Latour, "We may then be able, finally, to understand these nonhumans, which are...full-fledged actors in our collective...Now that nonhumans are no longer confused with objects, it may be possible to imagine the collective in which humans are entangled with them." From *Pandora's Hope: Essays on the Reality of Science Studies* (Harvard, 1999), 174-5.

[5] These "entanglements" range in complexity from the more simple/naturalistic to the more complex/artificial. Premodern flood recession agriculture in Egypt is the most obvious example of a simpler system adapted to the natural rhythms of a local water system. Modern Californian agriculture, on the other hand, is almost entirely conducted in arid but fertile desert regions with little naturally occurring water. Irrigation water is stored behind

study the interactions between nature—in this case, water—and culture, while remaining aware that although the two are deeply entwined, they never lose their distinctiveness: nature cannot be wholly socialized, nor culture wholly naturalized.[6]

Yet a study of ancient irrigation is handicapped, for the vital cultural element is often partially or entirely obscured by a lack of surviving evidence. Elements of the physical infrastructure may remain archaeologically recoverable but the daily interactions of the water community have long since vanished. As Francisco Beltrán Lloris notes in his publication of the *Lex rivi Hiberiensis*, a Hadrianic-era Latin irrigation decree from Roman Spain: "we do not have any ancient document that systematically describes the functioning of an irrigation community."[7] So too in Egypt, where we are similarly, if predictably, ill-served by the papyri. As students of papyrology quickly learn, although our texts are a rich and unparalleled source for ancient daily life they by no means preserve everything. Our documents are largely concerned with fiscal or economic affairs, hence the myriad lists, accounts, receipts, and contracts—the products of public and private administrative need—that dominate the corpus of published papyri. Such matters demanded meticulous record-keeping while mundane routines like irrigation do not. Still, irrigation was documented when things went wrong and threatened to case financial hardships and reductions in state revenue. In this vein, evidence for the social relations of ancient Egyptian irrigation survives in petitions and complaints. These texts will be discussed later on, although the corpus is minute. This may indicate that even when something did go wrong, locals managed to solve the problems themselves without resorting the documentary demands of officialdom.[8]

Since the papyri offer only occasional glimpses of the social aspects of irrigation in antiquity, any analytically useful study requires a theoretical and comparative approach.[9] Water is uniquely amenable in this regard since its circulation through living organisms and ecological systems is a historical and biological constant, a simple fact of life.[10] Perceptions and uses of water—e.g. in agricultural, civic, industrial, or ritual/devotional contexts—differ across time and space yet its movement through living systems is perpetual and it behaves in predictable ways in accordance with the rules of the hydrologic cycle. How a society adapts to this ceaseless cycle may also be highly particularistic but, water always being water, there is considerable overlap across cultures. For this reason I draw upon historical and contemporary examples both here and throughout the dissertation in order to illustrate my description of the various problems and possibilities of irrigated agriculture in the Arsinoite nome.

2.2: Crisis and Resiliency in the Fayyūm

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massive dams on distant rivers and must be conveyed over long distances through large artificially constructed waterways that demand perpetual maintenance.

[6] Cf. Tvedt and Oeestigard (2010), 7-8 for this critique of Latour.

[7] Beltrán Lloris (2006), 166

[8] So Anagnostou-Canas (1998), 44: "Le nombre restreint des documents de la pratique relatifs à un litige concernant l'usage de l'eau est sans doute dû au fait que, la plupart d'entre eux étaient réglés sans être portés devant un représentant de l'autorité publique, soit de gré à gré soit à la suite de l'intervention d'un puissant notable local, tel Zénon de Philadelphie."

[9] Beltrán Lloris recognizes the utility, indeed, the indispensability of a comparative historiography of irrigation in his publication and brief study of the *Lex rivi Hiberienses*. He deploys material from medieval and modern Spain to illustrate various aspects of the social aspects of Spanish irrigation that cannot be gleaned from the Roman text itself.

[10] Tvedt (2010), 146

2.2.1: Was there an 'Environmental Crisis' in the 3rd-4th Centuries CE?

Any study of human-nature relationships must acknowledge the risks of environmental determinism. Yet, there is another seductive danger inherent in an environmental approach to the Fayyūm: the temptation to retell an old story in a contemporary vernacular.[11] I refer here to a recent contribution to the history of the ancient Fayyūm that has adopted a refreshing environmental perspective on village abandonment. While the work wisely takes into account the natural environmental context of the desert Fayyūm, the author describes the so-called "abandons massifs" as manifestations of a "névralgie régionale"[12] and a "déséquilibre social," representing "une situation de crise" and a period of intense social dislocation.[13] While the environmental reframing of the terms of the debate is well received, I would argue that, on the whole, the study remains wedded to the earlier idea of a 3rd-4th century 'crisis,' substituting environmental factors for the formerly adduced governmental failings.

This is of critical importance, since the concept of 'crisis' itself, though not always inappropriate, remains problematic. The term itself "simplifies changes in multiple fields, involving various agents, into a unique event" and serves to identify simple, single causes for a complex series of events.[14] This can be an unhelpful exercise. As several archaeologists have recently remarked:

> [W]hat appears catastrophic at an archaeological timescale may be barely perceptible at the scale of a human generation, and a crisis at the scale of an individual actor may seem like sustainable land management when viewed from a millennial lens...It is only with a long-term perspective that we can identify which of the seemingly beneficial near-term actions truly contribute to long-term resilience and identify the ways in which some outwardly rational choices lead, in the end, to undesirable outcomes.[15]

To characterize Fayyūm settlement retrenchment as a 'crisis' is thus misconstrued and ultimately detrimental in two important ways. First, by interpreting the abandonments of only the marginal villages as representative of a wider *regional* calamity we uncritically adopt the parochial perspective of the farmers affected in antiquity by the degraded agro-environmental conditions in their respective settlements. To Aurelius Sakaon, for instance, the progressive abandonment of Theadelphia may indeed have been something of a personal crisis. His home village was nearly emptied and the revenue demanded by the Roman state could no longer be collected.

Yet the intimate detail on Theadelphia's troubles afforded by such well-known texts as *P.Sakaon* 33 and 44 (320 and 331/2 CE, respectively) can muddy the waters. While the Theadelphian portion of Sakaon's life was in trouble, elsewhere, in fact, things proceeded as normal. In *P.Sakaon* 68 (325 CE) we see our protagonist leasing out the thirty arouras of grain

[11] Roger Bagnall's discussion of "postcolonial" approaches to Ptolemaic history is illustrative in this regard. He briefly surveys three articles that propose to adopt a postcolonial analytical framework but fail to move beyond traditional papyrological methodologies. The studies conclusions "are framed in the language of colonialism, but with a few comparative remarks and with judgmental tones," and fail to add anything of theoretical or heuristic value, the postcolonial posture being mere "decoration and flavoring, rather than occupying any structural role in the argument." Bagnall (1997), 235-6.

[12] Ferron (2005b), 1

[13] Ferron (2005a), 4. Entitled *L'Émergence d'une crise régionale au coeur d'un écosystème atypique: le Fayoum.*

[14] Timothy Mitchell, *Carbon Democracy: Political Power in the Age of Oil* (Verso, 2011), 173, speaking specifically of the oil 'crisis' of 1973-4. The chapter, "The Crisis that Never Happened" can be profitably read as a theoretical exploration of the concept of 'crisis' and the tendency to conflate numerous, sometimes unrelated, circumstances into a unified event that unfolds according to simple rules of cause and effect (in Mitchell's case, the economics of 'supply and demand').

[15] Fisher *et al.* (2009), 8-9

land that he owns in the village of Boubastos (in the eastern Fayyūm),[16] while thirteen years later in *P.Sakaon* 70 (338 CE) his son Aurelius Aeil takes on a lease of ten arouras of grain land in the same village.[17] What of Boubastos, where the family of Sakaon had property and apparent connections? The village appears regularly in our documentation from the 3rd century BCE until the papyri themselves finally disappear in the mid 8th century CE.[18] Sakaon and the Theadelphians, then, were not entirely without recourse, even within the Fayyūm itself. They were not forever chained to their village of record and condemned to share its fate. We must be careful, then, not to read Sakaon's plaintive, manipulative rhetoric—designed to get him off a financial hook—as representative of socio-environmental conditions in the rest of the Fayyūm.

Secondly, the very notion itself of a Fayyūm "environmental crisis" makes little sense in a *longue durée* perspective.[19] In essence, the term can be usefully deployed to describe an inflection point at which a society and its environment are radically transformed, even if that transformation is far from instantaneous. We must be alert, then, to the differences between long-developing but self-contained local difficulties and wider systemic problems that provoked far reaching socioenvironmental upheaval. In this context I draw upon the work of archaeologist Sander van der Leeuw who observes that a true socio-environmental crisis entails the total breakdown of a socio-environmental relationship such that "the society can no longer maintain the kind of adequate relationship with its environment that enables its continued existence." That is, regardless of the processes setting it in motion, the crisis is of such an extent that the socio-environmental system becomes entirely incoherent and either collapses or is forced to change dramatically in order to survive.[20]

This is certainly not what occurred in the Fayyūm during the first few centuries of the common era. As I will demonstrate in the following two chapters, the Fayyūm's environment was distinctly fragmented and the slowly degrading margins differed radically from the better-watered, more fertile central floodplain. Different places went out of use at different times, representing the slow, progressive alteration of the landscape. Although settlement gradually retrenched toward the center, the core socionatural system—the relationships between farmers, canals, floodwater, and the land—remained unshaken, surviving intact until the introduction of perennial irrigation and chemical fertilization in the late 19th and early 20th centuries. While we should not be over sanguine and fail to appreciate the very real hardships that often accompany human mobility, in a long-term perspective the abandonments of Theadelphia and other border villages can still be read not as 'crisis' but as an ephemeral period of structural adjustment punctuating a longer socio-environmental equilibrium. It is, in fact, the intensive and

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[16] Lines 1-8: [Αὐρηλί]ῳ Ζακ̣α̣ῶνι Σ̣α̣[ταβοῦτος μ]η[τρὸ]ς [Θε]ρμ̣ο̣υ̣[θίου] [ἀπὸ κώμης Θεαδελφίας] παρ' Αὐρη[λίου . . . . . ἀπὸ τοῦ] Ἑρμοπολίτου [νομοῦ διαμένοντος] ἐν τῷ̣ Ἀρσι(νοΐτῃ).[βούλομαι μι]σ̣θ̣[ώσ(ασθαι)] παρὰ σοῦ τὰς ὑπαρ[χούσας σοι περὶ κώ]μην Βούβασ[τον σιτικὰς] ἀρ[ο]ύρ[ας] τριάκοντα.

[17] Lines 1-4: [Αὐρ]η[λ]ίῳ Ἀβίν̣α̣ Ἡσυχίου ἀπὸ κώμ̣[η]ς Βουβά[στου π]αρὰ Αὐρηλίου Ἀεὶλ Σακαῶνος ἀπὸ κώμης Θ̣ρασώ. β[ούλομαι] μισθώ[σ]ασθαι παρὰ σοῦ τὰς ὑπαρχούσας σοι π[ερὶ κώ]μην Βούβαστον σιτικὰς ἀρούρας δέκα, ἢ ὁ̣ς (*pap.,* l. ὅσας) ἐὰν ὦ̣[σι

[18] The earliest text is *P.Petrie* III 90 (3rd BCE) while the latest dated text is *SPP* VII 1199 of 744 or 759 CE. The village appears a total of 331 times in the published papyri per the list on TMGeo: http://www.trismegistos.org/geo/georef_list.php?tm=463&p=1. Accessed March 23, 2012.

[19] Archaeologist Robert Wichter points out an additional problem with the concept of agrarian crises in antiquity in "Agrarian Spaces in Roman Italy: Society, Economy and Mediterranean Agriculture," *Arqueología espacial (Paisajes agrarios)* 26 (2006), 341-359: "But the implication of this label [crisis] is that stability is the normal state of affairs and that any change was both exogenous...and to be considered negative automatically."

[20] Van der Leeuw (2009), 43-4, quote at 44.

unsustainable modern agricultural developments that represent the first true threat to the Fayyūm's and Egypt's coherence.[21]

2.2.2: The Resiliency of the Premodern Fayyūm

The durability of the Fayyūm across the 1600 years surveyed in this dissertation may seem counterintuitive. The region's unique, canal-dependent regime appears on paper to be highly fragile. A single variable—the amount of water entering the depression—remains a matter of the utmost importance. Both too much water and too little have immediate and highly deleterious consequences for the cultivability of farmland by causing either water-logging or desiccation (both promoting increased soil salinization and degradation).[22] If the controls at the entrance to the Fayyūm were to be irreparably damaged or the connection with the Nile severed the area would quickly become useless for agriculture. And yet no such disasters occurred in our period on a scale sufficient to totally upend the socionatural system. Of course, as with any piece of manmade infrastructure, the barrage at the entrance to the Fayyūm at al-Lāhūn (ancient Ptolemais Hormou) was liable to fail from time to time. Although these periodic failures would have caused short-term hardship, they did not pose a systemic threat. The Fayyūm thus experienced a long and uninterrupted period of socionatural stability during premodernity. As such, instead of focusing only upon its apparent fragility and the eventual abandonment of the margins, it will be more useful to characterize the Fayyūm as a whole as "resilient", i.e. highly capable of adjusting in response to perturbations both from within and without based upon its particular structural characteristics.[23] As with riverside basin irrigation in the Valley, it was the simplicity of the Fayyūm's system that lent it durability. Only one main water intake required scrutiny and maintenance. The canal infrastructure was equally straightforward: a network of gravity-driven, earthen channels maintained by the locals who depended upon them for their survival. Of course, these strengths could not compensate for a year of either excessive or insufficient inundation. Such times were difficult, but like the rest of Egypt the Fayyūm survived year to year, its underlying socio-environmental structures fundamentally unchanged.

Since we cannot describe the border desertions as either an environmental or social crisis, we need more useful terminology. We can more profitably describe it in neutral terms as progressively increasing land degradation or desertification (the reduction in the productivity of agricultural land in arid, semi-arid or subhumid regions via anthropogenic factors, natural processes, or some combination of the two[24]), coupled with gradual settlement shift.

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[21] Literature on the modern threats to Egyptian agriculture is vast and tends, rightly, to focus on the deleterious effects of intensification permitted by the Aswān High Dam, perennial irrigation, chemical fertilizers, and export-oriented growth strategies. For both the successes and the serious side effects of Aswān, see Ibrahim and Ibrahim (2003), 76-91. The first two chapters in Part III of Mitchell (2002), entitled "Fixing the Economy" are essential reading on the failures and deeply flawed reasoning and assumptions underlying unsuccessful developmentalist projects in Egypt. See also Ray Bush, "Politics, Power and Poverty: Twenty Years of Agricultural Reform and Market Liberalisation in Egypt," *Third World Quarterly* 28.8 (Special Issue: "Market-Led Agrarian Reform: Trajectories and Contestations"), 1599-1615. The scientific literature mined for much of the following chapter's discussion of the Fayyūm's environment is also of considerable use in understanding the region's current difficulties and possible future trajectory.

[22] The natural conditions contributing to soil salinity are discussed in the following chapter.

[23] Van der Leeuw (2009), 48. The author notes that this condition is sometimes referred to as "resistance" in the literature.

[24] There is no consistency in the use of the terms "desertification" and "land degradation" in the scientific literature. Johnson and Lewis (2007) at page 2 define the latter as entirely anthropogenic, while indicating that the former can refer to one form of human-caused land degradation in arid, semi-arid and subhumid ecosystems or to a general

Additionally, this land degradation was highly localized, affecting only the comparatively high-altitude margins of the Fayyūm. While settlement pulled away from the affected areas, there do not appear to have been any major social disruptions affecting the region as a whole. The Fayyūm as a socio-environmental unit remained active and productive throughout the period covered by this dissertation and beyond. Even in the fifteenth century an Egyptian author offered hyperbolic praise for its fruitfulness, claiming that each village in the Fayyūm produced enough food to feed the whole of Egypt for one day.[25] In short, then, the prejudicial and nearsighted crisis paradigm retains no value. It focuses the gaze upon a brief moment in the Fayyūm's long history, compelling us to see catastrophic decline and failure where we ought instead to see adjustment and long-term structural continuity.

2.3: Irrigation Systems in Context

2.3.1: Human Needs and Local Governance

I turn now to the basic socio-environmental characteristics of canal irrigation, which will be taken into account in the following chapters. As mentioned above, an irrigation system is both a social and a physical construct. The physical network links humans together and creates "communities of water" bound by mutual dependence upon the infrastructure and the water it delivers.[26] Like any community, water communities and their infrastructure must be governed and maintained, either by officialdom, the dependent farmers themselves, or some combination of the two. The two fundamental and interrelated tasks of this administration regardless of its shape and the source(s) of its authority are to maintain the water supply and to distribute it fairly so that the needs of all water users are met. Neither task is unproblematic. Firstly, while all human works progressively decay in time, water delivery systems suffer swiftly from the erosive action of flowing water. Water abhors confinement and exploits any structural weakness to carve an escape for itself. Insufficient maintenance, then, is lethal. It is thus critical to secure manpower sufficient to maintain systems that are in perpetual and often very rapid states of decay. If compensated, human labor must be paid at a rate adequate to seduce workers away from their duties at home.[27] If labor is an unpaid obligation—a corvée—it requires the close oversight of a leadership willing and able to seek out shirkers and compel their compliance. Ideally, if unrealistically, the labor force will be nearly as fluid and adaptable as water itself, its efforts directed at the appropriate times to appropriate sites, either for routine work or to repair sudden and unexpected damage.[28]

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result of climate change. Tal (2010), however, uses desertification in an entirely anthropogenic sense, noting among its causes "deforestation, overgrazing, or poorly considered water management" (147). The newness of the terms is largely to blame, with "desertification" entering the scientific lexicon only in 1949 and "land degradation" only recognized by the U.S. Library of Congress in 1994.

[25] Mikhail (2010), 569, citing Ahmad ibn-Ali al-Maqrizi, *al-Mawaʿiz wa-l-Iʿtibar bi-Dhikr al-Khitat wa-l-Athar*, 2 Volumes (Bulaq, Egypt: Dar al-Tibaʿa al-Misriyya, 1853), Volume I, 245.

[26] To adopt the terminology of Mikhail (2011) at 39.

[27] This assumes full employment in agriculture, of course, something not likely to be true at all times. Indeed, "river workers" (*potamitai*) are documented in the Graeco-Roman Fayyūm. See Rathbone (1991) at 166 and 225-6. See also Federico Morelli, "Sulle retribuzini nell'Egitto bizantini: il caso dei ποταμῖται," in *Pap.Congr.* 21 (*Archiv für Papyrusforschung, Beiheft 3, 1997*), 727-37.

[28] Mikhail (2010) demonstrates the difficulties of coordinating and directing labor in the 18th century Fayyūm, where a dam in the southern portion of the basin was repeatedly broken and repaired (somewhat haphazardly or incompetently, it seems) over a period of decades. The labor scenario discussed here is, of course, a fanciful ideal. Joachim Radkau notes that, in reality, large systems worldwide tend to display a great deal of inertia (Radkau [2008], 91). For instance by 2020 85% of the 2.5 million stream and river dams in the U.S. will have reached their

Secondly, there are theoretical as well as practical difficulties inherent in the equitable distribution of water, since *fairness* and even *need* elude easy definition. Is it fair, for instance, to charge for access to water? In the English tradition:

> [W]ater is a moveable wandering thing, and must of necessity continue common by the law of nature; so that I can only have a temporary, transient, usufructuary property therein: wherefore, if a body of water runs out of my pond into another man's, I have no right to reclaim it.[29]

The sentiment neatly adheres to Roman precedent where water, air, flowing rivers and, by extension, river banks, are said to be "common to all by natural law."[30] So too in modern Egypt where access to the waters of the Nile remains a fundamental right. The state provides water free of charge and, as far as possible, in line with demand, a practice that tends to encourage considerable profligacy.[31] In contrast, water users in the American West commodified water through the first-in-time, first-in-right doctrine of prior appropriation: the first person to draw upon a water source for a productive purpose—e.g. mining, agriculture, manufacture—earned a right to continue drawing upon the water as the senior appropriator, a right which can be sold to others. In this region irrigation water is now provided to agricultural and domestic users as a fee-based service.[32]

But regardless of the manner of its allocation, when water is scarce or over-allocated the questions of need and equity become highly contentious.[33] An allocation deemed "fair" and "necessary" to one water user—a large estate holder, perhaps, with vast acreage under water-intensive cotton—might appear intolerably unjust to a nearby smallholder who, though his minimum requirements are met, cannot hope to increase his water allotment and harvest without meeting significant resistance from his wealthier neighbor. Such tensions and the inevitable conflicts that ensue are endemic to irrigated areas where each farmer naturally seeks to secure his own water supply, even at the cost of his neighbors if there is too little to go around.[34] The two

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50-year life expectancy and some will need to be dismantled for they are too massive to simply be patched or otherwise superficially repaired (figure from "Tearing Down the Elwha River Dam," *Popular Mechanics*, February 10, 2006).

[29] William Blackstone, *Commentaries on the Laws of England* (1807) cited from Porter (2011), 327.

[30] *Institutiones* II.1.i: "Indeed, these are common to all by natural law: air, and flowing water and the sea and, consequently, the sea shore" (*et quidem naturali iure communia sunt omnium haec: aer et aqua profluens et mare et per hoc litora maris*). Cf. at II.1.ii: "All rivers and ports are public; therefore, the right of fishing in ports and rivers is common to all" (*flumina autem omnia et portus publica sunt: ideoque ius piscandi omnibus commune est in portibus fluminibusque*). Regulations touching upon water in the Codex concern aqueducts, which bring water to cities, rather than water used for primarily agricultural purposes (*CJ* 11.42).

[31] Merrey (1998), 3

[32] Porter (2011), 327-37

[33] While the U.N. has declared access to clean water a fundamental human right (U.N.G.A/10967, 28 July 2010: http://www.un.org/News/Press/docs/2010/ga10967.doc.htm. Accessed September 27, 2011), this will not solve any of the conflicts over water in those areas where it is scarce. For case studies on the countries of the Nile Basin see the essays in Tvedt *ed.* (2010). For the politics and polemics of "rights" and "needs" in one specific region, see Amnesty International's 2009 report on Israel-Palestine "Thirsting for Justice: Palestinian Access to Water Restricted" (online: http://www.amnesty.org/en/library/info/MDE15/028/2009/en. Accessed September 27, 2011) in conjunction with a pointed critique of the report by Alon Tal, "Thirsting for Pragmatism: A Constructive Alternative to Amnesty International's Report on Palestinian Access to Water," *Israel Journal of Foreign Affairs* 4.2 (2010), 59-73. For a study of water policy in a single metropolitan area encompassing not only conflict but also creativity and compromise see Steven P. Erie's study of Los Angeles *Beyond Chinatown: The Metropolitan Water District, Growth, and the Environment in Southern California* (Stanford, 2006).

[34] This is not, strictly speaking, a Hardin-esque "tragedy of the commons" scenario since the shared water source is not technically common property but rather a common-pool resource. Furthermore, irrigation systems worldwide

unforgiving tasks incumbent upon an irrigation system's management structure thus compel it to forever balance the available water supply against the demands of those whom Latin calls *rivales*: neighbors along the same stream and hence rivals.

2.3.2: Nature's Hand

Balancing water appropriators' often mutually exclusive demands is made more difficult by the ultimate unpredictability of the water supply. Even the contents of large-scale modern reservoirs are ultimately subject to the vagaries of regional and global climate patterns. Irrigation systems, then, do not exist in perfect isolation subject only to a tug-of-war between their human users: they are artificial creations embedded in and sustained by a larger natural *water system*. The governing bodies of an irrigation system, however efficient and responsive, can thus only administer what nature chooses to provide.[35] Even if additional supplies can be found these too remain finite, in flux, and are quickly used to capacity.[36] Surface and groundwaters replenish themselves at their own often leisurely pace and no one can conjure more water in times of need. Apart from energy-intensive and prohibitively expensive desalination in modern and wealthy coastal nations, periods of scarcity can only be endured.

The water apportioned and used in an irrigation system is also merely at one stage of the hydrologic cycle, its endless recycling through the water system. As such, agricultural requirements are but one of many demands upon it. A full accounting of the productive possibilities and limitations of any irrigation system must account for water demands throughout the larger water system, since demands in one part of the system affect water availability elsewhere. I use the word demand broadly here, referring not only to human requirements but to all biological and physical elements of the natural environment that "demand" water. All the biota in a water system, human farmers being but one group, demand a constant water supply.[37] So, too, the aquatic features of the landscape, the lakes, ponds, marshes, wetlands and river

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show numerous strategies—legal, customary, or in some combination—for allocating water amongst users (see Trawick [2001a], 2 for discussion and references). Struggle and conflict, then, do not necessarily indicate systemic failures but rather the efforts of individual members of a water community to enforce the mutually-agreed rules.

[35] Cf. Mikhail (2011a), 48: "The [Ottoman] Empire could neither invent nor create water. It could only find ways to manage effectively what it already had."

[36] Even the most abundant and accessible new water sources can quickly become "limited" or "scarce" when cultivators become used to the new bounty and use it to capacity. As Terje Tvedt remarks of early 20th century Egypt: "By 1914, perennial irrigation extended as far south as Deirut, in the northern [*sic*] Asyut province. But improved irrigation did not lead to less demand for water. On the contrary, a success of this kind does not satisfy; it rather creates a demand for more of the same" (Tvedt [2004], 91). The water supply provided by the Aswān High Dam is a further case in point. The Lake Nāṣir reservoir holds approximately two years of Nile floodwaters and current agricultural production has outstripped even the fantasies of British engineers. And yet modern Egypt is a "water stressed" food importer since its large population and thirsty capitalist agriculture now consumes every drop of the available supply and loses a vast amount from Lake Nāṣir due to seepage and evaporation. So too in modern California, which has exhausted easily accessible new water sources and must now find ways to better manage increasing (and increasingly polemical) demands for quick fixes. See in general Hanak *et al.* (2011).

[37] Any analysis that ignores the demands of nonhuman "water users" is of necessity incomplete. The problem of the water hyacinth (*Eichhornia crassipes*) in contemporary Egypt is a case in point. This prolific non-native species clogs canals, impedes navigation, and consumes large quantities of water that would otherwise be available for irrigation. "Thousands of *fellaheen* are today occupied all year in eradicating the water hyacinth, once introduced in Africa for the sake of amenity but harmful in the course of time. Needless to say, during the eradication of the plants the *fellaheen* wade in the water, thus exposing themselves to the risk of infection by bilharzia." The latter is a disease carried and transmitted by the worm *Schistosoma*, itself transmitted by freshwater snails, whose habitat has been vastly expanded thanks to perennial irrigation. Quote from Ibrahim and Ibrahim (2003), 84

deltas that provide humans with diverse and renewable benefits (ecosystem services).[38] Even the air and the soil make their own competing demands. Evaporation constantly draws water up and away from the system while capillary action similarly pulls it down into the soil. In arid regions evaporation is always more potent and, if soils are insufficiently washed each year, increasing salinity is its inevitable outcome. The non-human water users of a water system, then, are not mute. They can make their needs known by parching and salinizing the soil, or by desiccating, dying and disappearing altogether when their demands remain too long unmet.[39]

2.3.3: Water and Power

As the last chapter demonstrated, water and state power in Egypt have long been conceptually bound at the hip.[40] But the colonial-era expression of the trope stands in an even longer tradition. Of the Roman east at the height of Roman power, for example, Edward Gibbon wrote: "the solitudes of Asia and Africa were once covered with flourishing cities, whose populousness, and even whose existence, was derived from such artificial supplies of a perennial stream of fresh water." By ranking the aqueducts conveying this water "among the noblest monuments of Roman genius and power" Gibbon subordinates the prosperity of Rome's cities and by extension her empire to the state's hydraulic engineering prowess: water as the lifeblood of empire.[41] The real—not the imagined—connections between the control of water and power is the final variable that must be considered.

Indeed, despite a sustained attempt to banish "despotism" entirely, Wittfogelian thinking remains a part of the academic landscape.[42] Referring to the continuing appeal of the water-and-power nexus, Karl Butzer has said that "the Wittfogel model, like Elvis, refuses to die." The "hydraulic hypothesis," he claims, "continues to be repackaged in a variety of guises that assign

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[38] The concept of ecosystem services is relatively new way of describing for describing the benefits humans obtain from their ecosystem. More specifically, *hydrologic* services "encompass the benefits to people produced by terrestrial ecosystem effects on freshwater" (Brauman *et al.* [2007], 72.

[39] We will encounter the water "demands" of aquatic features of the landscape and the "ecosystem services" they provide later with regard to the Fayyūm's marshes (the *drymoi*), which were progressively desiccated by the alterations to Fayyūm hydrology caused by the Ptolemaic reclamation. Of course, it is impossible for me to take account of, let alone quantify, every sort of water "demand" in the premodern Fayyūm. Still, the major issues of conveyance loss via evaporation and seepage, the border marshes' needs, and the different demands of the central and the border regions are discussed in the pages to come.

[40] The supposedly strong correlations between water and state power have become so routine that they have worked their way into even the pop-historical imagination. The sensational title alone of journalist Steven Solomon's 2010 popular history *Water: The Epic Struggle for Wealth, Power, and Civilization* is sufficient to divine the author's ideological bent. E.g.: Page 2: "ancient Rome rose as a powerful state when it gained dominance over the Mediterranean Sea, and developed its flourishing urban civilization at the heart of its empire on the flow of abundant, clean freshwater brought by its stupendous aqueducts"; 237: "Britain quickly understood what all *previous rulers* (emphasis mine) of Egypt had learned: that to govern the country, one had to control the Nile waters"; 266: "Like other great states' rise to power, America gained command of its native resources."

[41] Gibbon cited from Shaw (1991), 63. Shaw's rendering is more elegant than my own and bears repetition: "The prosperity of the empire, in [Gibbon's] estimation, was to be judged by the efflorescence of its city life, which, in turn, depended on a practical and enterprising Roman 'genius' in the technical manipulation of nature."

[42] For representative writings in the anti-Wittfogelian mode see the articles collected in Mabry *ed.* (1996) as well as Leaf's (1992) study of the Indian state of Rajasthan. Radkau (2008) at 92 remarks that Wittfogel's "ghost cannot be exorcised." Indeed, contemporary China's grandiose hydraulic projects have renewed "hydraulic despotism" for a new generation See briefly, "Choking on the Three Gorges," *The Economist* June 9, 2011, "Yangtze rains bring drought relief, flood," *New York Times*, June 7, 2011, and "Plan for China's water crisis spurs concern," *New York Times* June 1, 2011. See also Molly DeSalle *et al.* (2008), "China's South-to-North Water Diversion Project," online: www.water.columbia.edu/sitefiles/file/Appleby_FinalPaper_FINAL.pdf. Accessed March 15, 2011.

a unique causal role to irrigation in the development of socio-political complexity."[43] In perhaps the most notable attempt to apply such an analysis to the modern world, environmental historian Donald Worster has claimed that "irrigation in California and the West did in fact mark a new phase [of cooperation and individualism], but past a critical threshold of development it became demonstrable that irrigation would do little to promote democracy, that instead it was capable of creating Leviathan in the desert."[44] With the help of an often compliant government a secretive and single-minded local elite co-opted the scarce water supply for their own needs, or so Worster argues.[45]

But apart from a standout like Worster, scholarly consensus has long since moved beyond the particulars of *Oriental Despotism*. Contemporary work does not ignore the state but instead offers more complex pictures of the interactions between irrigated rural environments and central power. James C. Scott, for instance, offers the useful example of rice-padi irrigation in upland Southeast Asia, noting that "the relationship between states and wet-rice cultivation was one of elective affinity, not cause and effect." The creation of large irrigated areas proceeded piecemeal, often preceding the rise of centralizing governments and similarly surviving the later disappearance of states that had attached themselves to an irrigated region in order to take "temporary advantage of its concentrated manpower and food supply."[46] Indeed, in response to Donald Worster's work on irrigation in the American West, more recent work has articulated an alternative perspective on the cooperation, competition, and conflict between local actors and federal and state agencies.[47] It has been remarked, for instance, that the "California record discloses a wide and often confused and crosscutting range of interest groups and bureaucrats, both public and private, who accomplish what they do as a result of shifting alliances and despite frequent disputes among themselves."[48] In the contemporary West, politically astute irrigation districts, though nominally bound by national environmental legislation, can mobilize popular anti-government sentiment and deftly outmaneuver Washington to secure access to additional water in the teeth of heavy government opposition.[49]

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[43] Butzer (1996), 200. Archaeologist Vernon L. Scarborough's 2003 *The Flow of Power* is exemplary in this regard. While the author notes on pp. 17-19 that the "hydraulic hypothesis" has been dismissed, the book's very title and its focus on the sociopolitics of prehistoric large-scale irrigation draws from the much the same thematic well as Wittfolgel's opus.

[44] Worster (1982), 507

[45] For a survey of the legal background to irrigation expansion by the earliest white settlers see Bretsen and Hill (2007). Former Secretary of the Interior Bruce Babbitt echoes Worster in a 1993 contribution: "The Bureau [of Reclamation] became part of an extraordinarily powerful political force composed of the U.S. Congress, local interests, and a hungry bureaucracy. This coalition elected Westerners to Congress by promising to dam every single stream in the regions, paid for with a continuous flow of tax dollars from people east of the Mississippi River. Thus did we create and subsidize a welfare state in the West, under the paternal guidance of the Bureau of Reclamation," ("The Public Interest in Western Water," *Environmental Law* 23, 933-41).

[46] James C. Scott, *The Art of Not Being Governed: An Anarchist History of Upland Southeast Asia* (Yale, 2009), 42.

[47] See for instance the highly critical contemporary review by Lawrence Rakestraw in *The Western Historical Quarterly* 18.3 (1987), 349.

[48] Norris Hundley Jr, *The Great Thirst: Californians and Water, A History* (Berkeley, 2001), xix.

[49] As illustrated in the 2010 skirmish between the San Joachin Valley's Westlands Water District and the federal government. See Matt Jenkins, "Breakdown: The 'Cadillac of California irrigation districts' has more than a tiny fish to blame for its troubles" (*High Country News*, April 21, 2010): http://www.hcn.org/issues/42.1/breakdown, and "Fenstein and Westlands: Who's Running Whom?" (March 7, 2010) at *High Country News* http://www.hcn.org/blogs/range/feinstein-and-westlands-2013-who2019s-running-whom. Accessed on dates of publication.

But even within a purposefully designed "despotic" system, top-heavy bureaucracies cannot control every variable or regulate every water transaction between users. Modern Egypt is a perfect case in point. The central Irrigation Department in the Ministry of Public Works has roughly 38,000 employees and is divided into five major units and numerous other directorates and inspectorates. All important decision-making takes place at the highest levels, restricted to about 14 high officials, with little participation from or accountability to the lower levels of the bureaucracy. During the season of peak water demands, the Minister of Irrigation himself makes decisions regarding water deliveries throughout the country, "leading to 'safe' but not necessarily optimal decisions"[50] The top-heavy system deprives individual farmers of any voice and the cooperation observed in community-based irrigation systems has been replaced by a high degree of individualism. Cultivators recognize the impotence of local bureaucracy and view it as an impediment to be bribed or evaded. Employees of local irrigation offices, on the other hand, frequently encourage such bribery and other rent-seeking behaviors, which are their only means of personal advancement. On the other side, the farmer is similarly beset by the demands of traditional institutions, village mayors and their deputies (*sheikh al-balad*) who simultaneously attempt to coordinate aspects of irrigation at a local level, entirely separate from state offices.[51]

Clearly, then, we cannot ignore the many possible links between irrigation and central governments. Although many studies have shown that large-scale irrigation can operate independently and that centralization and prosperity are not necessarily linked, the state is often present in some guise.[52] The previous chapter has even demonstrated that Wittfogel's "hydraulic hypothesis" can work in reverse: locally managed irrigation practices can be expanded, connected, and complexified by the state itself to such an extent that its own superior resources and managerial capacities become essential.[53] That central governments often facilitate the construction of large irrigation systems and thereafter maintain some manner of administrative presence is uncontroversial. The Fayyūm itself is a perfect example of a project planned and executed on a scale too vast for private initiative alone. But, as mentioned above, water cannot be grasped, held or fully contained. Total control is thus an illusion, eluding even those who seek it.[54] There is therefore no compelling reason to believe that ancient governments could maintain a level of control over the irrigation system of the Fayyūm imagined by earlier scholarship. Neither, then, do we have any legitimate cause to hold the Roman state fully responsible for the changes or failures observed at the outset of Late Antiquity.

Yet, while we cannot disregard the important roles governments can and do play, we must remain alert to the array of configurations that the combination of a state and an irrigation

[50] Drawn from Merrey (1998), 9-14, quote at 14.

[51] The above is drawn from Radwan (1997). The paper is reprinted in Mollinga *ed.* (1998). Radwan argues that one can characterize the problems afflicting Egyptian irrigation as essentially a conflict between the state-imposed demands and the customary, community-based traditions of water control, which the imposition of a weak and ineffective bureaucracy has failed to fully eclipse. On this dictatorial, despotic, but ineffectual "soft state" in modern Egypt, see chapter one of Galal Amin's *Egypt in the Era of Hosni Mubarak* (AUC Press, 2011), 7-20.

[52] Ostrom and Gardner (1993) is a fine starting point for the conceptual issues surrounding the success of communally-managed irrigation systems. For a collection of village- and peasant-centric case studies of small-scale communal irrigation see the essays collected in Mabry *ed.* (1996). See also Trawick (2001a) and (2001b). For accounts of the large-scale systems of the American West and their complex development and management histories involving both local agency and state wealth and power see, *e.g.* Pisani (2002), Porter (2011), Hundley (2001) and Worster (1985).

[53] Drawing upon language in Radkau (2008), 92

[54] See Tvedt (2010), 152 for the idea that water is fundamentally beyond control.

may take.[55] Just as the term *state* encompasses a multiplicity of institutional forms, the term *irrigation system* may be applied to a dizzying array of sociotechnical arrangements for the delivery and apportionment of freshwater. And even a single irrigation system may disclose great diversity in local patterns of water delivery and use, something that will become apparent in the later discussion of the Fayyūm's canal network. Such considerable diversity renders generalizations about "irrigation systems and the state" superficial and unpersuasive. A credible analysis of an irrigation system and the state must take into account both the specific characteristics of the environment and water system in which it is embedded as well as the nature of a government's demands and the extent of its on-the-ground presence.

2.4: Irrigation and Water Control in Ancient Egypt

Until the dams of the 20th century began to provide water perennially, the irrigation system of the Nile Valley was dependent upon the cycle of an annual inundation.[56] The yearly flood provided not only water but also riverine silts—Shakespeare's "slime and ooze"—which replenished soil fertility each year.[57] The flood waters also dissolved and leeched out accumulated salts, removing them from the upper horizons of the soil where they could injure the fragile roots of plants. The persistence of this system over millennia has made Egypt the archetypal irrigated ancient society. But this sustainability was not the result of highly engineered sophistication. Instead, basin irrigation is more usefully viewed as a locally managed "productive adaptation" to the flood.[58] That is, it worked with the Nile's rhythms, rather than attempting to alter them. One can easily imagine that the earliest Egyptian riverside agriculture was the simple scattering of seeds upon the muck left behind after the floodwaters receded. Basin irrigation simply restricted the lateral movement of the inundation, containing a greater depth of water and silt deposits on a smaller piece of ground, which in turn was rendered highly fertile and productive.

Differences in local topography, however, would have determined the size and shape of basins. That is, despite the matter-of-fact descriptions in the engineers' technical manuals, there was no "standard" basin. Still, we can say with at least some confidence that ancient basins were nowhere near as large as the massive interconnected column basin structures mentioned in chapter one. *P.Oxy*. XXXVIII 2853 (AD245/6), for instance, mentions an Oxyrhynchite canal called *Chiliarourai* or "one thousand arouras," probably indicating the size of the basin it served.[59] If we recall that in the late 19th century there were only 212 basins in upper Egypt covering 1.43 million acres, this returns an average basin size of over 9,904 arouras, well over nine times the size of the putative *Chiliarourai* basin.[60]

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[55] Radkau (2008) at 91: "It is obviously important that we do not think about this question in a deterministic fashion, by in terms of possibilities. While irrigation does not *compel* a centralized bureaucracy, it contains for an ambitious government great temptation to expand the systems of artificial irrigation as far as possible as a way of stabilizing and expanding one's own power and increasing the tax revenue. And that precisely is what makes it ecologically risky."

[56] The best source for a technical discussion of all facets of basin irrigation remains Willcocks and Craig (1913), chapters 4 and 5. I draw the technical summary of basin irrigation from this work.

[57] *Antony and Cleopatra* Act II, Scene VII

[58] The term is from Postel (1999), 31. This is not to say the ancient Egyptian irrigation was strictly natural. It was, of course, clearly an artificial intervention in the life of the river, one which will have built up the land on the banks of the river by concentrating silt deposits in the basins.

[59] The number could also be figurative and used simply to indicate a large area.

[60] For the figure see above, chapter one, p. 24 at note 53. 1 aroura = 2756 m^2.

Unfortunately, however, we lack detailed evidence for the construction and management of basins at a local level in antiquity and are deeply reliant upon the general impressions to be gleaned from these same works as well as from the writings of the *savants* in the *Description*.[61] While we should clearly be wary of the projecting the technologies observed in the 19th century onto the past, the basic functions of a basin are so simple as to make their operation relatively straightforward: fill, wait, empty. First, two connected longitudinal dykes were built parallel to the river's banks to create a large, enclosed basin, into which ran a feeder canal. As described in the 19th century, the bed of the feeder canals sat roughly halfway between ground level and the level of the Nile during the low season, leaving them dry save during the inundation. During the flood, water was channeled directly from the river through the feeder canal and into the main basin. If a large basin was divided into smaller basins, as the first of the sub-basins reached the desired capacity, its sluice gate was opened and water began to fill the subsequent basin. This continued until every sub-basin was full or until the water ran out, whichever came first.[62] The water then sat idle at an average depth of 1.5 m for some 40-60 days. During this time suspended solids settled out while the water saturated the ground, leeching out contaminants in the process. Once irrigation was complete, the basins were breeched and the water returned to the river.

This simplicity was the heart of Egyptian basin irrigation's successful longevity. By allowing the flood to take its course with only relatively minor interference, Egyptian cultivators created an agricultural system in which a thoroughly natural process provided all the water, fertilizer, and soil cleansing necessary for a year's crop. In addition, basin irrigation provided a roughly egalitarian access to water. Rather than altering the course of the flood, basins simply constrained it within an artificially narrowed floodplain. The river and its channel remained unimpeded and upstream cultivators had no ability to disadvantage their downstream neighbors as do modern dam builders.[63] Of course, vigilance was still necessary to ensure that the dykes' walls were sound, the basins adequately filled, and the feeder canals free of blockages. Still, compared to the uncertainty of rain-fed agriculture, Egypt's system was blessed with predictability and high productivity. This simplicity nonetheless left it vulnerable to low and high flood years, about which nothing could be done except to lament and pray. As traumatic though such events were, however, occasional disaster was the price of sustainability.

Basin irrigation neither required nor produced the centralized and despotic management system envisaged by colonial engineers and Karl Wittfogel. Still, we cannot neglect the very real interest of a state in the irrigation systems of its countryside. In a recent contribution, Joseph Manning attempts to go beyond simple castigation of Wittfogel and to model the connections between the central Egyptian state and the locals over whom it ruled. Manning rightly notes at the outset that throughout the whole of its ancient history Egypt lacked *any* central authority charged with the operation and maintenance of the hydraulic system. The Nile's simple earthwork inundation basins were instead easily maintained by their users, inhibiting the development of a centralized "hydraulic despotism." Rather, the imposition of taxation and the

[61] See for instance the schematic drawing of an irrigation basin on page 327 of Bruce G. Trigger's, *Ancient Egypt: A Social History* (Cambridge, 1983). The drawing is pulled from Alan Lloyd's 1976 commentary on Herodotus Book II.1-98 (Leiden, Brill, 1976) at page 75, who in turn relies upon Willcocks' 1913 edition of *Egyptian Irrigation*.

[62] This was clearly an adaptation to the ultimately unpredictable water supply. In low years, it was better to water and fertilize a smaller area and obtain from it a normal crop than to attempt to spread less water and silt over the entire basin.

[63] Upstream Nile states now desire to build massive hydroelectric dams of their own, overturning Egypt's privileged access to nearly 75% of the Nile's annual flow. Needless to say, ancient technologies offered no such opportunities.

royal ideology developed to defend the legitimacy of this taxation remained the only truly centralizing aspects of the ancient Egyptian state.[64] This ideology and the rituals of pharaonic kingship helped to reinforce the bonds between the state and local authorities, in whose hands lay the real hydraulic power. It was the locals who laid out basins, organized the cleaning of canals, measured water levels, and surveyed the land, though Manning does acknowledge a careful monitoring by the state since it always stood to benefit from the revenues of a well-managed system. Yet even in the Ptolemaic period where the reclamation of the Fayyūm marks Egypt's greatest pre-modern, state-funded agricultural expansion, Manning remarks that the project was undertaken as a one-time response to the need to settle an influx of Greco-Macedonian settlers, rather than emerging as part of a new ideology of centralization. Workers on the reclamation project were not masses of bedraggled servants, coerced by the lash; they were paid, if poorly, and laborers and equipment were often in short supply.[65] In short, while the Ptolemaic bureaucracy may in general have increased the level of state complexity beyond anything that preceded it, the management of irrigation remained diffused throughout the country in the hands of locals, an overarching state water bureaucracy still entirely absent.[66]

Despite the absence of central power from the local scene, Manning writes in a different work that agricultural yields in the Fayyūm varied from year to year, depending upon the amount of water and labor available, both variables affected by the "amount of political control that could be applied" by the state. Although Manning is speaking in particular of the Ptolemaic era, the statement could well apply to the Roman period as well, when the state regulated annual canal cleaning through a system known as the *penthēmeros*, from the five days of annual labor required of able-bodied males for the cleaning and preparation of the canals prior to the flood. This is true up to a point, and the state did indeed possess some capacity to coordinate local labor. Still, it could not regulate the aggregate amount of water that arrived each year. As we will see below, a considerable portion of the labor performed on the canals was undertaken by their local users, a part of the normal rhythms of life in irrigated agriculture. In large part, then,

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[64] Manning was anticipated here by Fakri Hassan (1997), 52: "[T]here are no indications that the main function of centralized government in Egypt or its bureaucracy was the management of artificial irrigation. In spite of references to occasional waterworks in response to droughts, and the digging of local canals for drainage or irrigating uplands, the magnitude of waterworks in Ancient Egypt hardly compares with the undertakings of Mohammed Ali in the nineteenth century. The centralized government in Egypt was more concerned with collecting taxes and attending to the monumental display of royal power and religious institutions than with irrigation." Even the use of Nilometers cannot be regarded as intervention in irrigated agriculture: "There was a professional interest in the maximum height of each year's inundation. Records of this were carved on suitable markers: Nilometers or temple quays. But there is no evidence that the figures were used in calculations to assess crop yields, although people must have been very well aware of the consequences of flood levels either much higher or much lower than the average." Barry Kemp, *Egypt: Anatomy of a Civilization* (Routledge: 2006, 2nd Edition) at 11. Thanks to Jean Li (Monmouth University) for this reference.

[65] Manning (2003), 107 with notes 47 and 48 citing pertinent texts.

[66] Manning (2002). See Manning (2003) for a generalized discussion of the reclamation of the Fayyūm, administration, and land tenure. An early text which could indicate central authority over irrigation in the Ptolemaic period is the widely translated *P.Tebt*. III 703, the instructions of a *dioikētēs* to a subordinate, likely the *oikonomos*. Lines 29ff: "[You must inspect]…and the water-conduits which run through the fields and from which the peasants are accustomed to lead water on the land cultivated by each of them, and see whether the water-intakes into them have the prescribed depth and whether there is sufficient room in them; and similarly the said cuttings from which the intakes pass into the above-mentioned conduit, whether they have been made strong and the entries into them from the river are thoroughly cleaned and whether in general they are in a sound state." These prescriptive instructions aside, Bonneau notes that there is no text that attests any substantive intervention by the *oikonomos* in irrigation (Bonneau [1993], 249).

this amount of water *available*—water successfully captured, channeled, and delivered—depended upon the labor of those who needed it. Such dependence formed a powerful motivation for labor wholly independent of outside political control.

We must also draw a clear distinction between the period of the Fayyūm's 3rd century BCE birth and early development, where large amounts of money and centralized coordination were required, and later periods when an equilibrium had been established. We may with profit compare the Fayyūm's reclamation and eventual normalization as a part of the Egyptian whole to the 18th and early 19th century Indus Basin where Mughal successor states (Sikhs, Nawabs, Amirs of Sind) "turned widely to inundation canal construction...to provide an agricultural base for their control of local and regional elites."

> But construction of canals depended usually on the ability of the state to mobilize local elites and their followers in canal digging, while creating new "communities" of sharers in canal water and in the yearly obligations of canal silt clearance and maintenance that kept canals flowing during the summer months. This allowed not only the localized production of valuable commercial crops (such as indigo), but also the definition of a structure of power linking the state and local elites together.[67]

Similarly in the Fayyūm state resources were mobilized for an initial burst of canal construction. The project can be viewed as more political than agricultural since the expansion reflected the need to provide for the nascent state's power base, not necessarily its need for increased food production.[68] Yet the Fayyūm's new residents and their descendents became dependent upon the region's productivity and fully enmeshed in the social structures—the irrigation communities—established to sustain it. State and rural society were thus bound by mutual dependence.

While it would be difficult to argue that one model can adequately explain every aspect of Egyptian irrigation from antiquity until the 19th century, Alan Mikhail's "coordinated localism" offers the most useful descriptor, one that acknowledges the central state's absence from day to day management while stressing its tangible interest in the productive operation of the system. Mikhail describes Egyptian irrigation as "a highly local process that could be understood only through an intimate knowledge of the rural Egyptian environment" while characterizing the Ottomans' hands-off approach as "a constitutive, deliberative, and integral facet" of the management of rural Egypt.[69] The state coordinated the local management of irrigation by making extractive demands—taxes—that locals were compelled to fulfill through successful irrigated agriculture. At the same time, locals coordinated state involvement in local affairs by periodically drawing attention to major maintenance issues that threatened both their own livelihoods and the fisc's take.[70] Mikhail has characterized the Ottoman system as one which was "predicated on mutual political, infrastructural, and economic benefit." The peasants of Egypt produced the state's wealth locally, part of which the state could reinvest in local waterworks when needed, functioning "very much like a bank—the mobilization of capital for investment in infrastructure—while at the same time ensuring its own future revenues."[71]

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[67] Gilmartin (1994), 1129-30.

[68] For similarly political irrigation expansions we may compare the colonial period, during which increased production was initially geared toward fulfilling Egypt's outstanding debts to Europeans creditors. The Aswān High Dam was also a massive prestige project, the crowning achievement of 'Abd al-Nāsir's "revolution" and the lynchpin in Egypt's transition to the industrial age.

[69] Mikhail (2011), 58-9 and 61.

[70] The case of a damaged dam in the 18th century Fayyūm's al-Gharaq basin illustrated in Mikhail's 2010 article is especially illuminating in this regard. The rhetoric used by local petitioners is key, since it continually forecasts gloom and doom scenarios for the Ottoman fisc unless it responds to the needs of local producers.

[71] Mikhail (2011), 65-6

Locally cooperative but centrally coordinated and irrigation regimes have been observed elsewhere. In his aforementioned study of Indus Basin irrigation Gilmartin describes coordinated local control of the irrigation system as "a hinge between the power of the local 'community' and that of the state."[72] A similar conclusion appears in an examination of the twentieth century transformation of irrigation management in northern Thailand. The authors of the latter study note that during the *ca.* 1946-86 period the state became more determined to expand commercial agriculture through larger, more modern irrigation projects. Its direct intervention in the countryside was hindered, however, by the lack of resources and skilled manpower at its disposal, forcing it to "rely on traditional concepts of patronage to *mobilize* the 'free labor' of farmers for the construction and maintenance of the communal systems (emphasis mine)."[73] All told, these three case studies—pre-modern Egypt, India, Thailand—suggest that the resources and administrative capacity of a central state affect the extent of its interference in local irrigation. Without a cadre of professionals at their disposal, states that wish to expand and/or more closely monitor irrigated agriculture have little option but to rely upon the knowledge and cooperation of local water users.

But it was not only the lack of state resources that precluded tight control over water. The orientation of Egyptian agricultural production was a significant contributory factor. As we saw in chapter one, the modern revolution in Egyptian water management was driven by the country's dislocating encounter with European "modernity" and the radical reorientation of agriculture, particularly cotton production, towards a world market. The development of modern commercial and export-oriented agriculture—"that collective drive to make the bleakest desert produce more and more of everything"[74]—offers significantly greater incentives to maximize and closely monitor water use, whether by private capitalists, the state, or both.

To be sure, ancient Egyptian production did have repercussions beyond its borders in imperial capitals but it was this was limited to the annual transfer of a portion of its reliable surplus to Rome or Constantinople. But while the early Roman period may have witnessed a more methodical oversight of canal maintenance, the annual levee did not drive an expansion of irrigation or a massive reorganization of the countryside. Indeed, although precision is elusive, the total amount of grain levied annually appears to have remained relatively stable from the Augustan period until the 6th century CE at somewhere between 6 and 8 million artabas *per annum*.[75] In the latter days of antiquity, Roger Bagnall notes there appears to have been no significant fluctuation in state incomes from the 4th century CE and the beginnings of the Arab period.[76] Although areas of the Fayyūm were abandoned and no longer taxed, the *annona* did not even seem to notice.

2.5: Toward an Environmental History of the Fayyūm: Water and Life

Any discussion of socioenvironmental issues in Egypt is at its heart an examination of human relationships with the Nile, the river system with which Egyptian civilization has been embedded since its beginnings. While the commonplaces about the Nile's centrality discussed in the first chapter are in many respects off the mark, it is inarguable that the river remains the principal

[72] Gilmartin (1994), 1134
[73] Cohen and Pearson (1998), 107
[74] Worster (1985), 53
[75] For Augustus' levy see Lewis (1983), 165 with n. 9 and Manning (2003), 135 at n. 21. For the later figure, Justinian *Edict* 13.8 (539 CE). According to Orosius (1.8.9), Egypt paid one fifth of its total production in tax.
[76] Bagnall (1985), 305

structure upon which all valley agriculture depends. As Egyptologist Fekri Hassan has remarked:

> In Egypt, the development of agriculture cannot be properly understood without an understanding of Nile hydrology and the geomorphic dynamics of the Nile floodplain, since these dynamics influence subsistence activities, settlement location and social relations. Of particular significance are the annual cycle of inundation, the decadal, centennial and millennial fluctuations in Nile flood discharge, the shape and landforms of the Nile floodplain and their implications for the location of settlements and field plots, irrigation and drainage, and long-term sustainability of yield in any given locality.[77]

Ottoman historian Alan Mikhail has even noted that one can without exaggeration claim that rainfall in Ethiopia, irrigation water, silt and soil salts have had more impact on Egypt's history than any ruling power over the millennia.[78] Dynasties came and went but the river was a constant actor. In the black lands of the valley its flood varied from year to year. Usually beneficent but occasionally destructive, the inundation was a feature of Egyptian life that could not be controlled but only blessed for its bounty or cursed for its miserliness or excess.[79]

These yearly variations should remind us above all that the river and the dependent Egyptians clustered about were not frozen in time, a sort of historical tableau. But beyond even the river-as-system lies water itself. The fundamental characteristics of water impose themselves heavily upon the study of a water system. Motion and change are the essence of water and water systems: one cannot, after all, step twice into the same stream. Consequently, no water system is or can ever be static. In a programmatic article on the study of human-water system relationships Terje Tvedt reminds us that the "idea that nature is not nature anymore, but [is] abolished by human interference cannot be sustained as soon as it is applied to water systems. It makes us blind to the fundamental fact that, for example, the hydrological cycle as nature is definitely to a large extent outside the control of humans."[80]

The point is well-taken, particularly in the context of the irrigation-dependent Fayyūm, a veritable *water*scape of canals and drains. The ceaseless, uncontrollable motion and change water embodies must be borne constantly in mind in this study, for irrigation merely channels moving water, it neither creates it nor controls it.[81] The rest of this study thus investigates the manner in which humans altered their water environment and were in turn altered by it in the face of the unpredicted and unintended consequences of such a massive intervention in the natural world.[82] We will follow the water of the Fayyūm through space—from al-Lāhūn at the entrance of the depression to its drainage sump in the Birkat Qārūn—and through time—from the Ptolemaic reclamation until the 13th century. While I can neither cover every aspect of water use nor discuss in detail every permutation of water management at both the state and local level,

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[77] Hassan (1997), 53-4

[78] Mikhail (2008), 17

[79] For a description of the reaction to the very high flood of 1887—"the terror reigning over the whole country"—see Willcocks (1935), 99-100.

[80] Tvedt (2010), 152

[81] The Aswan High dam still does not "control" the Nile. Although the river no longer floods and north of Aswan has been characterized as simply an irrigation ditch on a grand scale there is still no control over the amount of water available. No one can cause the rains to fall more plentifully in highland Ethiopia. Massive evaporative and seepage loss from Lake Nâsir cannot be arrested. The ecological costs of the project itself will eventually doom Egyptian agriculture itself, if on a timescale well beyond the concern of present and many future generations.

[82] The last two sentences draw upon ideas in Hill *et al.* (2009).

the following chapters will nevertheless allow us to see how ancient farmers used water to create different socionatural worlds in time and space, eventually building a Fayyūm that located itself only in the areas where water was most plentiful and life the most secure.

CHAPTER 3

THE PHYSICAL SETTING
Nature and the Environment in the Fayyūm

The field decreased its yield, repulsed the grain, (from being) black the tilth turned white, the broad plain gave birth to wet-salt, the womb of earth revolted, no plants came up. [1]

3.1: A PHYSICAL DESCRIPTION OF THE MODERN FAYYŪM

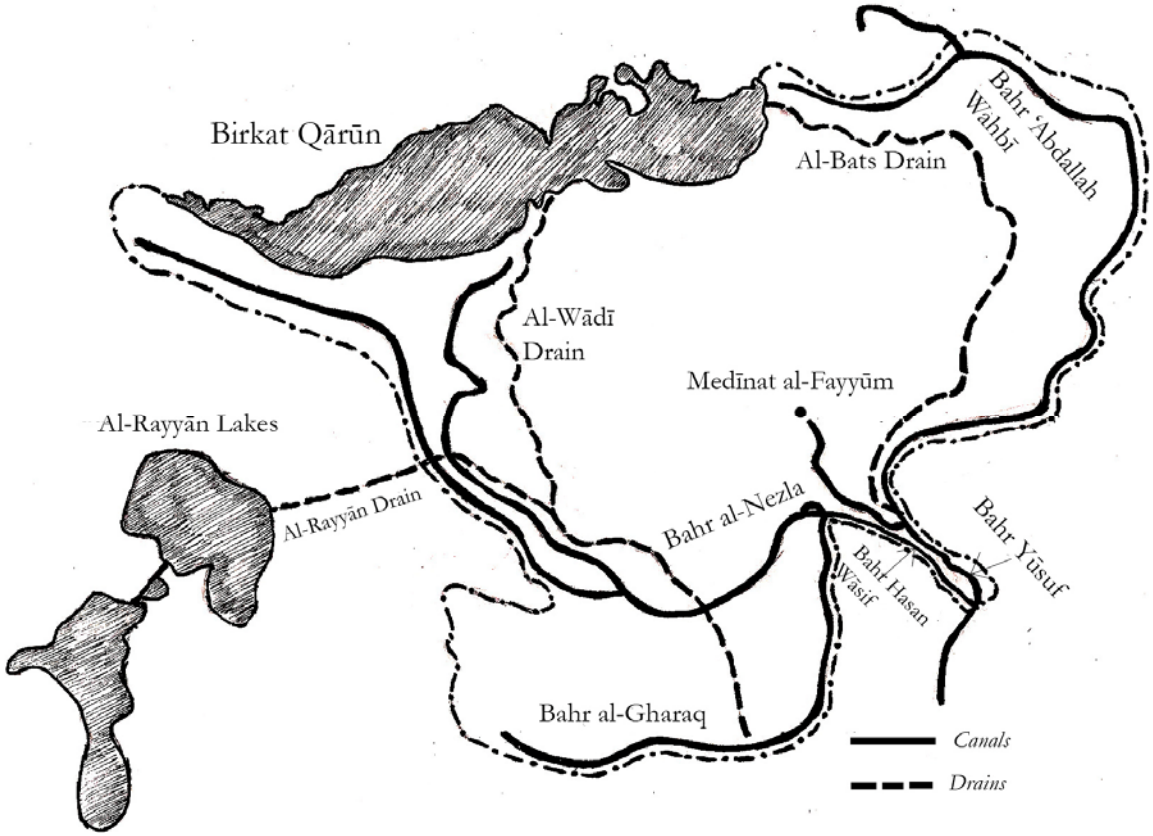

Fig. 4: Overview of the modern Fayyūm: major canals and drainage. Drawing: Rhys Haug.

[1] From a version of the Myth of Atra-Hasis found in the 7th century BCE library of Ashurbanipal. For soil salinity as a cause of the decline in early Mesopotamian civilization see Thorkïld Jacobsen and Robert M. Adams in "Salt and Silt in Ancient Mesopotamian Agriculture," *Science* (New Series) Vol. 128 No. 3334 (Nov. 1958), 1251-58 and Thorkïld Jacobsen, *Salinity and irrigation agriculture in antiquity: Diyala Basin archaeological projects: Report on essential results, 1957-58.* Bibliotheca Mesopotamica 14 (Undena, Malibu, 1982), from which the above translation is drawn (pp. 11-12). For recent critique of the theory see N. Yoffee, "Collapse in Ancient Mesopotamia: What Happened, What Didn't," in McAnanay and Yoffee *edd.* (2010), 176-206. See also Wilkinson (2003) at 93 and 98.

3.1.1: Overview: The Contemporary Fayyūm

The Fayyūm is the most dominant physical feature of Egypt's Western Desert, its northeast stretches lying some 70 km southwest of modern Cairo.[2] The geological extent of the depression proper is 6068.70 km^2 with a maximum depth of 52 mbsl (meters below sea level) at the floor of Birkat (Lake) Qārūn, just to the west of small al-Qarn Island.[3] The inhabited portion of the Fayyūm—the famous leaf-shaped formation—is considerably smaller, amounting to only 1849.64 km^2 (30.48% of the total area) of which 1609.32 km^2 is cultivated, sustaining a population of nearly 2.65 million at a density of 1,426 per km^2.[4] Human inhabitation and agriculture in this hyperarid and otherwise inhospitable environment is made possible by a connection to the Nile via a side channel known as the Baḥr Yūsuf ("Joseph's River"), which was the Fayyūm's sole water inlet throughout antiquity until the addition of a second manmade intake, the Baḥr Ḥasan Wāsif, in 1905.[5] Water flows from these inlets into several large border canals and thence through a network of ever-smaller canals down to the smallest ditches on tiny private landholdings—a total length of some 1306 km, which transports 2680 mcm (million cubic meters) of water annually.[6] Although it is an island of green in the midst of the desert and is often referred to as an oasis or semi-oasis, the Fayyūm should not be described as such since true oases draw upon groundwater. The Fayyūm has no such subsurface resources and the Baḥr Yūsuf remains its lifeline.[7] This hydrological regime is entirely distinct from those of the valley and the desert oases; the Fayyūm must thus be regarded as a wholly unique geological, hydrological and ecological zone. And yet this so-called "garden of Egypt" is an entirely enclosed (endorheic) basin, marooned in the desert and prone to the effects of sand encroachment and desertification. Unlike the Nile, which empties in the Mediterranean, water has no escape from the Fayyūm save by evapotranspiration. Salts and other deleterious minerals borne by water and wind are left behind, slowly building up in the ground and in the lake. The soil of the region is thus increasingly saline and ever more toxic to plant life. Although still green throughout, the modern Fayyūm remains underproductive and is one of the most agriculturally marginal provinces in the country.[8]

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[2] Cairo to Kōm Aushīm (Karanis) in the northeast, 68.25 km; Cairo to the central capital Medīnat al-Fayyūm (Arsinoe/Krokodilopolis), 91.54 km; Cairo to Tebtunis in the south/southwest, 116.17 km.

[3] Echo-sounder readings in the Birket Qārūn in 2003 returned 52 mbsl as the lowest depth. See the contour map in Ramadan H. Abu Zeid, Kevin W. Keatings, and Roger J. Flower (2007), "Environmental controls on foraminifera in Lake Qarun, Egypt," *Journal of Foraminiferal Research* 37.2, 136-46 at p. 137.

[4] Gad (forthcoming) for area figures, Hussein (2011), 866 for population figures sourced from the 2009 annual report of Egypt's General Agency for Public Modernization and Statistics.

[5] Since the Hasan Wâsif canal is of completely modern origin it will be eliminated from further discussion. Wolters (1987), 161. Al-Nābulusī recognized this situation already in the 13th century in his description of the Fayyūm's environs (Chapter II of the *TF*): "When the wind blows upon it from one of these regions [exterior to the Fayyūm], especially during summer afternoons, that which it passes over is covered with heat and dryness. And if it were not for the abundance of its water, which helps – despite its putridness – to keep it generally humid, the condition of its inhabitants would take the worst possible turn" (trans. Rapoport and Shahar).

[6] See the map in Gad (forthcoming), p. 8. Or, more easily, the 1953 U.S. Army Corps of Engineers' map presented in high resolution in the Wikipedia article "Faiyum Oasis." Length and annual transport figures from Elsheikh *et al.* (2008), 4.

[7] The depression does rest atop three aquifers. The shallowest of the three is the source of some minor streams. The second, the Quaternary aquifer, is salty and unsuitable for use. The third, an Eocene aquifer, is too deep for exploitation: Government of Egypt (2008), 6.

[8] Sand encroachment currently affects the cultivated lands of the western and southern portions of the inhabited area: Hussein (2011), 871. The province of Fayyūm was classified by the British-controlled government of Egypt in 1911 as possessing high marginality, 18% of its total land falling into the category of "marginal." It was ranked behind

Fig. 5: The Fayyūm receives only an average of 2 mm of rain per year, sufficient to promote the ephemeral appearance of plant life in the desert north of the site of Soknopaiou Nesos. Photo: B. Haug, 19 November 2011.

3.1.2: Water, Salt, and Soil

Since the beginning of large-scale irrigated agriculture in the Hellenistic period the Fayyūm cultivators have taken advantage of local topography and relied almost entirely upon gravity to drive the flow of both irrigation and drainage. The slope of the terrain is, however, very gentle, particularly in the southern half of the depression, and only becomes steeper in the north once the sea level contour is reached. Since water is delivered through the canals by gravity, the relative flatness of the terrain that tends to impede its flow in many areas. As such, after the introduction of perennial irrigation in the 19th century, the ceaseless supply of large amounts of irrigation water and the inadequacy of gravity-driven drainage has produced considerable water-logging in numerous locations.[9] The relative gentleness of the slope of the terrain may be clearly seen in a cross section of the depression (the image is compressed to highlight the changes in topography).

Gharbiyya and Buhaira, with 34% and 28% marginality, respectively. Cited from Monson, forthcoming at p. 36, based upon data in Egypt, Ministère des Finances (1911) *Annuaire Statistique de l'Égypte 1911* (Cairo: Imprimerie nationale). See Moustafa *et al.* (1990) for the Fayyūm's lower-than-average productivity and salinity conditions in Itsa district, with Shendi *et al*. (2010) for soil salinity in Sinnūris district.

[9] Sinnūris District may serve as an example of varying topography and its effects on drainage and standing water. Villages in its southern reaches lie between 11 and 17 masl. Biyāhmū (ancient Piamouei) is 17 masl and there is a large swamp on its western side. Malaria is relatively common. Even lower elevations in the central portion of the district between 15 and 24 mbsl suffer from poor drainage, surface pooling, water invading private homes and endemic malaria. Conversely in the northern portion of the district nearest the lake there is a steep drop in elevation, good drainage and virtually no instances of malaria: Bassiouny (2001).

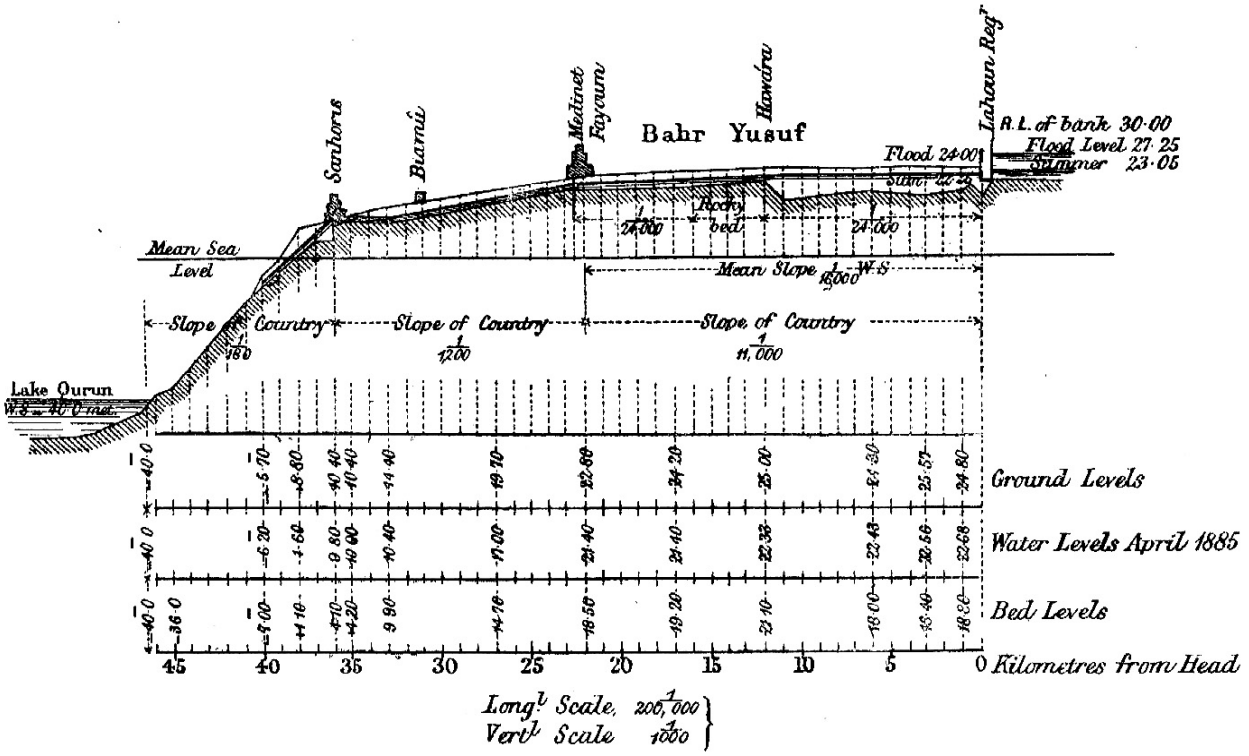

Fig. 6: Cross section from al-Lāhūn to Birkat Qārūn. Source: Willcocks and Craig (1913), 443.

Water-logging is simultaneously facilitated by the Fayyūm's subsurface geology, for the whole of the depression rests atop a relatively impermeable clay lens that promotes further surface pooling and pond formation thus reducing the volume of soil available to plant roots. [10] Today the 2680 mcm of water flowing annually through the Baḥr Yūsuf has created a high water table within 1.5 m of the soil surface. Standing water is abundant and the attendant public health hazards—e.g. exposed sewage and ample breeding grounds for malaria-bearing mosquitoes—are a source of constant worry.[11] Poor drainage also affects soil quality by promoting the buildup of salts. All excess or standing water is subjected to the high rate of evaporation and is swiftly removed from the soil leaving behind harmful minerals and contributing to soil salinization. Crop yields are generally lower than the national average since the high local salinity inhibits the productive potential of the region.[12]

[10] Moustafa *et al.* (1990), 253-4.

[11] Egypt, Government of (2007), 9. Arab Republic of Egypt with the Fayoum Drinking Water and Sanitation Company and USAID (Project No. 263-0270), "Scoping Statement for Fayoum Governorate: Hawarrat El Maqta Village, Qasr El Jabali Village," at p. 3. pdf.usaid.gov/pdf_docs/PNADK561.pdf. Retrieved March 10, 2010. In Fayyūm's Sinnuris District the observed water table depth varied between 31 and 200 cm, averaging 117 cm, between 2002-09: Shendi *et al.* (2010), 12. On malaria in the Fayyūm see Bassiouny (2001).

[12] The process, per Dixon (2009), 105: "Salts may also be derived from surface water runoff, especially where those waters accumulate in depressions in the landscape such as in salt pans, salinas, sebkhas etc. In such settings slow rates of infiltration coupled with high rates of evaporation result in salt accumulation." For Fayyūm salinity and drainage issues in general see Shendi *et al.* (2010) and Moustafa *et al.* (1990).

Fig. 7: The salinizing effects of waterlogging on land in the village of ʻIzbat Tūnsī in the northwestern Fayyūm near Birkat Qārūn. Note the white salt encrustations on the soil surface. Photo: B. Haug, November 15, 2011.

All of this soil, good and poor, derives ultimately from Nile alluvium. Silt was deposited every year during the flood but was not dispersed evenly across the whole floor of the depression. The Baḥr Yūsuf also carried a much smaller silt load than the main channel of the Nile in the Valley.[13] Even in the 13th century al-Nābulusī recognized gradations in the quality of the Fayyūm's soils, noting that the "land is composed of diverse types of soil, ranging from patches of pure alluvial deposits to clay mixed with sand, which is called *al-damlūf*,[14] and which does not prevent cultivation; to sand spotted with pebbles, which does not allow for the planting of trees or sowing of grains."[15] Although the Nile's flood is currently detained in the Lake Nāṣir reservoir and we cannot observe it on the ground, we may look to the soils to determine the general extent of the Fayyūm's flood plain from antiquity until the late 20th century.

The floor of the inhabited portion of the depression is covered by fluvio-lacustrine material deposited through the Pleistocene and Holocene epochs (2,588,000 years BP until present).[16] The whole of the depression can be divided into three physiographic units—lacustrine, fluvio-lacustrine, and alluvial plains—whose soil quality, productive potential, and depth decrease as distance from the Nile inlet increases.[17]

[13] Ross (1893), 185

[14] Rapoport and Shahar note that this word does not appear in any of the Arabic dictionaries which they have consulted. The closest words are *dumlūq* "smooth and hard stone" or "truffle"; *damala* can mean "to fertilize."

[15] *TF* 7

[16] Shendi *et al.* (2010), 2

[17] The following is drawn from Ali and Gad (2007), 242-5 and Gad (forthcoming).

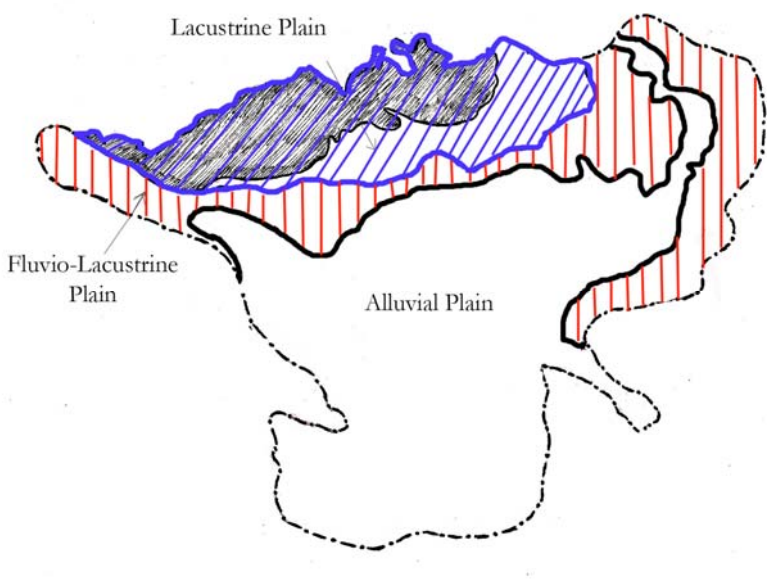

Fig. 8: Physiography of the Fayyūm depression[18]

In general, Fayyūm soils are shallower than those of the valley and overlie massive salt deposits, the accumulated remains of evaporation over the millennia.[19] The soils of the large central alluvial plain are entirely composed of younger, recently deposited soils (Entisols), Vertic Torrifluvents, which have not developed from their original parent material due to constant deposition.[20] This Torrifluvent layer comprises 701 km^2 and represents 39.5% of total Fayyūm soil cover. These soils are "highly capable/Class I" indicating their low salinity and potentially high productivity.[21] It is this central fan of highly fertile riverine sedimentation that represents the average extent of the annual flood and silt deposition. Outside of this central plain the soil profile differs. The edges of the Fayyūm, a total of some 390 km^2 and representing 22% of mapped soils, are primarily composed of Typic Calciorthids, older alluvial deposits which have undergone a considerable amount of calcification, a problem common in regions where evaporation exceeds rainfall, or in our case floodwater influx. [22] Calcium is thus not leached

[18] I have approximated the outlines of the three physiographic regions from the soil profile map published in Gad (forthcoming), Abdel Kawy and Belal (2011), 5, and Ali and Gad (2007), 243.

[19] Willcocks and Craig (1913), 391: "Since the Nile [silt] deposit is seldom more that 4 or 5 metres in thickness, and generally very much less, while it overlies as a rule bitter salts, [irrigation water] is very liable to be salted."

[20] The soils of desert or arid regions are primarily Entisols (Dixon [2009], 107). Entisols cover surfaces subject to frequent deposition, erosion or human disturbance. Of the five categories of Entisols, Fluvents are recently deposited sediments on, e.g., flood plains, where the rate of deposition exceeds that of pedogenesis (soil evolution or formation). L.T. West, "Entisols," in Rattan Lal *ed. Encyclopedia of Soil Science* (Marcel Dekker: New York and Basel), 2002 at 391-2.

[21] Gad (forthcoming) 6 and 10. As the name suggests, Fluvents form in "rapidly aggrading flood plains, fans, deltas and in some cases, mud flows," so Summer (2000), E232 and Torrifluvents refer to "recent alluvial soils" (Dregne [1971], 2). "Vertic" refers to a soil type not classified as but sharing the characteristics of Vertisols, soils which contain considerable expansive clay, clay whose volume changes drastically depending on water content and is thus prone to considerable expansion or contraction.

[22] Gad (forthcoming), 6 and Dregne (1976), 90. Orthids typically display an "accumulic horizon of soluble salts and calcium carbonate" (Dixon [2009], 107). Calcification, the buildup of calcium carbonate, $CaCO_5$, in soils requires an initial source of calcium such as limestone, calcaraeous shales and sandstones or unconsolidated sediments from

from the soil, instead forming hard crusts just below the surface that inhibit root penetration and plant growth. Classified as "marginally capable Class III," these surrounding regions—the locations of the archaeological sites deserted in antiquity—represent a distinctly less productive but certainly not uncultivable zone. Also of interest is a small concentration of Gypsic (Typic Haplogypsid) soils on the eastern border of the inhabited area (4.8%), their chemical makeup explicable only through the earlier presence of a much larger Fayyūm lake which has since regressed.[23] The soil profile is, of course, significantly more complex and variegated than the simplified version presented here and in the graphic below.[24] It can, however, be remarked that in general the risk of salinization increases at greater distances from the entrance to the Fayyūm. Those areas at high risk for salinization comprise nearly half of the Fayyūm's soils (some 45.56%) and are concentrated in the lacustrine and fluvio-lacustrine plains.[25] The issue of salinization and its causes will be discussed further below.

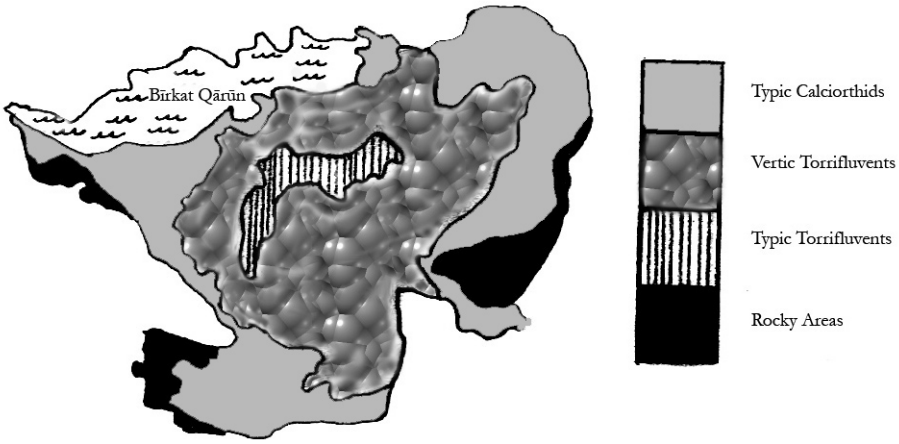

Fig. 9: Schematic overview of major soils in the Fayyūm. Drawn from Gad (forthcoming).

3.1.3: Drainage and the Fayyūm's Lakes

Certainly the most prominent physical feature of the Fayyūm is the endorheic lake in the north, the Birkat Qārūn. The lake is subjected to high evaporation (reaching 190 cm per year[26]) but is continually replenished by agricultural drainage water. The surface of this highly saline body of water covers roughly 200-250 km^2 and rests between 43-45 mbsl in the lowest portions of the depression.[27] From antiquity until the early 1970s the only two major drains in the Fayyūm were the al-Baṭs and the al-Nezla, which empty into the Qārūn. The intensification of irrigated agriculture in the 20th century, however, necessitated additional runoff collection and in 1974

such sources. Alluvium and lacustrine sediments, such as those deposited in the Fayyūm, are ideal sources. Janis L. Boettinger, "Calcification," in Lal *op. cit.* n. 20 at 131.

[23] Gad (forthcoming), 6. Gypsum = $CaSO_4 \cdot 2H_2O$. "Anhydrite ($CaSO_4$) is mainly associated with marine evaporites and is rapidly converted to gypsum when exposed to normal soil environment": Ahmet R. Mermut and H. Khademi, "Gypsum Formation in Gypsic Soils," in: *Encyclopedia of Soil Science* I, p. 800.

[24] The diagrams in Shendi *et al.* (2010) show the great diversity of soil classifications in the Sinnūris district. The maps and charts in Gad (forthcoming) at p. 7 and Ali and Gad (2007) at 243-4 may be consulted for a complete overview of Fayyūm physiography.

[25] Ali and Gad (2007), 250

[26] Meshal and Morcos (1984) at p. 142 cite a figure at 190.08 cm/y.

[27] The level of the lake is constantly in flux due to variations in the amount of water entering it and evaporating from it at any given point. The figures given for its surface vary from author to author depending on the data used.

drainage was expanded to the Rayyān depression to the west via the Wādī al-Rayyān creating two artificial lakes.[28] Currently some 154.37 km of drainage channels transport a total of 963 mcm of water annually to the Birkat Qārūn and the Wādī al-Rayyān.[29] The diversion of some wastewater to the Rayyān (predominantly the water of the southwestern Fayyūm) has still not been sufficient to fully stabilize the level of the Qārūn and land along its southern shore is periodically inundated.[30] In 1989, for instance, approximately 4,000 ha in this area suffered from drainage and salinity problems.[31] Clearly, the maintenance of the Fayyūm's water balance is a delicate operation and engineers must constantly measure demands for increased irrigation against the need to protect every acre now under cultivation. Egypt, once the ancient world's breadbasket is now a net food importer and the government is loathe to lose any productive acreage.[32]

3.2: NATURE AND ENVIRONMENT IN THE PREMODERN PERIOD

3.2.1: Introduction

As is well known, large-scale cultivation in the Fayyūm is the result of a major land reclamation project in antiquity. At the outset of the Ptolemaic period the only cultivated area was the roughly 100 km^2 of the raised central plateau at whose center lies the Fayyūm's capital city, Medīnat al-Fayyūm (Greek Arsinoe or Krokodilopolis, Egyptian Shedet).[33] At this point Baḥr Yūsuf was unobstructed and the lower areas of the depression were submerged under Lake Moeris. Indeed, a religious and cultic map whose origins may extend as far back as the 12th dynasty (1991-1802 BCE) and known today as the "Book of the Fayyūm" places the nome capital of Shedet "near the lake."[34] In Herodotus' time, some 200 years before the completion of the Ptolemaic expansion of cultivation in the area, the lake was between 18 and 20 masl (meters above sea level), covering approximately 1785 km^2.[35]

The reclamation project carried out under the Ptolemies Soter and Philadelphos (323-283 and 283-246 respectively) drastically reduced the lake's size, exposing the rich soil of its bed, a project that has been described as "one of the most impressive agricultural expansions in the history of the ancient world."[36] It is widely accepted that by restricting the flow of water into the Fayyūm depression at Ptolemais Hormou (modern al-Lāhūn) engineers exposed an area of

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[28] The use of the Rayyān depression as a reservoir was first suggested at the beginning of the 20th century by Egyptologist and explorer Frederick Cope Whitehouse (1842-1911) who "discovered" the Rayyan in 1882. He also, apparently, "promulgated a theory for the direct generation of electricity from the sun's rays." Indeed, a man ahead of his time. See his obituary in *The New York Times*, November 17, 1911 and Willcocks (1904) at 5.

[29] Elsheikh *et al.* (2008), 4

[30] Khattab *et al.* (2003), 10. See also the graph in Wolters *et al.* (1989) at 109. The inundation of marginal shore land (*aigialos*) with lake water was a common occurrence in antiquity as well although it was at that time due entirely to particularly heavy Nile floods as well as the annual draining of inundation basins.

[31] Wolters *et al.* (1989), 104. When the Fayyūm still freely communicated with the Nile before the completion of the Ptolemaic expansion the region was referred to in Greek simply as the *limnē* or marshy lake.

[32] Kishk (1993), 78

[33] Ball (1939), 214. The Egyptian name of the nome capital, Shedet, has connections to the idea of plowing or digging out. This is probably a reference to the early reclamation under Amenemhat. Thanks to Dr. Jean Li (Monmouth University) for the Egyptian etymology.

[34] Vandorpe (2004), 68. The so-called Book of the Fayyūm survives in Roman-era hieroglyphic, hieratic, and demotic copies is a cultic a topographical treatise pertaining to Sobek.

[35] *Histories* II.148-50. Shafei (1939) in his Fayyūm map at "Drawing No. 3" calculates the surface area of a lake at 20 masl at 582,400 Egyptian feddans. 1 feddan = 4,200 m^2 = 0.0042 km^2.

[36] Manning (2003), 104. The following introduction depends upon chapter four, "The land tenure regime in the Fayyum depression" for the figures cited here.

between 1200 and 1600 km^2, approximately 5-7% of Egypt's total cultivable area.[37] A new irrigation system and numerous new villages provided settlement and well-watered farmland for demobilized Ptolemaic soldiers in an area now christened the Arsinoite nome and divided into three administrative *merides*.[38] In the mid-third century BCE the nome's population reached perhaps 185,000-100,000 people living in at least 145 villages and numerous other smaller agricultural communities.[39] It has long been held that by the early Roman period cultivation reached its greatest extent and covered an area unmatched even in the present day.[40] We shall examine these issues in greater depth below beginning with the state of the Fayyūm in the millennia prior to the Ptolemies' grand project.

3.2.2: (Pre-) Historical Variations of 'Lake Moeris'

The prehistoric Fayyūm was not a static system patiently awaiting human (mis)management. The depression was at times completely covered by a lake, thoroughly desiccated, and everything in between. When present, the level of the lake fluctuated greatly due to a "remarkable combination of climatic and human factors during the Holocene."[41] The smaller modern *birka* now reaches only 8.5 m at its lowest point in the northwest while more than 76% of its area has a depth ranging from only 2 and 5 m.[42] Given the sparse rainfall in the region the lake has always been fed entirely by Nile water funneled through the Hawāra channel cut through the rock sill separating the Fayyūm depression from the Nile valley some 400,000 years BP by the high waters of the ancient Prenile. After the retreat of this early river, the depression was watered only if the annual flood was of sufficient height to reach the channel, which was some 17 m below sea level and 28 m above the Fayyūm's lowest point.[43] This connection appears to have been severed and reestablished multiple times throughout history. It may have silted up by 8000 BCE, but appears to have been reestablished some 500 years later by massive flooding which resulted in a lake at 18 masl. The lake then fell to 12 masl and later rose to 23 masl where it remained for 1500 years during which time the Paleolithic "Fayyūm B culture" lived along its shores. The connection appears to have been severed again between 6000 and 5200 BCE and the lake dried up until flooding restored a lake of 21 masl until 3900 BCE. Yet again reestablished in 3000 BCE the lake was finally maintained at a level of 18 masl by cutting and clearing the channel and creating the canal known today as the Baḥr Yūsuf under the pharaoh Amenemhat I (1991-62 BCE). This allowed free communication between the Nile and Fayyūm and provided an outlet for destructive excess floodwaters, perhaps at times flooding nearly the entire basin as depicted here.[44]

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[37] The amount of land exposed is disputed and will be explored below.

[38] The Herakleides, Themistos and Polemon *merides* persisted until the 4th century CE.

[39] Population: Thompson and Clarysse (2006) Vol. 2, 95. The Fayyūm's toponymy has been referred to as "colonial" in the sense that its villages were settled both by immigrants from abroad and from elsewhere in Egypt, a feature reflected in village names. Fayyūm villages could take their names from population groups (e.g. *kōmē Arabōn* or *Syrōn*), Alexandrian demes, other locations in Egypt, etc. See Clarysse (2006) for these issues, particularly at 72.

[40] E.g. A.C. Johnson (1936) *An Economic Survey of Ancient Rome Vol. II: Roman Egypt to the Reign of Diocletian* (Johns Hopkins), at p. 7

[41] Hassan *et al.* (2006), 40

[42] Ishak and Abdel-Malek (1979), 173

[43] Said (1993), 80 and Collins (2002), 128-9.

[44] The above is drawn from Bayoumi *et al.* (2010), 324. There has been significant debate regarding the extent and even the existence of an ancient "Lake Moeris." This debate has largely centered upon the description of the lake

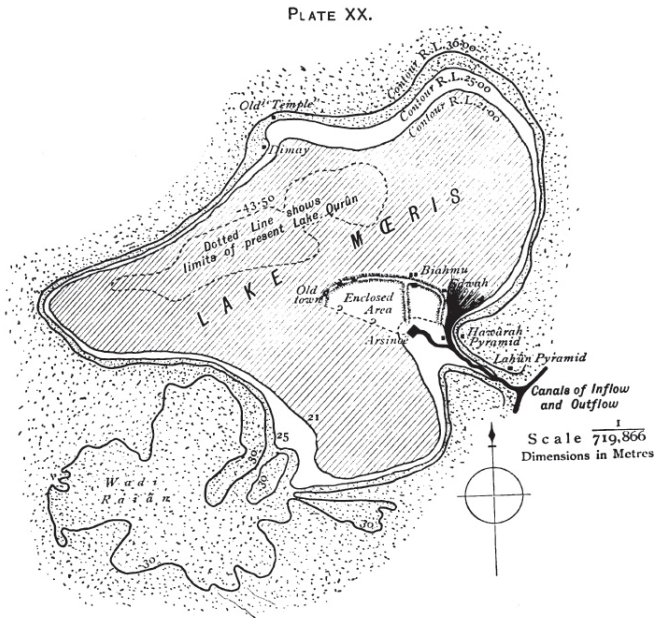

Fig. 10: Approximation of the pre-Ptolemaic lake by Hanbury-Brown (1892), 74.

The amount of water flowing into the Fayyūm through the Hawāra channel could be affected by three factors: 1) the quantity of the Nile's floodwaters, in turn affected by its east African head waters which are themselves dependent on monsoon dynamics, 2) climate variations in the immediate vicinity (Mediterranean), and 3) human activity.[45] Sediment coring has revealed dry periods in the Nile headwater areas at Lake Turkana (Rudolf) and Lake Edward in Eastern Africa, which probably correspond with a low Birket Qārūn during the years 1640–1540 BCE, 840–640 BCE, 340 BCE–160 CE, 560–660 CE, 860–1110 CE, and 1560–1790 CE.[46] During these arid periods the amount of Nile floodwater entering the Fayyūm was considerably less and the lake could not be replenished at a rate sufficient to counter evaporation of 1.8-2 m/yr. The Fayyūm lake's prehistoric levels have been compared with those of Lake Turkana in northern Kenya and southern Ethiopia. Turkana receives its water primarily from the Omo River in the Ethiopian highlands, rains in which are also the source of a considerable amount of the Nile's flow. Throughout the Holocene the rise and fall of Lake Turkana matches the periods of rise and fall of Birket Qārūn. The contraction of the latter between 5100 and 3900 BP matches contractions observed in Lake Turkana between 4800 and 3700 BP. High levels at Lake Turkana between 3720 and 2560 BP roughly correspond to high levels of the Fayyūm's lake between approximately 3890 and the period when Lake Moeris was observed by Herodotus in about 450 BCE, when its height was roughly 20 masl. If the decline in Lake Turkana after 2000 BP can be understood as indicating simultaneous declines in the Nile's flow, this will have lessened the

found in Herodotus, particularly 2.149-50. Caton-Thompson and Gardner (1929) summarize the 19th and early 20th century debate, themselves favoring (mistakenly, I believe) a Moeris at roughly sea level (see their Figure 4 at p. 25). Evans (1991) is a sensible and non-technical discussion, favoring the truthfulness of Herodotus who, the author believes, saw the Fayyūm and lake during the inundation when the waters of Moeris were at their highest. Very recent computer-generated imagery (unfortunately of rather low resolution) may be found in Hassan and Tassie (2006), a brief publication in connection with the University College London project "Environmental Change and History of the Water Management in the Faiyum Depression during the Holocene." It should be noted that images G and F (Ptolemaic and Roman periods) are transposed.

[45] Baioumy, *et al.* (2010), 323

[46] *ibid.*

need to use the Fayyūm as a reservoir for excess flood waters and aided the reclamation of the area under the early Ptolemies.[47]

3.2.3: The Ptolemaic Reclamation: Duration and the Extent of New Lands

The Fayyūm's lake was constantly in a state of flux over geologic time, affected by the climate and weather patterns further south. While the second variable, Mediterranean climatic variations, does not appear to have had any significant effect, human activity, both under earlier pharaohs and the later Ptolemies, has considerably impacted the lake. The interaction of human interference and natural processes is what has governed its level since the enlargement of the Hawāra channel under Amenemhat I. As noted in the introduction above, the single most important task in reclaiming the Fayyūm was to restrict the Nile's inflow at al-Lāhūn and allow evaporation to reduce surface water coverage. Although its precise beginnings are unknown the reclamation was largely complete by the mid-third century BCE. Climate was key. The aridity of the Fayyūm allows for particularly swift evaporation; in modern times the average evaporation rate of open water between the years 1960-76 was 1,950 mm/year.[48] In 1939 geologist John Ball estimated that a Lake Moeris at 20 m above sea level (covering 1784.83 km^2), deep enough to submerge the entirety of the Fayyūm except the plateau on which the nome capital rests, could be reduced to 2 mbsl—roughly approximate to the level of the early Ptolemaic lake—in a mere 12 years, assuming a fully blocked Baḥr Yūsuf and an evaporation rate of 1,800 mm/y.[49] At sea level the lake will have covered 960.96 km^2 and at 10 mbsl, 688.8 km^2, a considerable reduction.[50] Still, the inlet at the Baḥr Yūsuf may never have been completely cut off at any time since there was still a need to irrigate the already exposed and cultivated central plateau as well as to provide an outlet for the inundation, especially in heavy years. This plateau at the start of the reclamation project was only about 100 km^2 and would have required 0.15 km^3 of water to inundate fields to a depth of 1.5 m. 0.05 km^3 of this will have drained into the lake. After reclamation Ball estimates 1,230 km^2 of exposed agricultural land; if two-thirds of it, 820 km^2, were cultivated and added to the already farmed 100 km^2 of the plateau, 1.38 km^3 of irrigation water will have been required, providing some 0.46 km^3 of drainage into the lake in addition to the earlier 0.05 km^3. If roughly half of the total drainage, (roughly 0.25 km^3) entered Lake Moeris during the reclamation and the initial cultivation of new land, when combined with an evaporation rate of 1,800 mm/y Ball proposes a total reclamation time of about 30 years.[51] We might also suspect that the evaporation of the lake occurred more quickly in the ancient period than today. Modern fertilizers have greatly increased the salinity of the Birket Qārūn and roughly 500,000 tons of salt are flushed into the lake via drainage water annually. Average ocean salinity is 35‰ (parts per thousand), i.e. 3.5% salt, while the salinity of the lake varied between 30.9 and 34.5‰ in 1974-6[52] and in 1996 was measured at 36.82‰.[53] Freshwater, conversely, is defined by a salinity of 0.5‰. The fresher premodern Lake Moeris

[47] Hassan (1986), 495 and 498
[48] Wolters *et al.* (1989), 106
[49] Cf. the modern Birket Qārūn, which lies between 43 and 45 mbsl.
[50] Calculations of the lake's surface area at various depths are given in Egyptian feddans by Shafei (1939) in his Fayyūm map labeled "Drawing No. 3." 1 Egyptian feddan = 4,200 m^2 = 0.0042 km^2.
[51] All calculations in Ball (1939), 214. His calculations of the evaporative rate have been revised more recently. Ball calculated an evaporative loss of 177.4 cm/y while Meshal and Morcos (1984) at page 142 cite a figure at 190.08 cm/y.
[52] Ishak and Abdel-Malek (1980), 175-6
[53] Wolters *et al.* (1989), 107

may have shrunk more quickly than its saline modern counterpart, since saltwater evaporates more slowly than freshwater under the same conditions. I have not, however, found any estimates of premodern evaporation rates.[54]

The amount of land exposed by this reclamation is still a matter of debate. There is no ancient testimony and all modern estimates remain educated guesses. J.G. Manning's recent discussion of the reclamation project offers a range between 1200-1600 km^2.[55] To make a rough but rather more secure estimate one must first know the full extent of the inhabitable area and the lake. Surprisingly, it is impossible to find any agreement on such a figure in the scientific literature. Estimates vary widely and are most often uncited. Stated areas range from 1270 km^2 to 2000 km^2, not an insignificant spread. I have chosen figures from an unpublished GIS survey by Abd-Alla Gad of the Egyptian National Authority for Remote Sensing and Space Sciences (NARSS), and it is his numbers that are cited at the beginning of this section.[56]

Following Gad, a total inhabitable land area of some 1850 km^2 poses a problem for Manning's estimate of land exposed by the initial reclamation. As discussed above, in the early years following the reclamation the lake was only a few meters below sea level and consequently much larger than it is today, ranging between 688 km^2 at 10 mbsl and 960 km^2 at 0/sea level.[57] 1200 km^2 of reclaimed land returns a Fayyūm of 1888 km^2 with the lake at 10 mbsl, not a thoroughly outlandish estimate. Yet the higher estimate of 1600 returns a Fayyūm of 2288 km^2, which is surely too large. Gad's GIS figure for total surface area forces us to shift our estimation of the total reclaimed area downward to between 890-1162 km^2 with the lake at 0/sea level and 10 mbsl respectively. It is only during the Roman period when the lake had shrunk further that we approach a figure for the cultivated area that resembles earlier estimates of the reclamation. A substantially reduced Roman-era lake of 20 mbsl[58] at 503 km^2 surface area still returns only 1347 km^2 of cultivable/inhabitable territory. This is, of course, a rough thought-experiment but it should caution us against improbable overestimates of the initial results of the reclamation.[59]

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[54] The salinity of the lake has increased rapidly over the last century. It was slightly brackish until 1884 and salinity soon reached 8.5‰ in 1905, climbing steadily thereafter, with a high of 38‰ in 1980. Ross (1893) at 184 described its water as "brackish and undrinkable." See the chart in Keatings, et al. "Evaluation of ostracod-based palaeoenvironmental reconstruction with instrumental data from the arid Faiyum Depression, Egypt," *Journal of Paleolimnology* 38.2 (2007) 261-83 at 263.

[55] 1600 km^2 has been proposed by Davoli (1998), 339. She believes that the lake was much lower in the Ptolemaic period and thus that considerably more land was immediately available for cultivation.

[56] Abd-alla Gad (forthcoming). I am indebted to Prof. Gad for kindly sharing high resolution images of his data and maps with me.

[57] I have drawn my estimates of historical lake surface area from Shafei (1939), who states the surface area of the lake at 44 m below sea level is 218 km^2, roughly comparable to modern calculations. I have thus put faith in his estimates of its earlier extent.

[58] As depicted in Hassan and Tassie (2006), at 39.

[59] Thompson (1999b) at 124 states that "It may well be the case then that there was even more land under cultivation in the Ptolemaic period than in any period since, and the circle of ruined Graeco-Roman villages that now surrounds the Fayyum stands testimony to the scale of Ptolemaic expansion in the area." The greater size of the lake in the early period led to a more dispersed pattern of settlement, since the now-ruined villages were sited near its shores. This settlement pattern thus does not indicate the scale of cultivation. The much smaller population of the ancient Fayyūm also could not have cultivated as much land as intensively as the roughly 2.5 million modern Egyptians do.

Fig. 11: Remains of the ancient lakebed to the north of the Birkat Qārūn and west of Soknopaiou Nesos. Photo: B. Haug, 19 November 2011.

3.2.4: The Water Budget of Lake Moeris in Antiquity

Over time, evaporation steadily increased the amount of exposed, cultivable land. While the vagaries of the annual inundation will have had a constant effect on the lake's volume and surface area (both positive and negative) it is still possible, if difficult, to construct a hypothetical water budget—a measure of surplus and deficit—which indicates that despite these periodic fluctuations the general trend was invariably negative. The equation used here is (I + R + G) – (E + O) or (Inflow + Rainfall + Groundwater Seepage) – (Evaporation + Outflow).[60] Fortunately the Birkat Qārūn possesses several features that simplify the work. Since the lake has no outlet apart from some insignificant seepage, evaporation is the only source of water loss, today estimated at 97.4% of the annual total.[61] Additionally, rainfall is so rare that is has an insignificant impact on the lake's level. We may thus further reduce our equation to the simple (I + G) – E. [62] Clearly, in the absence of ancient data for any of the variables these calculations remain speculative thought experiments. Nevertheless they do offer a compelling indication that the Lake Moeris of the early Hellenistic period continued to recede dramatically over the years, pulling away from some of the marginal foundations of the Ptolemies.

Before we begin we must first approximate the volume of the ancient lake. This can be estimated using the known variables of the modern lake's volume, height, and surface area as well as its surface area in antiquity. Averaging the modern and ancient surface areas and

[60] Shabrary and Dumont (2009), 99

[61] Abd Ellah (2009), 48

[62] Wolters *et al.* (1989), 106 on rainfall. E.g. Abd Ellah (2009) notes the rarity of rainfall and omits it from his calculations of Birkat Qārūn's water budget entirely. Elsheikh (2008) notes at p. 12 that 2.59 mcm of rainwater enter the modern lake annually. This amount will have been greater in antiquity since the greater surface area will have allowed more rain to instantly enter the lake. If we apply the modern rainfall figure to the calculations below its estimated contribution to the lake's replenishment is virtually nil.

multiplying the result by the net gain in height results in an estimated expanded volume, which can then be combined with the known modern volume for an estimate of the ancient total.[63] The results are rough but serviceable. For instance, the modern volume of the lake is approximately 1.05 km^3 at a surface area of 240 km^2 and a height of 43.9 mbsl.[64] As mentioned above the surface area of Moeris in the Ptolemaic was between 688 and 961 km^2 for lakes at 10 mbsl and 0 respectively.

Lake at 10 mbsl: [(240 + 688)/2] x .0339 = 15.726 km^3 in *expanded volume* + 1.05 km^3 *present volume* = 16.78 km^3 *total*

Lake at 0/sea level: [(240 + 961)/2] x .0439 = 26.36 km^3 + 1.05 km^3 = 27.41 km^3 *total*

As I will demonstrate in the following chapter, the ancient Fayyūm was not perennially irrigated and thus did not have water continuously flowing into it as it does today. The Baḥr Yūsuf was largely a seasonal canal, and the Fayyūm thus received the overwhelming majority of its water during the 3+ months of the flood. Linant de Bellefonds' 1843 study of the lake estimates 3.078 km^3 for the total discharge of the Baḥr Yūsuf during the roughly one hundred days of the flood.[65] There was, however, cultivation on the banks of the canal all along its entire route, which would have consumed a healthy portion of this flow. De Bellefonds' figure thus cannot be used as our base figure for annual inflow.

Unfortunately, the earliest true Fayyūm inflow (I) figures of which I am aware are those published by Hanbury-Brown in 1892.[66] Although these data predate the 1904 Low Dam at Aswān, they still postdate the establishment of Fayyūm perennial irrigation via the Ibrāhīmiyya canal and should be regarded as too high for antiquity. Nonetheless this can serve as an upper limit and a hedge against underestimating the inflow in antiquity. Hanbury-Brown offers the following for Egypt's three seasons:

Inundation (June-September): 6.5-7 mcm (million cubic meters)/day
Winter (October-mid-February): 3 mcm/day
Summer (mid-February-May): 1-1.5 mcm/day

We should adopt the high range for the flood and summer flows (7 mcm and 1.5 mcm respectively) to obtain yet another upper limit. Over 365 days, the maximum inflow is 1.424 x 10^9 m^3 or 1.424 km^3 y^{-1} (y^{-1} = 'per year').[67] Willcocks notes that only about 20% of the total inflow drains the Fayyūm reaches the lake, a figure more or less in line with contemporary analysis.[68] Our (I) is thus 0.2848 km^3 y^{-1}.

Seepage (G) can be estimated as well based upon modern data. Owing to the climate and weather patterns there is seepage from the lake only in July, August and November while seepage to the lake occurs during the rest of the year. In the modern period the gain through seepage is 65 x 10^6 m^3 y^{-1} (0.065 km^3 y^{-1}).[69] This amounts to just under 3% of the total modern

[63] Method courtesy of Travis Wilkins, Intel Systems (Portland, Oregon). Pers. comm. March 23, 2011.
[64] Meshal (1977), 137
[65] de Bellefonds (1843), 15
[66] Hanbury-Brown (1892), 12
[67] This may be compared to the current perennial regime with an inflow of some 2304 mcm (in 1983-6)
[68] Willcocks and Craig (1913[3]), 444. According to Wolters (1987) at 161 annual Fayyūm intake is 2.304 km^3 while drainage to the lake is 431 mcm. This amounts to 18.7% of the total intake.
[69] Shabrawy and Dumont (2009), 100

inflow of about 2.304 $km^3\ y^{-1}$. We may thus reasonably assume for (G) 3% of the estimated ancient inflow of 1.424 $km^3\ y^{-1}$: 0.0427 $km^3\ y^{-1}$.

Evaporation (E) requires the variables of volume and surface area calculated above. To obtain total loss we must multiply the annual rate of evaporation in meters by the lake's surface area in m^2 to obtain a evaporative loss figure in m^3. Modern evaporation rates have been observed between 1.7-1.95 m/year, and I adopt an average annual figure of 1.85 m as representative:[70]

1.85 m * 961 million m^2 (at sea level) = 1,777,850,000 mcm or ≈ 1.78 km^3 *total evaporative loss*

1.85 m * 688 million m^2 (at 10 mbsl) = 1,272,800,000 mcm or ≈ 1.27 km^3

We may now apply these figures to (I + G) – E. All values are given in km^3:

Lake at sea level with a rough volume of 27.41 km^3: (0.2848 + 0.0427) – 1.78 = -1.4525 $km^3\ y^{-1}$ deficit[71]

Lake at 10 mbsl with a rough volume of 16.78 km^3: (0.2848 + 0.0427) – 1.27 = -0.9425 $km^3\ y^{-1}$ deficit[72]

It should be obvious that it remains mathematically impossible for the lake to have sustained itself at the size it reached in the third century BCE (between sea level and 10 mbsl). The amount of estimated total annual inflow from drainage and seepage was insufficient to counter the high evaporation rate in the Egyptian Sahara. Of course, the impact of evaporation will have decreased as the size of the lake decreased by eventually coming into a rough equilibrium with the amount expressed as (I + G). At this point water balance is achieved and the lake's level will have remained relatively stable, though still prone to expansion and contraction based upon yearly variations in the amount of inflow. The modern lake Qārūn demonstrates this phenomenon. Current inflow to the Fayyūm is approximately 2293 mcm/2.293 $km^3\ y^{-1}$, of which a 20% drainage to the lake amounts to a 0.4586 km^3 (I).[73] We may combine this with (G) from Shabrawy and Dumont (2009) and subtract an estimated evaporative loss of 0.432 km^3 (rate of 1.85 m y^{-1} * area of 240 million m^2) and observe a theoretical expansion:

Modern lake at *ca.* 44 mbsl: (0.4586 + 0.065) – 0.444 = 0.0796 $km^{3\ y-1}$ (or 79.6 mcm)

Of course the lake does not expand by this amount since a considerable amount of modern drainage is diverted to the Wādī Rayyān.[74] Indeed, the level of the lake constantly varies. Expansion was observed between 1983-6 due to a total intake of 8 mcm in excess of the losses from evapotranspiration, while a 1999 study documented a 19 mcm deficit. Still, thanks to the close attention of modern engineers the lake tends to retain its general size and volume.

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[70] These figures are meant merely as rough approximations and I make no pretense of accuracy. As a control one may take the average amount of evaporation observed in the modern Qārūn between 1970-86, 0.423 km^3. If we perform a similar calculation to those above using the formula above and the surface area from Shafel (1939) we obtain 1.85 m x 218,000,000 m^2 = 403,300,000 mcm or 0.4033 km^3 total evaporation, just over 95% of the actual documented total. The two are thus close enough to indicate that these estimations are reasonable approximations of the actual situation, although my estimations may underestimate the totals.

[71] -1.4491 km^3 if rainfall is accounted for.

[72] -0.93991 km^3 if rainfall is accounted for.

[73] Wolters *et al.* (1987), 162

[74] 431 mcm to the Qārūn and 229 mcm to the Rayyân (1978-1984): Wolters *et al*. (1987), 162.

We must remember that these calculations suppose a static inflow. According to our results the lake should have disappeared in 17-19 years. This is, of course, unlikely. The tight controls over inflow existing at the present period did not obtain until the last decades of the 20th century. Prior to this point the lake was still affected by the vicissitudes of the flood. In years of dearth the lake will have suffered more acutely than usual while years of high or catastrophic flood could have made up for considerable losses in prior years. And yet the trajectory during antiquity was perpetually downward. This can be confirmed archaeologically at the sites of Tell al-Rusas and Al-Qara al-Hamra north of the lake.[75] Situated some 40 mbsl these Roman settlements represent foundations of a period when the lake level was considerably lower than it had been in the early Ptolemaic era. And yet these sites were flooded at some point during one of the lake's oscillations back to a higher level and they remained under water for a considerable period of time, long enough to destroy nearly all surface features.[76]

To a certain extent, the size of the lake can be read as an indicator of the soundness of upstream irrigation infrastructure. The two most important features in this regard were the dam on the Baḥr Yūsuf at al-Lāhūn and the large dyke in the Tutūn Basin, which retained flood waters long enough for irrigation by preventing their immediate loss to the lake via the Wādī al-Nezla drain (see below, chapter 4). If both features were functioning properly over a long period we can expect that the lake level will have been reduced accordingly, apart from some fluctuation in years of high flood. And yet, any major failures, although disastrous for cultivators, were beneficial to the lake. [77] Lacking ancient evidence we may turn to an 1867 letter of traveler Lucie Duff Gordon to her daughter for a dramatic picture:

> The dyke burst the other day up at Bahr Yussuf, and we were nearly all swept away by the furious rush of water. My little boat was upset while three men in her were securing the anchor, and two of them were nearly drowned, though they swim like fish; all the dahabiehs were rattled and pounded awfully.

Such were the results of human and infrastructural failures. The annual inundation was also occasionally dramatic and disastrous. The flood of 1695, for instance, was so great that it washed over or destroyed Fayyūm's irrigation features, killed many people and destroyed a considerable amount of the Fayyūm's agricultural land.[78] Events such as these were indeed disasters at the human level, but the Birkat Qārūn will have profited immensely since the huge influx was entirely wasted and lost to the lake.[79]

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[75] The site of al-Qarah al-Hamra was only discovered in 2003 by the ongoing excavations of the University of California, Los Angeles, in cooperation with the Rijksuniversiteit Groningen. See: http://www.archbase.com/fayum/project_2003.htm

[76] See Davoli (1998) 161-4 for Tel (or Qaret) al-Rusas and the website cited in the previous note for al-Qarah al-Hamra.

[77] Situations such as this in conjunction with the occasional disastrously high flood will have helped sustain the lake in the face of relentless evaporation.

[78] Mikhail (2010), 588 at n. 54, citing Ahmad al-Damurdashi Katkhuda 'Azaban, *Kitab al-Durra al-Musana fi Akhbar al-Kinana*, ed. 'Abd al-Rahim ,Abd al-Rahman ,Abd al-Rahim (Cairo: Institut français d'archéologie orientale, 1989) at p. 30.

[79] The annual variations of the flood are also pertinent. Cf. the Roman-period Elephantine inscription *CIG* 4863, which records the height of the flood in given imperial regnal years.. A portion is translated in Johnson (1936), 16.

3.2.5: Observed Lake Levels: History and Archaeology

Oscillations in the lake's level due to dramatic events and also the simple vagaries of the annual flood could be extensive. Theologian and manuscript collector Johann Wansleben, who visited Egypt in 1672-73, claims that in the ancient Fayyūm there were "threehundred threescore and five Towns and Villages, but now there be but threescore and two; all the other [*sic*] have been swallowed up in the Lake Kern or destroyed by the tyranny of the Governors."[80] Detail is lacking but he clearly claims that the lake had been smaller in the past having grown only recently. In Wansleben's description we see that the lake had indeed returned to a size similar to that of the earlier Ptolemaic period: from the village of Sinnūris (ancient Psenyris) he made his trip to the lake on foot. He notes that its shores were "very near Sennuris, on the West-side," although this village is presently some 10 km distant from the water. He also describes its length, the eastern shores lying at Ṭāmiya (ancient Tamauis), now ca. 14 km distant, and at the west at Qasr Qārūn (Dionysias), now <5 km from the lake's western tip. Additionally, in the village of Sanhūr (anc. Psineuris), now ca. 10 km south the lake, dwelt a number of local fishermen who plied their trade on the lake.[81] Larger-than-average floods and the abandonment of agricultural land and the subsequent drainage of more water directly to the lake may have been contributory factors to the rise of the Qārūn's level.[82]

Such variations aside, the above water budget, rough and hypothetical though it is, nonetheless indicate how swiftly a combination of human engineering and natural aridity could have altered the landscape. Much of the land newly reclaimed in the 3rd century BCE was surely highly fertile since it had until recently been untouched lake bed covered by millennia of Nile silt.[83] The proximity of border villages to the now-smaller lake also gave them the ability to draw groundwater from wells or by *sāqiya* (waterwheel) from canals filled by infiltration. Canals of this nature were discovered in 1928 in the desert north of the Birket Qārūn and the sites of Tell al-Rusas (Neilopolis) and Kōm Auhīm (Karanis).[84] There was also no observed connection to any other part of the canal system here. The Ptolemaic eastern desert canal, the medieval Baḥr Wardan, which broke off from the Baḥr Yūsuf at Hawāra and ran north along the eastern edge of the Fayyūm, did not extend this far to the west and has not been located within at least 10 km of this smaller local canal system.[85] The elevation of the canals in this area is also higher than that of the lake level, given by Caton-Thompson and Gardner as some 20 feet, so they cannot have drawn water directly from the lake's surface. Infiltration, probably during the inundation, is the only possible source. A well in the vicinity of these canals some 6 km from the modern lakeshore serves as proof of the lake's level in the early days after the reclamation.[86] The well's bottom rested at 4.6 m below sea level and was filled with windblown sand. When this was removed considerable vine clippings were discovered, as well as a number of broken well-water jugs resting on harder silts. Some 2.5 m above the bottom at a height of 2 m below

[80] Wansleben, 155

[81] Wansleben, 161-2

[82] There are unfortunately massive gaps in the data for flood levels in the 17th century. See the tables in Toussoun (1925), Vol. II, 366-404. Still, levels during the few years for which records survive are not disastrously high. See also the graphs in Hassan (1981) at 1143.

[83] So Ball (1939), 215

[84] See Table LXXXVII in Caton-Thompson and Gardner (1934) and Ball (1939) fig. 26 at 217.

[85] Ball (1939), 217

[86] Ball (1939) 210-11. 150 meters from the well is a limestone quarry which provided the stone slabs lining the interior of the well. A coin of the early years of Ptolemy II was discovered here which gives us the "early Ptolemaic" date for the well.

sea level there was an incrustation of salt such as could only be formed by the presence of standing water.[87]

And yet the high rate of evaporation that once enabled Ptolemaic reclamation was a double-edged sword: it did not permit the maintenance of the lake at the level obtaining in the mid 3rd century BCE. Apart from periodic fluctuations the lake continued to shrink, slowly altering the environment and agricultural potential of villages on the fringes of the Arsinoite nome. By the 13th century the Qārūn had shrunk to some 30 m below sea level. It appears to have risen again during the 17th century but it had fallen again to 40 mbsl by Muḥammad ʻAlī's era.[88] Clearly, Fayyūm reclamation did not stop when Ptolemic laborers put their tools down. In the words of American paleontologist Spencer Lucas:

> By lowering Moeris as he did, Soter also dramatically reduced the lake's surface area. While Moeris was probably doomed anyway, the Nile River slowly entrenching into its own valley so that it would soon stop flooding into the Bahr Yūsuf, Soter had prematurely put Moeris at the mercy of the sun. The sun burned upon the lake as it always had, but now, though there was less surface area of Moeris to burn, the volume of Moeris had diminished significantly. Evaporation accelerated, and the lake slowly began to shrink. Over the years, the evaporation became more effective. Annual intake from flooding in the Nile Valley was no longer sufficient to offset evaporation's gradual effect.[89]

[87] A comparable phenomenon has been documented in modern Egypt around the shores of Lake Nâsir in the south. The waters of the enormous reservoir, created between 1963 and 1978, are drawn upon for small farm irrigation while subsurface water allows wells to be sunk at depths between two and four meters. Since the lake is constantly shifting laterally due to extremely rapid evaporation (*ca.* 3000 mm/y) and the vagaries of Ethipoian rainfall and the flood, local wells also move, following the groundwater level: Belal, *et al.* (2009), 10 and 35.

[88] Bayoumi *et al.* (2010), 325. See Shafei (1939) at "Drawing No. 3" for a visual representation.

[89] This statement is drawn from the introduction to the published diary of a 1907 paleontological expedition headed by Walter Granger and George Olsen under the auspices of the American Museum of Natural History in New York: V.L. Morgan and S.G. Lucas, *Notes from a Diary-Fayum, 1907* (Albquerque, 2002).

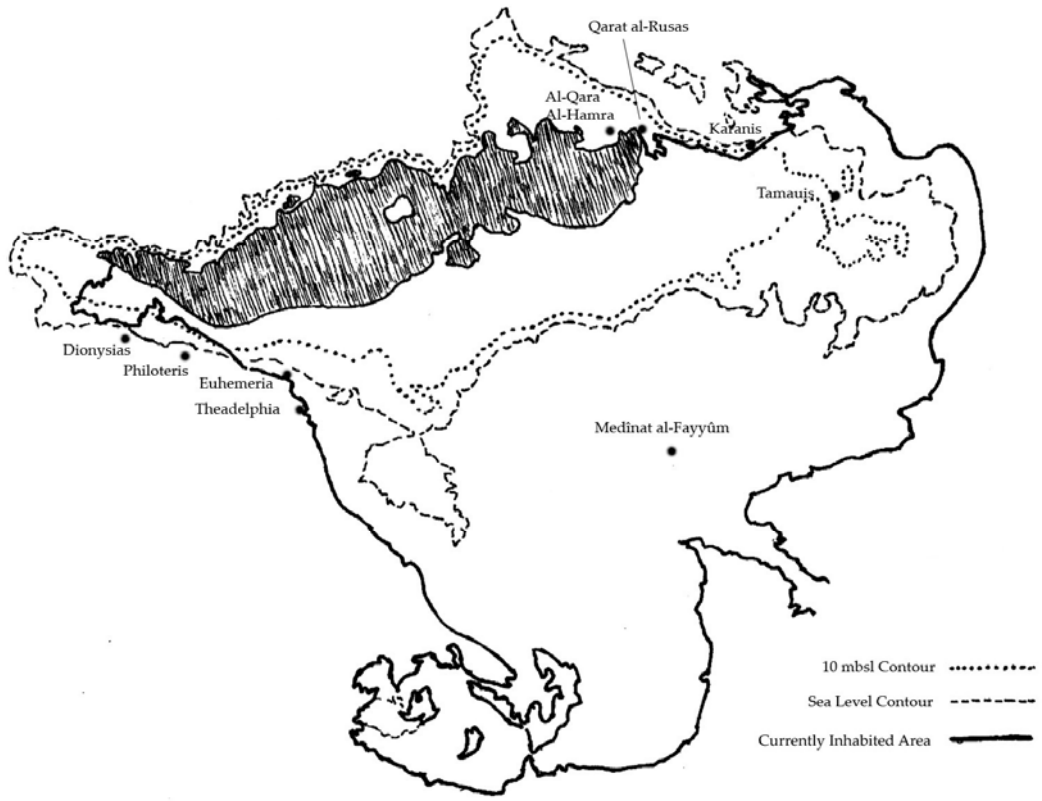

Fig. 12: Comparison of ancient lakes at sea level and 10 mbsl with the modern Birkat Qārūn. Drawing: Rhys Haug.

3.2.6: Lake Level and Settlement

It is by now clear that the edges of the northern Fayyūm were subject to protracted desiccation during the Greek and Roman period. This occurred to the detriment of early Ptolemaic settlement in the area, which was designed around a large lake at several meters below sea level: most new Ptolemaic and early Roman settlements in this northerly area occur in a band several meters above or below sea level, clustering around Moeris like frogs about a pond.[90] We may best appreciate the conditions by looking at four now-deserted Ptolemaic sites in the western portion of the Fayyūm, the Ptolemaic and Roman *meris* of Themistos: Dionysias and Euhemeria (both at the 0-5 m contour), and Philoteris and Theadelphia (5-10 m contour). In the early days of Fayyūm reclamation and cultivation, these villages will have been beach front properties, explicitly so in the case of a village like Berenikis Aigialou ("Berenikis of the sea shore"), which cannot now be located but lay somewhere in the vicinity of Euhemeria.[91]

Lakeside settlements like Soknopaiou Nesos and Dionysias were in particularly precarious positions since they were perched on the very edges of the nome, one face to the lake and another towards desert and the rocky sill surrounding the depression.[92] The ruins of the

[90] Conversely, Middle Kingdom Fayyūm sites occur above 15 masl. Mehringer *et al.* (1979), 241, citing table 4 in J.A. Wilson, "Buto and Hierakonpolis in the geography of Egypt," *JNES* 14.4 (1955) 209-236 at p. 219.

[91] Compare these villages to the settlement of Soknopaiou Nêsos at the site of Dima north of the lake.

[92] The map of soil cover in Gad, forthcoming, shows that Dionysias was placed in an area with very little cultivable land whatsoever. The rock of the desert encroaches into the cultivated area creating a small triangle of Class

former village now sit atop the summit of a ridge some 20 m above sea level to the north of the lake and for some 1,600 years prior to its reduction Soknopaiou was indeed a *nēsos* resting just above the water's surface.[93] In the Graeco-Roman period the village possessed some *aigialos*, marginal shore land to the south along the lake. This was cultivable only in years when the flood was low enough to leave it exposed (*apokalyphthē*).[94] In higher flood years it was useable only as pasture land. Soknopaiou's *aigialos* is recorded as increasing over a span of fourteen years during the 3rd century from 93 arouras in 215, to 242.5 arouras in 219 to 408 arouras in 229. This is surely a factor of the continuing shrinkage of the lake as well as natural variations in flood level and, since the village had at least 150 arouras of *aigialos* some years earlier in 212.[95] Dionysias, lying at the furthest western edge of the Fayyūm, was similarly disadvantaged. The irrigation system comes to an end at the village, agricultural land was scarce, and its initial proximity to the lake was important to a village economy that relied on numerous sources of income, including fish.[96] As the lake receded, later village foundations reflect the changed physical environment. The newly-discovered Roman site of al-Qarah al-Hamra is a case in point. It rests 40 m below sea level and thus represents a foundation dating to a period when Lake Moeris was of roughly similar size to the modern lake. Although the site appears to have been flooded at some point, the general trend in the area is one of ever-increasing aridity. Later settlements like al-Qarah al-Hamra represent life in a contracting Arsinoite nome, where life had begun pulling away from the old drying margins to move inward towards the more fertile and easily watered flood plain.[97]

3.3: SOIL SALINITY AND CALCIFICATION

3.3.1: Effects on Agricultural Productivity

All naturally occurring fresh water contains salts, though usually in quantities so insignificant as to cause no adverse effects to the user.[98] The salinity of irrigation waters is higher than in naturally flowing waters since it is continually subjected to evaporation and the progressive concentration of remaining salts during its meandering flow through artificial canals.[99] The regular application of such water, even if it remains of high quality, can thus lead to soil

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III/marginal soil at the western edge of the modern lake almost entirely cut off from the rest of the inhabited Fayyūm.

[93] Ball (1939), 215.

[94] The word is found in l. 13 of *P.Gen* I^2 16 (207 CE)

[95] See Hobson (1984) for a discussion of the *aigialos* and other agricultural aspects of Soknopaiou Nesos. Hobson notes the amount of shore land on p. 97: 212 CE, *P.Lond*. II 350; 215 CE, *CPR* I 33; 219 CE, *SPP* XXII 174; 229 CE, *BGU* II 659.

[96] FVP: P. Van Minnen, "Dionysias, meris of Themistos." See the note here for references to documents mentioning fishermen and fish in the village.

[97] The idea was already voiced by Hanbury Brown at p. 51 of his 1892 work on the history the Fayyūm and Lake Moeris: "As regards the old abandoned towns mentioned, some of them are on elevated spots, and probably were on the shores of Lake Moeris. When Lake Moeris had declined and the water had receded to a distance from them, they were abandoned for more favourable sites, less remote from a water supply and water transport. Probably Sanûris and Sanhûr, and the other villages on the edge of the second plateau, are the successors in time of the ancient elevated towns mentioned as ruined and abandoned."

[98] Grattan (2002), 1.

[99] Park (2001), 66. Sodium chloride, calcium sulfate (gypsum), magnesium sulfate (Epsom salts), and sodium bicarbonate (baking soda) are the most common. Even waters with a very low salt content, suitable for the irrigation of most crops can contain nearly a full ton of salt per acre foot of water: Grattan (2002), 1-2.

salinification over the long term, particularly in arid regions.[100] Saline soil conditions occur when the water applied is insufficient to leech out soluble salts, while rapid evapotranspiration simultaneously draws water and dissolved salts towards the surface thus removing the water and leaving the minerals behind. This process progressively increases salinity in the upper horizons of the soil, creating conditions toxic to most plant life, and in extreme cases it can result in a hard salt crust on the soil surface.[101] As noted earlier, the endorheic Fayyūm suffers from considerable salinity issues due to heavy irrigation, poor drainage, artificial fertilizers, high evaporation and the basin's complete enclosure. The problem is much the same as that obtaining in the oases of the Western Desert: irrigation has created a very shallow water table, the evaporation of which leads to ever-increasing salinization.[102] The contaminants which are successfully leeched from the soil and drained eventually make their way to Birkat Qārūn where they remain, at least for the most part. The lake's salt content is not entirely stable since there is some minimal loss of water and solutes to groundwater seepage but recorded salinity levels show a steady rise in the modern period.[103] Although this continuing increase in the Fayyūm's total salinity inhibits the productive potential of the basin, its soils are highly resilient if properly drained. The introduction of tile drainage, for instance—subsurface piping that carries drainage safely away from plant roots—markedly improves soil conditions in a very short period of time.[104]

Salinity problems in Egypt were recorded and studied by Europeans during the British colonial period. Julien Barois, a French engineer who served as Secretary General of the Egyptian Ministry of Public Works in the late 19th century, noted the problem in his 1887 study of irrigation in Egypt. Well water, he records, generally possesses a mineral content four times higher than water obtained directly from the Nile, since it picks up a great deal of minerals from the surrounding soils and rock. Barois commented that all infiltration waters are "more or less brackish" and, if improperly drained, will leave "a whitish efflorescence and true salt deposits, which render any cultivation at such places impossible." Such drainage issues have, according to Barois, caused significant ruin to many parts of the country. Thus, many farmers preferred that their feeder canals lie at a lower level than their fields. This, of course, necessitates the laborious and time-consuming raising of water by *shadūf* or *sāqiya*, but is a small price to pay to avoid the "fatal action of infiltration water," which is likely to reduce the yield of a plot by steadily increasing its salinity.[105]

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[100] Irrigation does not lead to salinization in every circumstance. Systems whose canals are covered and protected from evaporation and where drainage functions properly are significantly less prone to saline soils, at least as long as the water used remains of high quality: Radkau (2008), 8.

[101] Soil Analysis Support System for Archaeology: "Calcification and Salinisation," [online tutorial]: http://www.sassa.org.uk/index.php/Tutorial:Soil_Calcification. Accessed April 19, 2011. See the dramatic images of dry salt-crusted soils in Sinnûris district south of the Birkat Qārūn on page 3 of Shendi *et al.* (2010).

[102] Kotb *et al.* (2000), 251. The study of soil in Sinnūris district in Shendi *et al.* (2010) found the greatest concentration of salts in the north of the district just south of Birkat Qārūn, where poor drainage combines with the infiltration of the lake's saline water. Anecdotally, any traveler to the Fayyūm will have noticed, if only in passing, the striking coexistence of water-logged areas and spaces of total desiccation, the visible effects of heavy evaporation on a high water table.

[103] See above at n. 54.

[104] Moustafa *et al.* (1990) and Shendi *et al.* (2010) both discuss the rapid improvement in soil conditions under a proper drainage regime. The latter authors document a massive improvement in Sinnûris district between the years 2002 and 2009.

[105] Barois (1887), 19-20.

Salinization is of course not a problem confined solely to the modern period and the papyri preserve some evidence for salt problems in antiquity. The relative purity of the Nile's water and the limitations and variability of its supply to the Fayyūm will have slowed the advance of saline conditions in antiquity. The Nile's water remains very fresh, i.e. containing <1000 mg l^1 (per liter) of total dissolved solids (TDS). At Aswan current TDS levels reach only *ca.* 150 mg l^1 and a mere 250 mg l^1 at Cairo 950 km downstream.[106] At the beginning of the 20th century chemist Alfred Lucas investigated the soil and water of the Fayyūm and remarked that the water quality was quite high with only one sample—obtained at the tail end of a major drain—containing soluble materials in quantities sufficient to render it unsuitable for agricultural use.[107] The floodwaters that entered the Fayyūm in antiquity were thus surely of similarly high quality. Nevertheless the simple imposition of an irrigation regime in this enclosed arid basin assures a steady if protracted build-up of salts. It is thus important to attempt to determine the extent to which such problems affected the Fayyūm in antiquity, particularly those areas along the margins. It has recently been hypothesized that a prolonged increase in salinity was a primary cause of the desertion of the Fayyūm's liminal sites.[108] The evidence is spotty but it may indeed have been a significant contributing factor.

3.3.2: Salinity in Antiquity

It is clear that saline conditions were present and recognized in the Greek and Roman periods. There are four attestations in the papyri of a small settlement bearing a name indicating its location on or near salted land: Halmyra or Halmyras *epoikion*, near the village of Herakleia, the latter somewhere in the vicinity of Pisais (modern Ibshāwaī).[109] The problem of under- or non-productivity resulting from deleterious levels of salt was also recognized. *Halmyris* ("salt land") appears with some frequency in the land surveys from the 2nd century BCE archive of Menches, *kōmogrammateus* of Kerkeosiris, a village in the southwest of the nome (the modern Gharaq basin).[110] Twenty of the pertinent papyri mention salt land in Kerkeosiris, while there are two instances of the problem recorded in Berenikis Thesmophorou and Philadelphia and one instance each in Magdola, Tebtunis and Argeas (two texts do not record a locale).

A representative papyrus from the Roman period is *P.Col.* IV 95 (mid 3rd CE), possibly from Philadelphia. The text is a brief account of fifteen arouras of land, some of which produced fodder and of which five arouras were dry and salt crusted (*halismoi xērou*). The much longer land survey *P.Lond.* II 267 (114 CE), records considerable amounts of salted and untaxed land (*halmē aphoros*) in Soknopaiou Nesos, although this village was in many ways unique.[111] "Dry salt land" (*chersalmē*) is also recorded near the village of Ibion Argaiou (*P.Oxy.* VI 918, 2nd CE) and in an unknown location in a text broadly dated to the first to fourth centuries CE (*SB* XIV

[106] Kotb, et al. (2000), 247.

[107] Lucas defines "unsuitable" water as having 300 parts soluble materials (of which ~50% are salts) per 100,000 parts water: Lucas (1902), 9.

[108] Andrew Monson, pers. comm. April 19, 2011. See also Monson (forthcoming)

[109] Hobson (1985), 102 for the location of Herakleia. Halmyra(s) appears in *P. Lond*. III p. 23-24 no. 901, 5 [a] (75-125 CE), BGU I 227 (2nd CE), *BGU* XIII 2242 (2nd CE), where it is located *pe*[*ri kōmēn*] *Hērakleian*, and *BGU* III 790 (198-9 CE). It has been speculatively restored in l. 15 of SB I 5338 (between 4th and 7th CE) as Ἀ[λμυ]ρᾶς. This is possible but obviously far from secure.

[110] E.g. *P.Tebt.* I 60-64, 66, 74, 74, 75, 83-85.

[111] No provenance is provided in the DDBDP although the demotic text on the verso proves that the text is from Soknopaiou Nesos: Monson (forthcoming).

11913). So also the short survey fragment *P.Strasb.* VIII 788 from Theadelphia (157-8 CE), which notes the presence of "dry salt land" (*kalmē kai chersos*) in the village.

The most complete description of both saline conditions and the methods by which they were remedied is *P.Hamb*. I 12 of 209-10 CE, which preserves a survey of land leased to one Heron and unnamed others and described as 213 3/32 arouras capable of cultivation, with 2 ¼ ar. devoted to a brick yard and 2 ar. to a threshing floor. The text epitomizes some sixteen years of irregularly performed surveys during which the 213 3/32 arouras were reclaimed from some 259 previously non-productive arouras. During the first year of the survey 263 13/16 ar. were assessed at a reduced rent: the 4 ¼ ar. devoted to the brickyard and threshing floor, as well as 44 21/64 ar. uncovered late by the flood, 186 ¼ ar. salted (*chersalmē*) and 28 55/64 dry (*chersos*). Roughly 79%, that is, was thoroughly uncultivable, 96% if the nearly 45 ar. uncovered late are included in the total. The results of the second year of the survey are lost in a lacuna and there is no mention of a survey in the third or fourth year. After the fifth-seventh years during which no survey was performed, the surveys of the eighth to seventeenth years list the land as under water before it was finally restored to productivity.

P.Hamb. I 12 remains unique, and one must still explain why there is no consistent indication of salinity problems from our deserted sites, if one is to argue for the deleterious effects of salinization along the margins. As Andrew Monson has noted, rather than land surveys *per se* much of the surviving documentation concerning land from the Roman period are *sitologoi* accounts concerned with taxation, which do not preserve information on land quality.[112] This general absence of evidence is, of course, not conclusive. Salinity need neither display itself as a white surface crust or occur suddenly as a result of the accidental rupture of an irrigation basin or canal overflow (abnormal occurrences that were more likely to be recorded).[113]

Apart from such extraordinary incidents the incremental growth of salinity might simply have remained undetected, contributing to reduced productivity over a period of centuries.[114] It has been the argument of this chapter that the edges of the Fayyūm were becoming progressively desiccated in antiquity due to the retreat of the lake and the difficulties of maintaining a consistent water supply. If this is accepted then the precise process of salinization obtaining in the present day—massive evaporation from a shallow water table--cannot have occurred. It is quite possible, however, that the distance of the deserted villages from the inlet at al-Lāhūn contributed to salinization. Situated as they were towards the tail end of the canal system, not only was their water supply reduced and probably even precarious in low flood years, it was surely also much more salty due to the cumulative effects of evaporation. As such, what water was available will have been of reduced quality in comparison to that used by villages upstream.

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[112] Andrew Monson, pers. comm. April 19, 2011.

[113] *E.g. P.Tebt.* III 998 (either 202-1 or 178-7 BCE) refers to ten arouras of *halmyris* resulting from canal overflow: [διὰ τὸ κατα]κεκλ(ῦσθαι) ὑπὸ τοῦ αἰγιαλοῦ (l. 5). See Bonneau (1989) at 67-8 for examples of salinization from accidental inundation.

[114] So Warren A. Hall in 1973 (rather melodramatically), then acting director of the Department of Interior's Water Resources Institute: "Salt problems are particularly insidious. They do not come charging at you with trumpets blowing and battle flags flying, a sight to set stirring the hearts of activists in any century. Rather, they slip in almost unnoticed. Time is of no concern, for they are supremely confident of their ultimate victory. History is on their side, as are the laws of physics, chemistry and biology. They have quietly destroyed, without fuss of fanfare, more civilizations than all the mighty armies of the world." Cited in Gary Pitzer (Water Education, Sacramento, CA), Salinity in the Central Valley: A Critical Problem," 19 October 2009, online: http://www.aquafornia.com/archives/13578. Last accessed 25 April 2012.

According to a 1902 survey, even the best soils of the Fayyūm were not of outstanding quality.[115] In samples of the surface soil of the Fayyūm that were compared his results to "American standards" of soil quality (e.g. high quality, productive, largely salt-free soils) and noted that "even the land bearing good crops…is only comparatively good. The best samples are by no means free from harmful constituents, and in several instances the amount of injurious salts in so high that with a very slight increase only the crops would begin to suffer."[116]

It might be objected that a soil survey postdating antiquity by centuries is certain to return a higher salinity than that which obtained in the Graeco-Roman period due simply to increase over time. This is indeed probable, though, Lucas' examination of the Fayyūm's subsoil also returned interesting results. The subsoil of the cultivated area contained a significantly higher proportion of injurious salts than existed on the surface. He noted that the sands just beyond the limits of cultivation, as well as the "clays and limestones underlying it through which the outermost canals are cut, all contain a large amount of [sodium] chloride and [calcium] sulfate."[117] That is, not only did the simple act of irrigation continually bring extra salts into the depression, the Fayyūm's substrate itself, atop which its thin soils rest, was heavily salinized.[118] Indeed, al-Nābulusī reports the existence of a then-disused salt mine (*mallāḥa*) at the village of Dumūshiyya (anc. Mouchis), a village just to the southeast of Medīnat al-Fayyūm.[119]

3.4: CONCLUSION

This chapter has sketched in outline the natural-environmental characteristics of the Fayyūm both before and after the Ptolemaic intervention in its natural hydrology. As we have seen, the reclamation was not *sensu stricto* a drainage project. Rather it was the restriction of inflow coupled with evaporation that exposed cultivable ground. The results of the project illustrate the fact that human "environmental knowledge is generally put into practice only in a very truncated, simplified form" with an eye to immediate needs and little consideration for *longue durée* effects.[120] The early Ptolemaic foundations along what were then the borders of the newly-minted Arsinoite nome were planted in areas which were at this early period very close to a large, freshwater lake. It appears as if ancient engineers assumed that once the reclamation had reached the desired extent and villages were planted in the earth the continued evaporation of the lake could be arrested. This was clearly not the case. From the middle of the third century BCE onward the hydrology of the basin continued to change as the lake shrunk and the edges of the Arsinoite progressively dried out. As has been argued above, the reduced availability of fresh water and the increasing salinity, calcification and resultant marginality of the soil combined to make the border areas of the northern half of the depression unattractive, if not necessarily uninhabitable. I will explore these issues further in the final two chapters, examining the functionality of the Fayyūm's complex irrigation system as well as the social ramifications of life in communities consistently threatened by water shortages.

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[115] The use of imported Chilean nitrates began in 1902, the year that Lucas' study was published: FAO (2005), 19.
[116] Lucas (1902), 10
[117] Lucas (1902), 11
[118] Cf. Willcocks and Craig (1913), 391
[119] *TF* 39. The mine was out of use, al-Nābulsusī states, because the price of salt had fallen too low to cover the costs of maintaining a waterwheel what brought water to the area from a nearby well.
[120] Radkau (2008), 11

CHAPTER 4
LANDSCAPES OF SCARCITY
The Irrigation System and Landscape Diversity

> *Before 1865, when there was no Ibrāhīmīyah canal, the people in the Fayūm used to collect water in small reservoirs called Khazzān. These reservoirs held up at their lower end about 20 feet of water. In the winter they were partially emptied by a sluice, and the higher parts were cultivated, and at the end of the winter they were filled up again. Some of the more important ones were filled in September and retained full during the winter. As the Fayūm has no wells in it, the importance of these reservoirs must have been very great. The last one was abandoned in 1885 and its cultivable area sold.*[1]

4.1: IRRIGATED LANDSCAPES

4.1.1: Introduction

Like its modern analogue, premodern Fayyūm irrigation was based in large part upon a complex, interconnected canal network. Supplied by a single inlet at al-Lāhūn, water flow was distributed through progressively smaller waterways that linked every settlement to its neighboring *rivales* and ultimately to every other community in the depression. All beneficiaries were equally dependent upon the main inlet at the entrance to the Fayyūm but once within the depression, trouble, like water, flowed downhill: both profligate water use and poorly maintained infrastructure in upstream portions of the system created potentially serious problems for those downstream, particularly the tail-end users at the system's termini.

This network and the high level of human interdependency that it fostered was a wholly unique socio-technical system in the premodern Egyptian landscape. Indeed, al-Nābulusī is explicit regarding the Fayyūm's distinctiveness. He refers to villages just outside the borders of the depression as watered "like the countryside" (*al-Rīf* or Lower Egypt), rather than "like the Fayyūm," the difference being between irrigation via inundation basins as opposed to canals.[2] Yet al-Nābulusī's unique Fayyūm occupied but a portion of the central region of the depression, comprising only the lowest-lying, most easily watered areas. It did not even occupy the full extent of the alluvial plain. A large sector of the natural floodplain in the southeast, once forming the eastern portion of the ancient *meris* of Polemon—now the Tuṭūn basin or al-Mala'a, formerly Ḥūḍ al-Ṭuyūr, "the basin of the birds"—was only sparsely populated in the mid 13th century .

In the Graeco-Roman period, however, the cultivated area was more expansive and more diverse, its subregional fragmentation resulting from the inherent limitations of the ancient irrigation system. As discussed in the conclusion to the first chapter, modern hydraulic

[1] Ross (1893), 184-5

[2] Although the villages of al-Ḥammām and Sadamant, for instance, were but a short distance outside of the Fayyūm proper (to the northeast and southwest, respectively, of al-Lāhūn) both were watered only in the days of the flood (Sadamant, *TF* 118, al-Ḥammām, *TF* 53-4). Al-Nābulusī's Fayyūm comprised only the areas in which some water was available year-round. On Nābulusī and 13th century Fayyūm irrigation in general, see now Rapoport and Shahar (2012).

technology in Egypt attempts to homogenize the landscape by fully controlling the flow of perennial water. The great hydraulic projects of the 19th and 20th centuries were meant to emancipate Egypt not only from the unpredictable flood but also from the hyperlocalism of ancient flood recession irrigation. Perennial water—controlled by a single, centralized authority at a single source and evenly and predictably distributed throughout the country—would create one unbroken landscape fully covered with the water of a domesticated river "regulated like an ordinary canal."[3]

But ancient technology was not so all-powerful. Yes, the Ptolemaic reclamation and canalization project substantially altered the depression's natural hydrology but, as we will see, the irrigation system's capabilities were still constrained by a limited water supply, which impacted its functionality and effectiveness in different parts of the depression. This chapter argues that the ancient Fayyūm's landscape and irrigation practices were thus characterized by considerable heterogeneity and fragmentation. In antiquity, the limits of the irrigation system informed the creation of four irrigated subregions within the broader landscape, each possessing its own unique character. Only one of these subregions still survived by al-Nābulusī's day.[4]

4.1.2: Irrigated Landscapes in the Fayyūm

At heart, the diversity that I will describe resulted from the inability of the ancient irrigation system to overwhelm subregional distinctiveness as the modern system was designed (yet fails) to do by providing plentiful perennial water to every part of the depression equally.[5] In fact, it has long been at least acknowledged by papyrologists that the ancient Fayyūm was not irrigated as it is today and was heavily dependent upon the flood and a modified form of basin irrigation. This feature of its hydrology persisted through premodernity until perennial irrigation was gradually instituted over the 1870s and '80s.[6] As Hanbury-Brown remarked in 1892 of the previous water regime:

> Considerable areas were enclosed by banks, and inundated under the basin system, known in the Fayūm as "Malaq," in contradistinction to irrigation by small field channels, a system called "Misqāwi." The contents of these small basins, when emptied, flowed into the lake.[7]

Yet the significant implications of the premodern Fayyūm's flood dependency have not been fully appreciated in the scholarly literature. Firstly, the Fayyūm is still sometimes inaccurately

[3] Willcocks (1903b), 46-7

[4] One could continue subdividing the Fayyūm or indeed any landscape *ad infinitum*. I might, for instance, include the desert area north of the lake, home to Soknopaiou Nesos as well as several other sites whose names have not survived in the sources. Where, too, to place Medīna Quta, west of Dionysias and apparently connected to mining activity in the desert? Since my focus is on irrigation, however, I restrict myself to environments directly served by the irrigation and shaped by the particularities of local nature and human interactions with irrigation water within them.

[5] Of course, local distinctiveness cannot be entirely overcome, particularly now that water scarcity is becoming a significant problem. On contemporary attempts to deal with scarcity in the Fayyūm through greater farmer participation via the establishment of Water User Associations see Barnes (2010), 134-200.

[6] See in general e.g. Johnson (1936), 10-11, Thompson (1971), 110 for acknowledgements of the Fayyūm's flood dependency. The modern system is, of course, not perfect. DeVeer (1993) documents the differences in water supply between regions.

[7] Hanbury-Brown (1892), 96. *Malaq* is more accurately transliterated *mala'*. The author seems to have misunderstood the terminal glottal stop as a *qaf*, which is most often rendered as an unvoiced glottal stop in spoken Egyptian Arabic. *Mala'* or colloquially as *mala*, to fill or to irrigate by flooding (*A Dictionary of Egyptian Arabic*, El-Said Badawi and Martin Hinds. *Libraire du Liban*, 1986). *Misqāwī*: "irrigated" from *saqy* "to give to drink" and by extension "to irrigate", whence *sāqīya,* an "irrigator."

described as perennially irrigated, a situation seemingly incompatible with its acknowledged flood dependence.[8] Secondly, the prevalence here of a traditional and unremarkable once-yearly basin irrigation regime seems to be equally irreconcilable with the widely-accepted notion among historians of Graeco-Roman Egypt that it contained the Roman Empire's most productive agricultural land.[9] I will demonstrate below that we can to a certain extent explain these apparent contradictions. Still, subregional diversity makes it impossible to speak of the specific character of *the* Fayyūm or *the* Fayyūm irrigation system.

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On the whole, the confusion surrounding water in the premodern Fayyūm results from the complexity of the system as it functioned on the ground. Irrigation in the Fayyūm did indeed rely heavily upon the flood, but it was not equally flood-dependent throughout. While the nome received the bulk of its annual water supply during the inundation, the Fayyūm's central regions contained a small amount of semi-stagnant water year-round, a side-effect of geology: lateral seepage from the Nile's main channel constantly infiltrated both the Baḥr Yūsuf and the Fayyūm's lowest depths. Since this seepage water was largely unable to penetrate the relatively impermeable clay layer that underlies the depression it remained near the surface pooling in low-lying canal beds. One could perhaps describe the center as perennially irrigated, although the hybridity of its water supply must be acknowledged. Semi-perennial irrigation, then, is perhaps a more apt descriptor.

This well-watered region of the depression was the longest-lived portion of the ancient reclamation, representing the central core of the Fayyūm that survived intact until the modern irrigation revolution. The northeastern and northwestern borders, where villages like Dionysias and Philadelphia lay, form a second irrigated subregion. These highly marginal settlements lay toward the tail ends of long canals that traversed the shallowly-graded, higher altitude terrain of the borders, lands too elevated above the low-lying alluvial plain to benefit from Nile seepage. Here, water was scarcer and agriculture was wholly dependent upon the annual inundation. More particularly, these villages were dependent upon a flood that was heavy enough both to reach their far-flung locations at the tail ends of the canals and to compensate for profligate "first-come-first-served" water use farther up the canals. Any water that arrived in excess of immediate necessity was banked in small storage reservoirs.

The southern portion of the depression, the the Graeco-Roman *meris* of Polemon, formed the third and fourth irrigated subregions. This southern expanse is comprised of two geologically distinct portions: the large, flat, expansive eastern Tuṭūn basin (itself part of the alluvial plain), and a smaller western section external to the alluvial plain and enclosed by a low rocky sill and now known as the Gharaq ("flooded") basin. The wide and flat Tuṭūn hosts the head of the Wādī al-Nezla, the Fayyūm's main western drain. Here, a massive seawall was constructed across the wadi mouth at some point in antiquity, remaining partly visible today. The purpose(s) of this large dyke have been disputed but I will show that the structure briefly retained water within the Tuṭūn turning the subregion into a traditional, if massive, inundation basin. To the west, the Gharaq was something of a Fayyūm-in-miniature. It contained a small

[8] E.g.. Roger Bagnall's 'Fayum' entry in Bowersock, Brown, and Grabar's encyclopedia cited above at page 38 with n. 95. "Perennial irrigation also made it a logical zone for extensive planting of vineyards and orchards, and gardens." See also Scheidel (2002), 83.

[9] Bagnall (1985), 297. Monson (forthcoming) has convincingly dismantled this long-standing assumption.

endorheic lake that retained water (and apparently fish) year-round. The agro-environmental characteristics and limitations of the Fayyūm as a whole are to a certain extent reflected in this mini-depression. I can say less of the Polemon than the other two regions due to the limits of the sources. Nonetheless, it will be clear that they were sufficiently distinct to warrant inclusion as separate subregions.

4.2: THE BAḤR YŪSUF AND THE FAYYŪM'S WATER SUPPLY

4.2.1: Al-Lāhūn and the Yearly Flood

Ancient Ptolemais Hormou, now al-Lāhūn, lies at the entrance to the Fayyūm depression, the choke point on the Baḥr Yūsuf (the "Henet of Moeris" in Egyptian and the *diōryx Argaitidos* in Greek) at which water movement into the depression is controlled.[10] Although the town is located at the central hub of the irrigation system, it technically lay outside the borders of the Fayyūm proper. According to al-Nābulusī its own land and that of some nearby fields dubbed Umm an-Nakhārīr were irrigated like "the countryside,"—i.e. only during the time of the flood—"without irrigating the land (*saqy*) in the manner of the Fayyūm." This water supported only a small amount of grain production in the village.[11]

The precise functionality of the dam or barrage at al-Lāhūn is key to my arguments about the water supply to the premodern Fayyūm. While the more permeable modern structure regulates a perennial water flow through its gates and into the depression, before the late 19th century the dam instead functioned rather like a large seawall that could be open and shut as needed. In his contribution to the *Description de l'Égypte* P.D. Martin refers to the dam's early 19th century incarnation as simply "a dyke that retains the waters carried by the grand canal [Baḥr Yūsuf]."[12] The medieval Arabic sources similarly concur that the purpose of this dam or barrage was to allow water into the Fayyūm, retain it, and simultaneously allow dangerously high floods to escape back into the Nile.[13] Still, these same texts make clear that there had been some change over time in the design of the structure, even though its fundamental nature remained unchanged. The writer al-Masʿūdī (d. 956) describes a system of openings that allowed water to pass through the structure.[14] The later author al-Muqaddasī (d. 985) says that water simply overflowed the dam when the flood was high enough, allowing boats to sail

[10] See Vandorpe (2004) for discussion of the identification of the Yūsuf with the ancient Henet.
[11] *TF* 52-3.
[12] P.D. Martin, "Description hydrographique des provinces de Beny-Soueyf et du Fayoum," *Description de l'Égypte, État Moderne* Vol. 2.1, 204-5.
[13] Rapoport and Shahar (2012), 6, from which the following discussion and references to the Arabic sources are drawn. See the article for detailed citations of the texts discussing the al-Lāhūn barrage. It seems that the very simple seawall-like dam or barrage was high enough to retain all the water the Fayyūm required, yet simultaneously low enough to allow the excess to overtop it as the river receded. This seems to be the thrust of Murtaḍā ibn al-Khafīf's late 12th or early 13th century description: "they raised the bank of Lahūn, that it might retain as much water as they stood in need of." At page 194 of the English translation, for which see above, chapter one, page 31 with note 81.
[14] Citing Al-Masʿūdī, *Murūj al-dhahab wa-maʿādin al-jawhar* (*Meadows of Gold and Mines of Gems*), ed. Ch. Pellat (Beirut: al-Jāmiʿa al-Lubnāniyya, 1965-79). The text is a world history from Adam and Eve through the ʿAbbasid Caliphate.

directly over the top.[15] When the Fayyūm had received enough water, excess could be released through a system of pipes at its foundation.

In 1301 the writer Abū Iṣḥāq describes two openings in the barrage, one at its southern end and another on its north, which were opened to the flood. The southern opening was sufficiently deep and broad to allow boats to pass through. Al-Nābulusī's fourth chapter offers a similar description of the dam and its operation in the mid 13th century. He too states that boats could pass through the large opening during the flood, adding that they used the opening to avoid the unnecessary risk of bottoming out in an attempt to pass directly over the barrage when the river was high enough to overtop it. When the Nile began to recede, this opening had to be closed in order to retain the floodwaters that had passed through into the depression:

> [W]hen the Nile recedes...the "piece" (*qiṭ'a*) is installed at al-Lāhūn. . . . the "piece" is a long palm log to which straw and rags are fixed. These are tied up with ropes, so that it becomes very thick. The strong ropes are at its edge, and the ends of the ropes are in the hands of a large group of men on the bank adjacent to the small village called al-Lāhūn, and on the opposite bank. They release the ropes little by little, while the water carries the piece and pulls it toward the opening ....releasing it little by little, until it comes to the mouth of the opening and blocks it and thereby prevents the water from escaping. Then the men pile soil and clay on it so that it resembles the bank adjacent to the structure, so much so that a person may cross over the dam from al-Lāhūn to the bank of [the village of] Qāy just as he would proceed on the same bank. The purpose of blocking the opening is that the water that is escaping through it would be available for the villages of the Fayyum. This occurs at the time when the Nile still reaches it, and before its flow stops at the opening of al-Munhā [i.e. Baḥr Yūsuf], *which becomes dry each year as I have described* (emphasis added).[16]

There are two key elements here. First and most importantly, water did not enter the Fayyūm at any time other than the flood as it does today: the force of the flood bore water into the depression, after which its flow subsided and ceased to pass through the Lāhūn gap. In fact, Herodotus had long before commented upon the seasonality of Fayyūm hydrology, writing that "for six months the water flows into the lake [Moeris], and for six months out into the Nile again."[17] Murtaḍā ibn al-Khafīf's late 12th or early 13th century *Egyptian History* makes the same claim, stating that "the water overflowed al-Fayyūm from the Munhā [Baḥr Yūsuf] when the Nile was at the highest; and when it was very low, the water ebbed from al-Fayyūm."[18] Secondly, al-Nābulusī states that the Baḥr Yūsuf/al-Munhā was wholly dry during a portion of the year, its flow eventually halting at "the opening of al-Munhā" where the Yūsuf splits from the Nile to the south at Dairūt.[19] That is, prior to the introduction of perennial irrigation in the late 19th century the Baḥr Yūsuf, now flowing year-round, was a seasonal canal. The English

[15] Citing the author's geography of the Islamic world *Kitāb aḥsan al-taqāsīm fī ma'rifat al-āqālīm* (*The Best Divisions for the Knowledge of the Regions*).

[16] Combining the translations of Rapoport and Shahar (2012) at 8 with their draft translation of al-Nābulusī's *Tārīkh*. This alternate name Munhā for the Baḥr Yūsuf seems to refer to the canal prior to its entry into the Fayyūm. Rapoport and Shhar read the Arabic منهى in al-Nābulusī as Munhā, rather than the Manhī, which appears in early Anglicizations of the word. I defer to their expertise.

[17] II.149: καὶ ἓξ μὲν μῆνας ἔσω ῥέει ἐς τὴν λίμνην, ἓξ δὲ μῆνας ἔξω ἐς τὸν Νεῖλον αὖτις.

[18] Modified from page 193 of the 17th century English translation to remove archaisms of print and spelling.

[19] *TF* 12.

writer James Augustus St. John, who visited Egypt and Nubia in 1832-4 (before perennial irrigation), has left us a clear description of the Baḥr Yūsuf during the summer:[20]

> By [a local farmer's] aid we traversed the bed of the great arm of the Bahr Yūsuf, by which, at the season of the inundation, the waters of the Nile are conducted into Lake Moeris, and diffused in innumerable smaller streams all over the province, which they fertilize and beautify. In several parts of the channel, now dry, we observed immense quantities of oyster-shells, bright and shining like mother of pearl.[21]

But the channel was not completely desiccated along its entire route, for St. John later describes it as "a chain of small shallow ponds, in many cases miles asunder."[22] This agrees with a comment by Willcocks that prior to the construction of the massive Ibrāhīmīya Canal, the Baḥr Yūsuf received only a small amount of seepage from the Nile during the summer (likely pooling at low points to form St. John's "chain of small shallow ponds").[23] Completed in 1873, the Ibrāhīmīya began to supply the Baḥr Yūsuf perennially by drawing directly from the Nile at Asyūṭ and connecting with it at Dairūt, some 55 km to the northwest.[24] Here the Ibrāhīmīya feeds the natural channel of the Baḥr Yūsuf then continues northward parallel to the Nile. Yet even after the completion of this canal, the summer flow of the Baḥr Yūsuf was still negligible and summer cultivation in along its southerly stretches was strictly prohibited in order to reserve the whole of its meager flow for the Fayyūm. But the weak summer discharge of 17 m^3 per second increased fifty times over to 850 m^3 during the flood, raising the water level a full 4.5 meters.

In short, the premodern Fayyūm simply could not have made use of any water in the bed of the Baḥr Yūsuf in the low water season. Firstly, its contents seem to have been minimal and largely stagnant. Yet more importantly, any water that managed to trickle along its bed would eventually be faced with an impassable object: the bed of the canal at the Lāhūn gap was simply too high to receive Nile water at any time other than the flood.[25]

Since water would not again flow through the Baḥr Yūsuf until the next flood, the communal labor of the men of al-Lāhūn was vital. They had to quickly replace the palm log block and waterproof the entire structure with clay in order to retain the water that had entered the depression at the height of the flood.[26] If the block was not replaced in time or was done so incompetently, precious and irreplaceable water would surely escape during the flood's recession. At least superficially, then, the premodern Fayyūm resembles a colossal inundation basin: like the basins of the valley it was opened to the flood and then sealed to prevent the escape of water. Of course, instead of flooding the whole area the water retained by the dam at

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[20] On St. John see his biographical entry in the Oxford Database of National Biography, online at http://www.oxforddnb.com/. Accessed February 22, 2012.

[21] *Egypt and Nubia* (Bradbury and Evans: London, 1845), 182. He surely refers here to the equatorial African freshwater mussel *Etheria elliptica*, native to the Nile and other freshwater systems in the region.

[22] *ibid.* 192

[23] Willcocks and Craig (1913), 305

[24] See Brown's (1887) discussion of the contemporary Baḥr Yūsuf. He briefly discusses the Ibrāhīmīya, noting that since its construction, the Yūsuf has been provided with a perennial flow for the first time.

[25] See Barois (1887) at 41-2 for the discharge levels and the relative height of the Baḥr.Yūsuf's bed at the Lāhūn gap.

[26] Rapoport and Shahar (2012) stress the local nature of the labor in this period. The work on the Baḥr Yūsuf was not compelled nor organized by a higher authority.

al-Lāhūn was conducted by canals to the various parts of the nome, where it immediately irrigated fields or was stored reservoirs for use later in the year.

4.2.2: The Semi-Perennial Center

While the inundation was the primary and most important water source, I mentioned above that the water supply in the lowest portions of the Fayyūm was supplemented by the depression's natural tendency towards waterlogging, perennial marshiness (and likely endemic malaria).[27] Farmers could draw upon this brackish Nile seepage year-round when it rose to the surface in the bottoms of canals.[28] Al-Nābulusī comments extensively on this feature of local hydrology, claiming that the Fayyūm has been called the lowest place on earth: "indeed, the highest point in it to which its water can rise is lower than the level of the surface of the Nile at its minimum ebb. Were it not so, its waters would not flow in it."[29] Well out of the reach, that is to say, of the higher altitude marginal villages.

According to al-Nābulusī, a low level of seepage water was always available in the Fayyūm's lowest reaches:

> I say - may God grant success - there are breaches in the bed of al-Manhā Canal and in the lower parts of its banks at numerous locations, that are fed by an underground source from which water seeps. This is because its level is below the level of the blessed Nile. It is part of its ingenious design that whenever waters are drawn through the aforementioned openings in towards the lands of the villages of the Fayyūm, its cultivated fields, gardens, trees and sugar plantations and by means of waterwheels, and thereby decreasing the water level, the seepage immediately substitutes for it, mixing with what was obtained from the Nile's water. This is always and forever like that.[30]

Willcocks also commented on the minor amount of perennial irrigation permitted by this seepage, which only increased after the Ibrāhīmīya canal began to carry more water to the vicinity year round.[31] Limited in quantity and restricted to the lowest portions of the nome, seepage water could not support a depression-side summer crop.[32] Figures from 1892, well before the completion of Aswān Low Dam, are illustrative: only 60,000 feddans at maximum (62,280 acres) were cultivated during the summer months compared to nearly 280,800 feddans (291,470 acres) during the winter, a nearly 60% drop in acreage.[33] Of course, these figures still date to nearly twenty years after the Ibrāhīmīya canal began to bring a small amount of perennial

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[27] For malaria in the Fayyūm see Scheidel (2002), 84ff. In his second chapter al-Nābulsī uncharitably describes the character of the people of the Fayyūm, blaming their sluggishness upon the water and noting that foreigners who take up residence in the area soon become like the natives. E.g.: "Decay becomes common in the places where they dwell, as moisture dominates there, so putrefaction circulates with the air they inhale, which affects the innate heat (*al-ḥarāra al-gharīziya*) and the vital pneuma, and disturbs them. Their black bile increases, and the dissolving vapors grow thick, linger, decrease (*taqillu*), and accumulate in their bodies because of their lack of movement" (trans. Rapoport and Shahar). As Scheidel notes, the whole of the description in Al-Nābulusī's second chapter surely reflects the general symptoms of endemic malaria within the marshy central portion of the depression.

[28] Even with the high modern water table, the border village archaeological sites are still largely desert, although patches of salt, waterlogging and scattered vegetation do appear. In the premodern period, however, their altitude placed them well out of reach of subsurface Nile seepage. E.g. Bakchias ranges from 17-23 masl, above the surface of the river directly parallel to the site (15 masl). Other sites are much lower though they remain considerably elevated in comparison to the central villages.

[29] *TF* 9.

[30] *TF* 9.

[31] Willcocks and Craig (1913), 388.

[32] Johnson (1936), 10-11.

[33] Hanbury-Brown (1892), 17.

irrigation water into the Fayyūm, supplementing the naturally occurring water. In the premodern period, summer productivity would have depended entirely on this seepage and the disparity between winter and summer crops must have been greater. Indeed, Justin Ross wrote in 1893 that "the natural supply [of water in the Fayyūm] is not capable of irrigating more than one-fifth of the cultivated area in summer."[34] A total cultivated area, that is, that even at its greatest extent still represented a much smaller Fayyūm than in antiquity.[35]

This constant low-level marshiness helps to contextualize the third chapter of al-Nābulusī's survey, a bitter if amusing diatribe against the Fayyūm's climate and water. He complains that the depth of the Fayyūm inhibits air circulation and that the air itself is befouled by contamination by "the putridities arising from its water." This "extremely vile" seepage was not of sufficient quantity to flow swiftly through the canals and remained rather stagnant:

> All of [the Fayyūm] consists of stagnant shallow water or a swamp, while the Nile's water has been condemned, despite having the good qualities previously mentioned, merely for passing through the likes of it...This seepage contains notorious foulness, which we cannot describe here for the sake of brevity. It is so vile because it is mixed with grains of earth, turning it into a swamp. This has led one witty man to describe it as "the earth passing water", and another described it as urine dripping from a bladder.[36]

He further compares the consumption of Fayyūm's water to the drinking of poison, particularly for those at the tail end of the Baḥr Yūsuf who "are in a state of undeniable suffering and complete humiliation, as they use sheer filth and deadly poisons." They are left, he claims, with only the "abundant foul matters and corpses thrown into it from the two banks, continuously and endlessly, [which] mixes with the scant water of the canal."[37] Surely by the point just before the next flood, the available water was thoroughly unappealing (at least to al-Nābulusī's discriminating palate), and in dire need of refreshment.

Once the flood had mercifully arrived and cleared the barrage at al-Lāhūn, its waters were apportioned to separate sub-canals. We are largely ignorant of the premodern infrastructure that served this purpose though there appears, expectedly, to have been change over time. Unfortunately, al-Nābulusī omits any discussion of the partition of the Baḥr Yūsuf from his treatise. He simply states that the canal runs through the capital city Medīnat al-Fayyūm and thence to the villages. In the early 19th century M.P.S. Girard's contribution to the *Description de l'Égypte* mentions a "bassin irrégulier" situated somewhere between the modern capital and the ruins of ancient Arsinoe that served as a "réservoir commun" from which the Baḥr Yūsuf 's waters were distributed to the rest of the villages, though he offers no further description of the structure or its operation.[38]

In this case, the papyri are of some help, testifying to sluice-gate structures that initially divided the Baḥr Yūsuf's flow. Twenty three 1st-2nd century CE certificates verifying individual participation in the annual work of canal maintenance (so-called *penthēmeros* receipts) recovered from multiple villages throughout the Fayyūm refer to labor on a "six-gated sluice"

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[34] Ross (1893), 184. If the total winter area had covered the 280,000 feddans, a one-fifth summer crop is some 56,160 feddans.

[35] Compare the contemporary cultivated areas of some 1609 km^2 (about 383,305 feddans. 1 feddan = 4200 m^2), a 27% increase. First figure from Ali (2005), 390.

[36] *TF* 10.

[37] *TF* 10-11.

[38] M.P.S. Girard, "Memoire sur l'agriculture, l'industrie et le commerce de l'Égypte," *D. de l'É.* Vol. II.1, *État Moderne*, 498.

(*heaxathyros*), whose location is usually unspecified. It was hypothesized that this *hexathyros* might refer to an important, central structure at Ptolemais Hormou since the receipts indicate that laborers were drawn from throughout the nome to work on it. Further, save for one odd standout[39] all the texts date from the period during which the river is at its lowest ebb, the months of Pachōn, Pauni and Mesorē, seventeen of them from Pauni alone.[40] The recent publication of *P.Sijp*. 42b (170 CE) has confirmed this hypothesis since the text records the completion of work on the *hexathyros Ptolemaidos Hormou*.[41] It was surely this structure that began to divide the floodwaters of the Baḥr Yūsuf into the various canals explored below.

4.3: The Eastern and Western Margins

4.3.1: Seasonality and Scarcity

The largest and longest waterways (Arabic *baḥr*) branching from the central inlet were the three desert border canals, which fed the marginal settlements from which papyri survive. The contemporary border canals follow much the same paths as their ancient counterparts, running along the shallowly graded terrain of the desert margins. The modern Baḥr ʻAbdallah Waḥbī is the first to separate from the Baḥr Yūsuf, breaking away just under 8 km from the inlet at al-Lāhūn and following the curve of the Fayyūm's 'stem' before bending sharply to the east to trace a path along its eastern edge. With an elevation of 28 masl at Hawāra the route of the canal reaches only 12 masl along the Waḥbī opposite the site of ancient Bakhias, a path of roughly 50 km with an average gradient of a mere 3.2%.[42] In antiquity, this eastern canal was known by several names, among them the "canal of Kleon" (*diōryx Kleōnos*), the "great canal" (*megalē diōryx*), and the "desert canal" (*oreinē diōryx*).[43] Although the precise route of the canal has been all but lost, Brian Kraemer has reconstructed a plausible path from the few remaining sections as well as evidence from 19th century photography and modern satellite imagery. After it branched from the Baḥr Yūsuf /Henet of Moeris at Hawara, the ancient desert canal followed a route much the same as the modern ʻAbdallah Waḥbī.[44]

Unfortunately, we do not know where the *diōryx Psinaleitidos*, the ancient counterpart to the modern Baḥr al-Nezla, broke away from the Yūsuf. The Baḥr al-Nezla is no longer even fed directly by the Baḥr Yūsuf, but rather by the modern Hasan Wāṣif intake. It is somewhat longer than the Waḥbī, with a ca. 4.6% grade over a ca. 60 km course that takes it well beyond the site of Dionysias/Qaṣr Qārūn, which was the last stop in the ancient canal system. Al-Nābulsī refers to this then-abandoned canal as the Baḥr Tanabṭawiyya and indeed claims that its route terminated in the lake near Qaṣr Qārūn. The site of Dionysias was merely one of twenty-one deserted villages al-Nābulsī locates along its route, three others—Burjtūt, Badrīs, and Aqnā—additionally identifiable as ancient toponyms.[45]

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[39] *PSI* XV 1519 (41-54 CE). Work from 15-19 Tybi.

[40] For the *hexathyros* texts see Pearl (1951). Of the 23 receipts appearing in the DDBDP fully 17 date from the month of Pauni in the middle of the low-Nile season. The preserved receipts show work upon the *hexathyros* is performed by laborers from Theadelphia, Narmouthis, Tebtunis, Soknopaious Nēsos and Karanis.

[41] ἐξ̣α̣θ̣[(ύρᾳ) Πτ]ο̣λε(μαίδος) Ὅρ[μ]ο̣υ (l. 6).

[42] Altitudes obtained from Google Earth.

[43] Kraemer (2010), 367

[44] See the figure in Kraemer (2010) at 373.

[45] Perkethaut/Philagris, Patres and Kna. See the relevant entries in the Themistos section of the topographical appendix. Another of the deserted sites in this list, Sanhūris, bears resemblance to both ancient Psineuris and Psenyris though cannot be identified with either. Cf. the relevant entries.

Fig. 13: The modern Baḥr ʿAbdallah Waḥbī at the site of Hawara. Photo: B. Haug, November 24, 2011.

The eastern canal was similarly deserted and silted in the 13th century and known to al-Nābulsī as the Baḥr Wardān, though only two of its abandoned villages are immediately identifiable with ancient settlements (Samaṣtūs/Psimistous and Umm al-Atl/Bakchias).[46] It is unknown when this eastern canal finally went completely out of use. It appears that the head of the ancient *diōryx* traced a path around Hawara 200-300 meters to the west of the site, bypassing the Labyrinth—the great temple and mortuary complex of Amenemhat III (1842-1797 BCE at

[46] *TF* 18. There may be a problem with Nābulusī's and thus Kraemer's topography here. Al-Nābulusī thought that the Fayyūm was at one time encircled by the Baḥr Wardān and the Baḥr Tanaḅtawiyya, the two eventually meeting somewhere in the northwest (Yossef Rapoport, pers. comm. Feb. 8, 2011). This is mistaken and we cannot regard all of the deserted villages listed by al-Nābulusī "along" the Wardān as having actually been watered by the Wardān/*oreinē diōryx* and thus adversely affected by the latter's failure. Kraemer claims that the list of deserted villages in *TF* 18 includes Dima/Soknopaiou Nesos and (Kom) Aushim/Karanis. The latter is definitely mistaken. Kraemer lists the fourth deserted site in the list as "Washīm," interpreting this as a variant of (Kōm) Aushīm, citing Shafei (1939) in general. This may refer to Shafei at 296 (118 of the reprint) where he transliterates this list, including "Washeem." Still, Kōm Aushīm appears in the map at the end of Brown (1892) as Kōm Washīm. Boak (1926b) at 215 similarly refers to the village as "Kōm Aushīm or Washīm." The pronunciation *au-* may be a more contemporary development. Nonetheless, to read *washīm* in the Arabic MS of the *TF* is mistaken. The supposed initial *wau* of *Washīm* is clearly *wa*, the Arabic conjunction "and." Each village after the first in the series is preceded by *wa* since Arabic grammar requires its repetition in lists. For "Washīm" to be read we would need *wa-Washīm* (ووشيم), "and Washīm". The text of Nābulusī most commonly used also contains a misprint, reading وشبم (*wa-Shabam*). وشيم is the correct reading as evident in a Hagia Sophia MS (image provided by Ido Shahar, pers. comm., Feb. 10, 2011). As for "Dima," the text in fact reads دميه (*dmya*), which James Keenan has transliterated as Damīyah and Yossef Rapoport as Damya. Still, considering Nābulusī's topographical errors this could in theory be a legitimate reference to Soknopaiou Nesos. If so, it nonetheless remains incorrect to regard the village as having been watered by the Baḥr Wardān/desert canal.

Hawara—while the medieval canal (the Baḥr Sharqiya or Baḥr Sayla) and the modern ʻAbdallah Waḥbī cut directly through the site (as it was no longer of religious significance).[47] The ancient course of the canal would have placed it in dangerously close proximity to the main eastern drain, the Maṣraf al-Baṭs ravine, requiring a sharp bend at the southwest to circumnavigate the site. Kraemer suggests that this situation may have created a weak point at which the canal was liable to burst its banks during a high flood. Any damage at this point would have shunted most of the flow into the ravine and left the canal-dependent communities to the north dry for the year. The construction of the later Baḥr Sharqiya which replaced the ancient *oreinē diōryx* cannot at present be dated more specifically than the 6th-13th centuries but its routing through Hawara was a significant undertaking requiring the "removal of mud-brick remains, compacted stone debris from the remains of the Labyrinth, and a significant amount of limestone bedrock."[48] By the time of its completion the northeast of the Fayyūm may well have been water-starved (or already abandoned) for many years and its population dispersed into the more reliably irrigated villages of the interior.

Fig. 14: The much-damaged remains of the border canal at Bakchias (Umm al-Atl) in the northeastern Fayyūm. The high modern water table allows vegetation to grow in the bed of the ancient canal, the lowest portions of the site.

Whether the canal ever suffered such a serious breach cannot now, if ever, be known. As argued in the first chapter, we should be skeptical of attempts pin Fayyūm landscape change upon massive failures and poor management. Regardless, even when these border canals were

[47] On the Labyrinth in general, see Inge Uytterhoeven and Ingrid Blom-Böer, "New Light on the Egyptian Labyrinth: Evidence of a Survey at Hawara," *Journal of Egyptian Archaeology* 88 (2002), 111-20.
[48] Kraemer (2010), 371

fully functional, they contained water only during the flood, even during the early period. This is made clear in a fragmentary letter to Zenon published as *P.Cair.Zen*. I 59072 (257 BCE). The letter is dated to the 29th of Pharmouthi, the final month of the growing season and thus just prior to the harvest, the period of the Nile's lowest ebb. Although the specifics are lost, the writer indicates that water is to be brought to Philadelphia from its southerly neighbor Tanis in order to irrigate some young olive trees. Clearly, insufficient water was available in Philadelphia at this time of the year to establish these fragile and thirsty young plants.[49]

While completely or at least largely empty before the flood, the border canals received a major seasonal influx during the inundation, the "season of the waters" (*kairon tōn hydatōn*) in the words of Aurelius Sakaon.[50] This is made equally explicit in a text of the Heroninos archive, *SB* VI 9361 (252 or 255 CE), in which Appianus orders Heroninos to drag some tree trunks in from the fields "before the waters."[51] A Philadelphian papyrus, *P.Wisc.* I 32 (305 CE), similarly comments upon preparations for the coming inundation. Here, the *kōmarchai* of Philadelphia pen a petition the *stratēgos* of the Arsinoite. They freely admit their village's longstanding debt to the treasury but lay the blame squarely upon their upstream *rivalis*, the village of Tanis.[52] The *kōmarchai* request that the *stratēgos* order the inspection of stone *rhithrōn* (presumably canals) in Tanis so that the Philadelphians might "be able to enjoy the rising (*parochē*) of the Nile, have drinking water (*potimon hydōr*), sow the plain of our village, remain in our own territory, and have enjoyment of our property." Notably, the petition is dated to the 1st of Pachon, the first month of the harvest and roughly four months from the beginning of the inundation. The authors likely hoped to ensure that any necessary repairs would be accomplished during the remaining months of the low-water season in advance of the flood.

Since water was not perennially available on the margins, the fields of border villages were consequently designed for seasonal basin irrigation. Fields were embanked by means of ring dykes (*perichōmata*), which transformed each plot into a self-contained mini-inundation basin.[53] These ring dykes are mentioned with great frequentcy in Fayyūm land leases in the clauses that enumerate the duties of the lessee.[54] In these texts, the act of irrigation (*potismos*) is very often paired with the duty to maintain the dykes surrounding the fields (*chōmatismos* or *perichōmatismos*) and occasionally the construction of *emblēmata.*[55] These *emblēmata*

[49] From ll. 3-5: ἐγράψαμεν οὖν σοι [----] / [----]αι τὰ ἐλάινα φυτὰ ζω[οφ]υ̣τοῦντα̣ πάντα ποτίζο̣μ̣[εν ------]/ [-----] τὸ ὕδωρ φέροντες ἐκ Τάνι[ο]ς.

[50] *P.Sakaon* 45 (334 CE), 5: [. . . . τ]ὸν̣ κ̣αι̣ρ̣ὸν̣ τῶν̣ ὑ̣[δάτων . . . .].

[51] ll. 6-8: ποίησον οὖν αὐτὰ πρὸ τῶν ὑδάτωνεἰς κώμην συρῆσαι. Cited in Rathbone (1991), 221.

[52] From ll. 7-10: "Best of the *stratēgoi*, we inhabit our village long indebted to the most sacred treasury, not indeed because of our village but in fact because of the part of Tanis" (στρατηγῶν̣ ἄριστε, μακρόθεν τυγχά[νο]μεν κατοικοῦντες τ̣ὴν ἡμέτερα̣ν κώμην, πάμπολλα δὲ χρέως [ἔχο]ν̣τ̣ες τῷ̣ ἱερωτάτῳ ταμιείῳ ὑπὲρ τῆς ἡμετέρας κώμης οὐ μὴν̣ [ἀλλ]ὰ̣ κ̣αὶ ὑπὲρ μέρους Τάνεως).

[53] See Rathbone (1991), 119-228 for a more detailed look at basin irrigation as it appears in the archive of Heroninos.

[54] Customary duties other than those specified in the texts are simply referred to as *ta alla panta hosa kathēkei* in *P.Cairo Isid*. 101 (300 CE), *P.Gen*. I 78 (3rd CE?); *ta alla hosa kathēkei: P.Tebt.* II 378 (CE 265) and *SB* VI 9269 (297 CE) .

[55] A representative formulation from *P.Tebt.* I 106 (101 BCE): τοὺς καθή]κοντας χωματισμοὺς καὶ ποτεισμοὺς ἐπιτελείτωι (*pap.* l. ἐπιτελείτω). The (*peri*)*chōmatismous—potismous* pairing appears in numerous other texts throughout antiquity. See e.g. *SB* XVI 13017 (24 BCE), *P.Mich.* XII 633 (30? CE), *P.Tebt.* II 378 (265 CE). The version *perichōmatismos* appears later, all seven instances dating to the late 3rd or early 4th century CE. Of the seven, six appear in land leases. In an earlier lease published as *P.Tebt.* I 105 (103 BCE) the lessee is to return the land to the lessor free of rushes and weeds as well as fully embanked (l. 27: *kechōmatismenēn*).

("transverse dykes") temporary halted the downstream flow of water so that it could be diverted from a feeder canal and directed to a nearby field.[56] That the margins of the Fayyūm were originally designed for such once-yearly inundation rather than perennial water is evident in some of the earliest Ptolemaic papyri. The gift-estate of the *dioikētēs* Apollonios managed by Zenon at Philadelphia appears to have been organized in this fashion. An important papyrus, *P.Lille* I 1 (258 BCE), preserves an illustration of a massive 10,000 aroura field on the estate subdivided into forty smaller basins of 250 arouras each, also called *perichōmata.*[57]

But the floodwaters that annually irrigated the margins did not always arrive in force and quantity. A papyrus of the Heroninos archive from Theadelphia in the west attests to the slow, inefficient delivery of water via the *diōryx Psinaleitidos*. *P.Prag.Varcl* II 52 is an undated letter whose recipient and sender are both lost, though Dominic Rathbone suggests that the sender is Alypios, the general manager of the Appianus estate in the Fayyūm, and the recipient a *phrontistēs*, or the manager of an estate parcel, perhaps Heroninos himself. The sender informs the recipient that one Kopres had been instructed to install an *emblēma* in a canal for a single day. Kopres was afterward to remove the *emblēma* and release the water downstream (*apolythēnai*) so that in five days it will reach olive trees (*elaiōnas*) elsewhere, possibly Euhemeria or Dionysias, Theadelphia's downstream neighbors. That it should take a full day for a farmer at Theadelphia to build up a head of water sufficient to irrigate and another five days for the water to reach Dionysias (ca. 15 km) let alone Euhemeria (ca. 4.5 km) is clear indication that there was very little water in the canal to begin with by the time it had reached Theadelphia.[58] Another letter from the archive, *P.Flor.* II 153 (257 CE), similarly indicates a limited water supply during the flood. Here, Alypios orders the *phrontistēs* Heroninos to "make provision for waterwheels (lit. axles, *axonōn*) so that, until the canals do not have water [i.e. run dry], there is a supply sufficient for our use."[59] It should be noted that both texts come from a period in which the estate of Aurelius Appianus was investing considerable capital to maintain and improve the canal system at Theadelphia.[60]

But it is a short, simple letter from Euhemeria (*P.Fay.* 131 of the 3rd to early 4th CE) that offers the most matter-of-fact testimony to water scarcity along the margins. After mentioning the sale of some barley, the writer simply instructs the recipient Sarapion: "If the water comes down, make every exertion until the basin (*hydrostasion*) is full, but by all means water the vegetables of our friend Decasius. If you are not irrigating, do not let the oxen be idle."[61] The Euhemerian farmer is thus compelled to be cautious and use carefully whatever water, if any, he receives. Fragile vegetables must be watered and anything left over is to be banked in a reservoir. But if the water fails to arrive, he has other tasks.

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[56] For the term, see Bonneau (1993), 39-44.

[57] Thompson (1999a), 111.

[58] In both cases, the water would have to be travelling at speeds well under one km per hour.

[59] ll. 7-13: φροντίδα δὲ ποίησαι καὶ ἀξόνων ἵνα ἕως αἱ διώρυγες ὕδωρ μὴ ἔχουσιν προβολὴ ἡ αὐτάρκ[ης] ἡμῖν τῇ ὑπηρε[σ]ίᾳ γένεται. Cited from Rathbone (1991), 224.

[60] On irrigation and the estate at Theadelphia see Rathbone (1991), 219-28, from which I have drawn the reference to *P.Prag.Varcl* II 52. Distances above estimated in Google Earth.

[61] At ll. 9-16: ἐ[ὰ]ν τὸ ὕδωρ κατέλθῃ πάσῃ προθυμίᾳ χρῆσαι ἔστ' ἂν τὸ ὑδροστάσιον γεμισθῇ, ἀλλὰ πάντως τὸ Δεκασίου τοῦ φίλου λάχανον πάντως πότισον. ἐα (*pap.* l. ἐὰν) μὴ ᾖς ποτίσας, τὰ ταυρκὰ (*pap.* l. ταυρικὰ) μὴ ἀργείτω (*pap.* l. ἀργείτωι).

Along the eastern and western desert borders, then, irrigation was an annual phenomenon and even then not guaranteed.[62] The very gentle slope of the terrain presented a significant obstacle to reliable water delivery, a problem that would have been compounded by conveyance loss (evaporation and seepage) during the water's long and meandering journey along the desert's edge. While I have not found comparable evidence in the papyri, conveyance loss was a recognized phenomenon in the 13th century. In his description of village water rights, al-Nābulusī records that access to water was controlled by the width of the opening in the weir that channeled water from a feeder to canal to smaller village canals. These openings were measured in a unit called the *qabḍa*, literally a "fist length."[63] The wider the opening in the weir, the more water would flow from the feeder canal into the village. Rapoport and Shahar demonstrate that as distance from the ultimate water source at al-Lāhun increases, so to do the sizes of the weir openings.

This was surely an attempt to compensate for the increasingly reduced flow of the canals over distance but was probably not entirely successful and the villages nearest the medieval Fayyūm's borders remained marginal.[64] Although its location in the far east would put it at least near the course of the eastern Baḥr Sharqīyya, the tiny village of Bandīq, ancient Pantikou ("a meadow with shacks" in al-Nābulusī's words) received water only during the flood ("like *al-Rīf,* not like the Fayyūm") and produced only 15 *ardebs* of wheat and 140 of barley, as well as providing some pasture for livestock.[65] Farther north, the villages of Bayāḍ, Maqtūl and al-Rubayyāt, Shāna and Sayla (ancient Selē) are explicitly said to have shared water from the Sharqīyya, each receiving an allotment of 12 *qabḍa*s save the larger Shāna which received 24 *qabḍa*s. The villages were not highly productive and specialized in wheat, barley, broad beans, and hay, hardly water-intensive crops. The conjoined villages of Maqtūl/al-Rubayyāt are specifically said to be empty of trees or date palms. Additionally, the production ratios of these three villages and Bandīq may indicate some degree of soil salinization or otherwise marginal soils; nearly all of the villages produce more barley than wheat, the former a hardier and more salt-tolerant crop.[66]

A village called Shāna had also recently migrated inward.[67] Al-Nābulusī claims that the primary reason for the shift was an increase in population in "Old Shāna" and the availability of

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[62] Insufficient irrigation was occasionally a problem throughout Egypt and declarations of uninundated lands appear in all regions. For discussion and lists of texts of this type see Claire Préaux, *CE.* 75 (1963), 117ff. and L.C. Youtie and H.C. Youtie, *ZPE* 33 (1979), 193. For Fayyūm texts see, e.g, Euhemeria: *P.Fay.* 33 (163 CE), *SB* V 7528 (170 CE), *P.Stras.* IX 834 (190 CE); Karanis: *BGU* I 198 (163), *P.Ryl.* IV 682 (202? CE).

[63] One *qabḍa* = 1/6 *dhira'* or 15.875 cm. See Rapoport and Shahar's internet resources at http://www.history.qmul.ac.uk/ruralsocietyislam/database/index.html. The word comes from a root *qbḍ* (قبض) meaning to seize or grasp and related *qubḍa* (قبضة) refers to a "handful."

[64] See Rapoport and Shahar (2012) at 14-21 for water allocation in al-Nābulusī's Fayyūm. See chapter five below for a modern Fayyūmī customary practice that attempts to compensate for conveyance loss, which, though widely accepted, does not fully compensate for downstream shortages.

[65] *TF* 80. Al-Nābulusī records a cash revenue from the village of 40 gold dinars, a substantial sum which is entirely incompatible with the minimal production of the village. It is either a mistake or the village indeed produced something of very high value left totally unrecorded. It seems entirely unlikely that Nābulusī would have overlooked productive activity of such substantial monetary value.

[66] Wheat/barley production in *ardebs*: Bayāḍ: 80/1800; Sayla, 833/1666; Maqtūl/al-Rubayyāt, 1400/1400; Shāna, 4000 barley.

[67] The ancient village of Bakchias appears to have made similar movements throughout its history. The site gradually moved inward (north to the south), each major phase of its existence—Ptolemaic, Roman, Coptic—farther south than the last. Pers. comm. Dr. Paola Buzi, Universitá di Bologna, Bakchias (Umm al-Atl), 24 November 2011.

prime lands in the nearby deserted village known as al-Lawāsī. Residents of Shāna began to farm this vacant land and eventually relocated permanently. Yet he also notes that water pressure on old Shāna had increased due to the expansion of sugarcane in the Fayyūm.[68] Perhaps this notoriously thirsty crop had "stolen" water once destined for use in old Shāna forcing the population to seek resources elsewhere. Downstream villages like Shāna—or like Dionysias and Theadelphia, for that matter—would always have been in danger of water shortages due to increases in upstream consumption. If they could not control upstream water use through agreement or management by complaint, they would simply have to endure.

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Even modern technology and perennial irrigation has failed to solve the borders' every problem. Border villages served by the modern Fayyūm's liminal canals still suffer water supply problems and locals cannot rely upon gravity to deliver irrigation water to their fields. As in antiquity, fields lie at a considerable height above the level of the canals and their water must be raised a fair distance.[69] Indeed, the water level of the border canals was so low relative to the level of the surrounding fields in the early 20th century that Barois commented "one can only use their waters for irrigation by means of very powerful [water-] lifting machines."[70]

No differently than in antiquity, the gentle gradient of the marginal canals still inhibits water flow and lateral canalization, which prohibits the use of water-powered undershot waterwheels to raise water from the canals. Although these devices are common in the central Fayyūm where canal flow is of sufficient strength, they are entirely useless on the margins.[71] By contrast, farmers of the modern border regions raise water from the main canals to their fields with animal-powered *sawāqī* or gasoline-powered pumps.[72] Unsurprisingly, it is only here in the liminal regions of the Fayyūm that such machinery is common and required.

[68] *TF* 122-3: "It was also said that among the various reasons for their move was a dearth of water (*qillat al-mā'*), due to the increase in [cultivation of] sugar cane in the Fayyūm." Trans. Rapoport and Shahar.

[69] Naphtali Lewis already recognized this problematic feature of border topography: "Their lands were largely marginal to begin with, and as they were also the most remote as well as the most elevated above the basin floor, the amount of labour required to get the irrigation water to them was disproportionately high": Lewis (1983), 108.

[70] "On ne peut y utiliser leurs eaux pour l'arrosage qu'au moyen de machines élévatoires assez puissantes." Barois (1904), 183-4.

[71] Rathbone (2007), 254. Undershot waterwheels are such a ubiquitous feature of the central Fayyūm that a stylized wheel forms the central design emblem of the Fayyūm Governorate's coat of arms.

[72] DeVeer (1993), 72.

Fig. 15: A modern pump in a high-level field near Tebtunis. Note the height of the field relative to the canal.

It is thus likely that the border regions had a far greater use for animal-powered water lifting devices (Greek *mēchanai*). The nearly nonexistent canal flow seen in *P.Prag.Varcl* II 52 would seem to have made natural basin irrigation next to useless on the Appianus estate in Theadelphia, while *P.Flor.* II 153 clearly shows the estate's heavy investment in water-lifting machinery, an attempt to make the most of the limited, ephemeral water supply. The distinction between these poorly-served border regions and the center is indeed made plain in a circular from the estate's general manager Alypios that differentiates between estate units (*phrontides*) containing *antlētika ktēmata*, vineyards artificially irrigated by waterwheel, and "vineyards of the plain" or the naturally watered regions of the central Fayyūm's alluvial plain (*ta epipeda*).[73]

But the cost of such waterwheels in antiquity was surely prohibitive. Demanding not only a large initial investment for materials (rare or even imported woods,[74] metal and numerous ceramic pots) in addition to professional construction and maintenance, mechanical waterwheels also required one or two beasts of burden to provide power, food and water for the animals, one or more attendants to monitor its progress (although this work could easily be performed by children[75]), a constant supply of replacement parts, and eventually new animals. Indeed, an additional text of the Appianus estate (*P.Prag. Gr*. I 44 recto, ii 1-12) illustrates the expense and effort involved in procuring or maintaining a *sāqiya*, which records 48 days of labor for the manufacture of one 5.5 cubit (2.9 m) component, probably the *tympanon*, a wheel which held and turned the long garland of pots constantly lowered into and raised from the well. Other texts from the archive detail the types of work done by carpenters and their wages, all tasks ranging

[73] *P.Flor.* II 148 (265-6 CE). Cited from Rathbone (2007), 261.

[74] On the local wood resources in Egypt during the premodern period, wood importation, and local use, particularly for the construction and maintenance of irrigation machinery see chapter 3 of Mikhail (2011), 124-69.

[75] "Abdul Hadi...went to his field and started the water-wheel. He waded bare-foot through the mud, opening the runnels to the flowing water; while to guard the wheel, and encourage the blindfold cow if she stood still, he left a small boy, hired for tuppence-halfpenny." From Abdel Rahman al-Sharqawi's 1954 novel *Egyptian Earth* (*Al-Arḍ*). Trans. Desmond Stewart, University of Austin Press, 1990, at 51.

from two to five days of labor, the latter earning the workman twenty drachmas.[76] Single owners of one or more *sawāqī* are thus certain to have been the proprietors of large estates or at least wealthier farmers who could finance the purchase, operation, and maintenance of a *sāqiya* out of their own capital.[77]

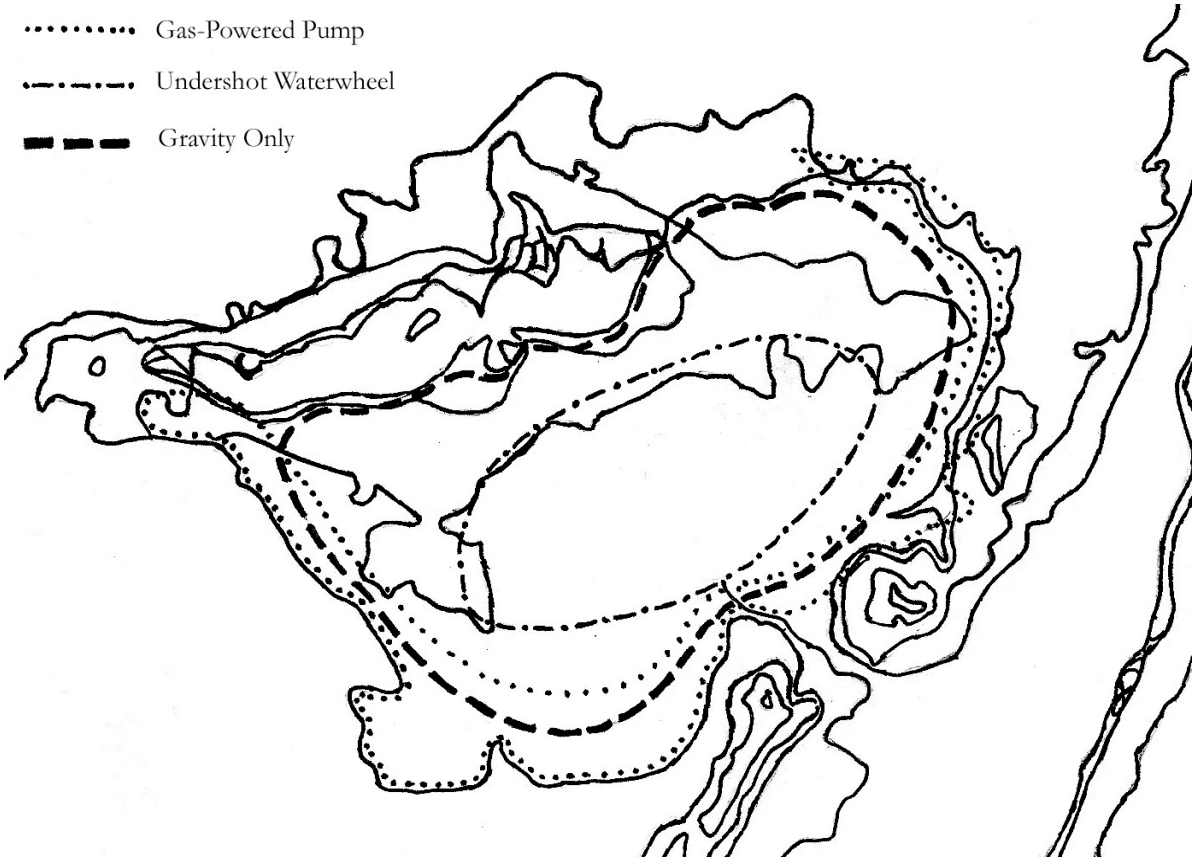

Fig. 16: The extents of various water delivery technologies in the modern Fayyūm. Water-powered undershot wheels are feasible only in the center although gravity can still serve a larger area. Gravity fails on the margins, where pumps and *sawāqī* are widely used. Drawing: Rhys Haug, based upon several images in Price (1993).

4.3.2: Silt Deprivation and Fertility on the Margins

But Egyptian irrigation is about more than water. In addition to irrigating the land the Nile's flood brought soil-replenishing silt deposits to the valley each year. Inadequate irrigation thus entails inadequate fertilization. As noted in chapter three, since the Fayyūm was watered not directly by the Nile but through a smaller subsidiary channel, its water was "not so red—i.e. highly charged with deposits—as the Nile itself."[78] Yet whatever silts were discharged into the large border canals will have failed to reach marginal fields in quantity. Due to the shallow gradients and slow flow of the eastern desert canal and the other major liminal waterways, silt

[76] Rathbone (2007), 256-9.

[77] This does not necessarily preclude cooperative *sāqiya*-groups formed by smaller farmers on the pattern of those in the modern Fayyūm yet I am unaware of any evidence for the phenomenon. Such groups share all the costs of construction, operation and maintenance and may even forgo a traction animal, renting one for several hours at a time from a nearby owner. Price (1993), 284-7. Price notes at 290 that farmers often form gasoline pump-user groups as well, pooling their resources to purchase and operate the machinery.

[78] Ross (1893), 185.

instead settled to the bottoms of the canals and further impeded water flow, becoming an nuisance rather than a benefit.[79] Still, it retained a use: it was removed each year and deposited on the banks of the canal to create embankments that would help ensure against the rupture and overflow of a canal during a particularly high, violent flood. *SB* XVIII 13735 (mid-2nd BCE) straightforwardly describes the process. The document simply states that it is "custom" (*ontos ethismou*) for those served by a canal to "dig out the mud in the canal for the dykes so that the lands are not flooded."[80]

It is vital to remember, however, that although it was useful for flood protection, this silt was lost to the Fayyūm's fields and unable to contribute to their continued fertility. As I have shown in the preceding chapter, the border regions contain the depression's poorest soils, an indicator that they had been long deprived of fertility replenishment in addition to water. This does not mean that ancient farmers could do nothing to supplement their fields' fertility. Indeed, the commonness of dovecotes for manure collection amongst the archaeological remains of Karanis was noted long ago.[81] Pigeon dung and other manure, as well as silt from the canals, could be transported manually to fields and spread by hand.[82] A concern for manuring is clearly evinced in the first-second century CE Gemellus archive from Euhemeria *P.Fay* 118 (110 CE), for instance, references the transport of manure (*koprēgein*) to Pseonnophris (mod. Sanūfar).[83] Several texts from Theadelphia preserve references to these tasks. *P.Col.* X 255 (131 CE) is the most informative surviving papyrus and records a contract between a herdsman of Theadelphia and an Alexandrian to transport dung and canal mud (*koprēgian kai ammēgeian*) to a vineyard in the village. The herdsman agrees to make six dung-carrying runs and eight mud-carrying runs.[84] A sublease of a Theadelphian vineyard, *P.Berl.Leihg*. I 23 (252 CE) similarly references these tasks as part of the duties of the lessees,[85] while two papyri of the Heroninos archive similarly reference the fertilization of the estates *ktēmata* in the village.[86] Border farmers in antiquity were thus compelled at times to supplement manually what the canals failed to provide.

After the construction of modern dams the problem of reduced soil fertility manifested itself rapidly, requiring the use of massive amounts of artificial fertilizers annually.[87] Although

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[79] So Bagnall (1993), 144 at n. 39. The total siltation of the border canals reported by al-Nābulusī was the eventual result of the abandonment of these regions and the concurrent end to annual silt clearance.

[80] Lines 3-10: ὄντος ἐθιζμοῦ (*pap.* l. ἐθισμοῦ) ἔτι ἄνωθεν τοὺς ὑποκειμένους κλήρους καὶ τὰς ἄλλας γᾶς τῇ φερούσῃ ἐκ τοῦ Ἀττίνου Εἰσιήου διώρυγι ἥ ἐστιν ποτίστρα, τούτους δὲ ἀνασκάπτιν (*pap.* l. ἀνασκάπτειν) τὸν ἐν τῇ διώρυγι χοῦν ἐπὶ τὰ χώματα πρὸς τὸ μὴ κατακλυσθῆναι τὰς γᾶς.

[81] Dovecotes, used for manure collection, were common in the ancient Fayyūm and remain so today. For texts and archaeological evidence see Elinor M. Husselman, "The Dovecotes of Karanis," *Transactions and Proceedings of the American Philological Association* 84, 1953, 81-91.

[82] I have personally observed soil-spreading from a small donkey-drawn cart in the modern Fayyūm border village of Tūnis (November 2011). The process is slow and laborious, as even the smallest field requires many cartloads of earth, which must surely be purchased elsewhere, transported a considerable distance, and spread by hand.

[83] ll. 18-20: ἐπὶ (*pap.* l. ἐπεὶ) κοπρηγεῖν μέλλι (*pap.* l. μέλλει) τὰ κτήνη εἰς Ψεννῶιφριν. Two other texts of the archive, *P.Fay.* 110 (94 CE) and 119 (100 CE), similarly mention the manuring of vineyards. Cf. the Philadelphian letter *P.Princ.* II 65 (39 CE), which references daily manuring of the soil. ll. 4-5: κοπρηγείτωι (*pap.* l. κοπρηγείτω) καθ᾽ ἡμέραν.

[84] Initially published in *BASP* as *P.Col. inv.* 16 by Delia (1986).

[85] ll. 10-11: τὴν δὲ ἀμμηγείαν ἣ καὶ κοπρηγείαν ποιήσομεν ἀμφότεροι.

[86] *P.Flor.* II 143 (264 CE), ll 5-6: κοπρηγίαν καὶ ἀμμηγίαν τῶν κτημάτων. *P.Flor.* II 241, ll. 11-12: ἀμμηγίαν

[87] Egypt requires approximately 1.25 million tons of fertilizer per year. For modern fertilization in general see FAO (2005). A short twelve-minute documentary on Egyptian agriculture by journalist and film-maker Philip Rizk entitled "Pity the Nation" (دولة تتثير الشفقة) records the complaint of a contemporary farmer that, absent Nile silt, the

Willcocks had hoped that his design would allow the silt-laden early flood to pass through unhindered and store only the later, clearer water, the Low Dam nonetheless trapped a fair portion of the annual silt load in its reservoir.[88] Soils began to degrade rapidly, speeded along by the greater cropping intensity permitted by perennial irrigation. Despite the increase in irrigation water and although manuring was in use as a supplemental fertilizer, cotton production began to decline rapidly in quality and quantity.[89] Between 1897 (before the dam) and 1909 (five years after it came on line) yields per acre dropped more than 50 percent from 5.8 *qantar*s (hundredweight) per acre to 3.25.[90]

Silt deprivation is thus a serious, even existential problem in Egyptian agriculture, although it can be compensated for by heavy fertilization. Of course, farmers of the ancient border villages did not conduct massive export-oriented capitalist agriculture specializing in soil-depleting cotton. And, in addition to artificial fertilization by manuring, crop rotation was regularly practiced in the attempt to maintain fertility.[91] Still, the results of many centuries of irrigation and agriculture are plainly inscribed upon the depleted and nutrient-poor soils of the border regions. When first founded, the villages located here rested upon land that had only recently been lake bed. Their rich soils were a natural patrimony built up over millennia, a patrimony that was gradually depleted. Coupled with their already spotty water supply and the subsequent soil salinity, silt-deprived border regions of the Fayyūm cannot but have suffered a steady loss in productivity as soil quality declined over time.[92]

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soil is poor and he cannot cultivate using the flood like his ancestors, "no hoses, no potassium, no nothing" ("*wala kharātīm, wala botassium, wala ay ḥāga*"). http://vimeo.com/20810522. Accessed April 26, 2012.

[88] Although it was not entirely successful, this design feature was intended both to provide the silt to Egypt's fields while simultaneously eliminating buildup behind the dam and the need to periodically dredge the reservoir. See Collins (2002), 144 for Willcocks' design scheme.

[89] Carrier (1928), 95-6. Cf. the use of nitrate-rich earth from archaeological sites (*sebakh*), its heyday roughly from the 1830s-1930s, for which see Bailey (1999).

[90] Mitchell (2002), 106. By 1902 Chilean fertilizers were being imported: FAO (2005), 19. In the 1930s the more than 300,000 tons of annually imported fertilizers cost roughly LE 1.5 million: Tvedt (2004), 148.

[91] Bagnall (1993), 116-7

[92] See Bagnall (1985) for calculations of the decline in Fayyūm village productivity in the Roman period.

Fig. 17: Manually transporting Nile mud from the river to higher ground (ca. 1900-1923).[93]

4.4: THE CENTRAL GREEN BELT

4.4.1: Tourists' Snapshots

While the eastern and western margins were precarious, the center was an altogether different place, where the conventional, optimistic appraisal of ancient Fayyūm productivity may be more convincingly applied. Here, topography was a blessing rather than a curse. This was not simply a matter of the year-round availability of seepage water described above. Topography also eased water flow and apportionment. M.P.S. Girard's appraisal of the Fayyūm (at this time confined only to only this central alluvial plain) stresses the ease of water distribution permitted by the steeply graded landscape. Distributary canals, he says, were located "above the level of the adjacent land, making the province of Fayyūm capable of being better irrigated and, by consequence, suitable for a greater number of crops than the other parts of Egypt."[94] Al-Nābulusī similarly describes the garden-like environs of Medīnat al-Fayyūm: "many orchards surround this city and, in the eyes of a person approaching it from any direction, it resembles a beautiful fruitful valley. It is a beautiful sight, with plenty of pasture."[95] A year before the Aswān

[93] Preserved in the Frank and Frances Carpenter Collection at the U.S. Library of Congress: http://www.loc.gov/pictures/item/93512776/. Accessed August 27, 2011. No restrictions on publication.
[94] Girard, *op. cit.* n. 36, 499
[95] *TF* 26-7

Low Dam was inaugurated in 1904, an American visitor echoes his sentiments: "the country around the town [Medīnat al-Fayyūm] is very productive…Many trees seldom seen in the valley of the Nile can be found in this province. Among these the olive predominates."[96] It remains so. Anthropologist David Price has written that the "ease of water lifting in this [central] region...has turned it into a green belt of orchards, vineyards and fieldcrops."[97]

It should be apparent that all of these descriptions of the Fayyūm's fertile center bear a resemblance to a passage of Strabo generally understood by many to be a description of the whole of the ancient Fayyūm landscape: "this nome is the most remarkable of all in its appearance, prosperity and design; it is planted with olive and alone possesses fully-grown olive trees which produce a fine crop.[98] Rather than taking Strabo's comments as representative of the entire Fayyūm, then, it is more plausible that like the descriptions of the other visitors, his notice reflects only the well-watered and fruitful central floodplain, particularly the area surrounding the capital city. Indeed, the visitor who sees only the capital and its environs will emerge with an entirely misleading impression of the Fayyūm and fail to appreciate the variegated nature of its landscape. In the green of the center the rocky desert is nowhere in sight.[99]

4.4.2: A Dense Waterscape

A critical lack of evidence has made the central Fayyūm a massive blind spot and I cannot comment in any detail upon the nature of the Graeco-Roman period irrigation system. We do not know, for instance, how many canals branched from the *diōryx Argaitidos* (Baḥr Yūsuf), though constant human movement within the landscape surely worked to keep the system in a state of constant flux. Still, to judge by the description in al-Nābulsī's survey, the center was densely packed with waterways, truly a landscape or, better, a *water*scape of canals.[100] The Baḥr Yūsuf—becoming the Baḥr al-Fayyūm upon entering the cultivated area—had thirty openings (*khalīj,* pl. *khulūj*) to its north and twenty-three to its south.[101]

During the flood, water would have moved swiftly and easily through this landscape. The steep terrain of the region (a 33% grade from Medīnat al-Fayyūm to the edge of the modern lake at 44 mbsl) provided for fast moving and more efficient gravity-fed canalization. Water moved easily throughout the central canal system, irrigating, depositing sediment, and carrying away accumulated salts. Because of this swift canal flow the use of water power was in theory a viable technology. Yet if my arguments about the availability of water in the Fayyūm are correct, even in the center swift-flowing canals were a brief, annual phenomenon appearing only

[96] Johnson (1903), 16.
[97] Price (1993), 299
[98] Strabo XVII 1.35. Strabo's entire discussion of the Fayyūm consists of this quotation, a negative review of the Arsinoite's olive oil, and a brief notice of the lake in the north.
[99] The dramatic changes in the landscape were immediately apparent to me in a recent visit. Moving from the border regions to the center, the landscape changes quite quickly from one dominated by field crops, vegetables, scattered palms, and the ever-present desert to one densely packed with large fruit-bearing trees and other orchard crops.
[100] Cf. Ali Shafei maps of al-Nābulusī's Fayyūm in Shafei (1939), an illustration that forms the basis for the maps included in Rapoport and Shahar (2012). It is truly a densely packed waterscape. It is difficult to see canals and waterways in satellite images in Google. However, a 1953 US Army Corps of Engineers map of the Fayyūm, freely available in Wikipedia's "Faiyum Oasis" article, clearly shows the close-packed network of canals in the center, in contrast to the more sparsely watered margins.
[101] *TF* 7. See the settlement maps in König (1995/6) and Shafei (1939). By Nābulusī's period the southerly Gharaq and Tuṭūn basins were largely emptied of settlements, which perhaps explains the greater number of canal openings to the north. The Arabic root *sqy* clearly indicates perennial irrigation.

during the flood.[102] The 180 functioning wheels al-Nābulusī counts (out of 242, 62 having been abandoned) were thus likely animal powered *sawāqī*. Indeed, true water power was strictly limited. Al-Nābulusī counts only six water-turned stone sugarcane presses and as eight water-turned mills scattered throughout the landscape, not all of which were functional when he performed his survey.[103]

Yet a tantalizing phrase in Justin Ross' 1893 survey of Egyptian irrigation developments hints at the possibility of utilizing water power in the premodern Fayyūm outside of the main canals. While discussing measures recently introduced to control the level of the Birkat Qārūn, Ross mentions a policy of not allowing more water into the Fayyūm than necessary at the time of the year when it was required only for "the corn mills in the ravines."[104] Though he offers no further explication the brief statement at least reminds us that during the draining of basins the two main ravine drains would have filled with flowing water rushing headlong toward the lake, an ample source of kinetic energy sufficient to at least briefly power water mills, if one chose to take advantage of it.[105]

Whatever the case, even if it was not constantly flowing, seepage water was at least perennially available for drinking and irrigation here, in contrast to the drier margins. Yet during the summer months water was still limited in places. The small village of Bāja, southeast of 13th century Medīnat al-Fayyūm, for instance, received water during the inundation and shared a ditch with Minyat al-Usquf to its northeast. Yet after the Nile receded it received water only "on cattle's necks" (*'alā a'nāq al-abqār*) that is, transported to it by animals.[106] So too the village of Dimashqīn al-Baṣl, the first village beyond the dam at al-Lāhūn and lying on the east bank of the Baḥr Yūsuf. It too received its summer water "on cattle's necks."[107] Even Ibshāyyat al-Rummān (Greek Pisais, Coptic Pishai), a large, productive, still-extant village lying towards the western edge of the then-cultivated area was faced with summer scarcity. Although the village received enough water to sustain some orchard crops—a few olive trees, date palms, and some small pear trees—it contained a well from which its inhabitants drew drinking water in the

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[102] For antiquity, it is difficult to assess the type of waterwheel described by the terms *mēchanē* and *sāqīya*. Rathbone notes that the undershot, water-powered wheel was nonexistent in Graeco-Roman Egypt, where animal powered machines remained the norm. If this is true then all our Greek *mēchanai* are animal-driven. Rathbone refers to a "proper" *sāqīya* as a pot-garland device, which raises and lowers a string of jars into and out of a well. The same drive system used to power a compartmentalized wheel raising water out of a canal is more accurately a *tabut.* Such a device might also be referred to as a *noria* (Arabic *nā'ūra*), a term which also applies to the undershot waterwheel. In the contemporary Fayyūm the term *sāqiya* is also applied to the undershot wheel (Price [1993], 287). The same may be true in Nābulusī. He is very careful to distinguish between two types of stone sugarcane press, animal- *vs.* water-powered. See the entry for the village of Fānū (*TF* 133), which had two stones, one turned by water and the other by *'awāmil* (literally 'factors' or 'agents' but by extension, animal power). Nowhere, however, does Nābulusī refer to any waterwheels (*sawāqī*) as animal-driven. On waterwheels in general, see Andrew Wilson's two studies, "Water-Power in North Africa and the Development of the Horizontal Water-Wheel," *JRA* 8 (1995), 499-510 and "Machines, Power and the Ancient Economy," *JRS* 92 (2002), 1-32.

[103] *TF* 7

[104] Ross (1893), 185

[105] The widespread contemporary use of undershot waterwheels in the central Fayyūm may be a modern phenomenon adapted to the perennial availability of flowing water in the canals. Despite quaintness to western eyes of this seemingly antiquated technology, they are a comparatively recent introduction to the landscape. They are situated in areas where canal level drops rapidly (20-70 cm), increasing the flow rate and providing additional impetus: Price (1993), 287-9. See also figure 4.4 above.

[106] *TF* 63.

[107] *TF* 99.

summer "when the canal water fails to reach them due to its scantiness."[108] So too the village of Ṭubhār, which contained a well from which the inhabitants drank "during the period of decrease in water."[109]

It is difficult at the moment to say more than this about the center in the premodern period without relying entirely on al-Nābulusī and thus recapitulating the recent work of Rapoport and Shahar. Still, despite the lack of ancient evidence from the center, the few texts recovered from Medīnat al-Fayyūm offer the possibility of constructing a topographical overview of the 6th-8th centuries, a period that is otherwise an evidentiary black hole. These texts illustrate that these central regions were densely populated in the period just prior to and following the Arab conquest, hardly a reflection of 'crisis' or 'collapse.' This small corpus of central administrative texts contains a number of village lists, some alphabetical, some random (or organized in a manner that eludes easy detection). The lists yield the names of more than 400 active villages between the 6th to 8th century. These lists are clearly administrative records of tax-paying settlements and some even record payments from villages.[110] They thus provide us with an administrator's bird's-eye view of the inhabited central portion of the nome after virtually all border settlements had been deserted.[111] Although we lack the fine detail preserved in the more parochial village records of the earlier period, these government documents show that the central region of the Fayyūm was thriving in later antiquity, cultivating fields and paying taxes. This period of the Fayyūm's history marks a medial stage between its earlier extent and the more sustainable size it had attained by the 13th century. It is an irony of history that we are so well informed about life in the border villages, where soils were poor, water increasingly scarce, and life ever more tenuous. Theadelphia and Philadelphia, problematic and eventually failed settlements, are well known. Villages like Zizonos, Ouo, Metrodorou, and Onniton are invisible to us, appearing merely as names on a list. Yet they endured. The preliminary results of this topographical survey, with a map, are included in the appendix to this dissertation.

4.5: THE *MERIS* OF POLEMON

4.5.1: The Tuṭūn: Lake or Inundation Basin?

Although the Tuṭūn basin is part of the Fayyūm's alluvial plain I consider it a distinct region due to its unique place within the Fayyūm's irrigation system. Like the marginal villages of the eastern and western borders, its altitude—ranging between the tens and twenties masl—placed it far above the level to which Nile seepage reached. Unlike the lower central portions of the alluvial plain, water could only reach the Tuṭūn during the flood. Yet topography erected an obstacle to inundation in the form of the head of the Wādī al-Nezla at the Tuṭūn's northwest. If unchecked, water would have immediately entered the ravine and run to the lake, unused. As mentioned above, sections of a large dyke totaling 4 km in length that blocked the mouth of the wadi remain visible today between the modern villages of Iṭsa and Shidmū. The original extent

[108] *TF* 48.
[109] *TF* 129.
[110] For samples of lists with payments, see, e.g., *SB* VI 9583 (650-99 CE), *SPP* X 76 and X 171 (8th CE).
[111] The famous abandoned villages do not occur in the late antique village lists as tax-paying agricultural settlements. Although archaeology keeps pushing their final, complete abandonments farther and farther forward in time, if there was inhabitation along the borders between the 6th and 8th centuries, it was not of the sort that produced taxable revenues.

of the structure was probably about 8 km although much has been covered by modern roads that have used the wall as a ready-made structural foundation.[112]

Since it was built across the mouth of the Wādī al-Nezla, the wall or dyke would have served to contain water within the flat, expansive basin. Two hydrologists, Günther Garbrecht and Horst Jaritz, have concluded that the dyke's original construction was in *opus caementitium* and date it to sometime in the early Roman period although Dominic Rathbone prefers and earlier but unspecified Ptolemaic date.[113] Analysis of its construction and materials indicate that the dyke was continuously repaired through the first half of the 19th century under the *khedive* Muḥammad ʻAlī after which point it went out of use.[114]

Garbrecht and Jaritz have proposed a controversial theory arguing that the dyke created an artificial lake every year in the Tuṭūn 114 km^2 in size between October and February/March. This giant irrigation reservoir (*Speichersee*) could then be drawn upon throughout the rest of the year as needed by local cultivators. Overflow from the *Speichersee* would have passed into the neighboring Gharaq via a canal cut through the rock barrier separating the two basins.[115] The presence of such a lake, they argue, would surely account for the former name of the area, Ḥūḍ al-Ṭuyūr, the "basin of the birds," since a large, semi-permanent body of water would have attracted considerable waterfowl. The current name of the region, al-Mala'a, Garbrecht claims, refers to "a wide and open area covered with water."[116]

Fig. 18: A masonry-faced section of the dam near the village of Iṭsā. Photo: B. Haug, November 18, 2011

[112] Davoli (1998), 269 for the length. The modern toponym Shidmū preserves an Egyptian toponym meaning "dam of the waters." The vocabulary is related to Arabic: *sadd*, "dam", *ma'*, "water."
[113] Rathbone (2001), 1113.
[114] See also the brief description in Bagnall and Rathbone (2004), 142-3.
[115] Garbrecht and Jaritz (1990), 133 with Garbrecht (1996), 59-64.

[116] Garbrecht (1996), 59

The theory is a radical reappraisal of Fayyūm hydraulics and one that Paola Davoli has charitably dubbed "molto discutibili," while wondering what economic or hydrological purposes would have been served by such a massive reservoir. Critically, she remarks, the presence for one half of the year of a massive lake will have rendered a vast area of prime agricultural land totally uncultivable, some of which must surely have belonged to the agricultural village of Tebtunis at the basin's southern border. Since Tebtunis' southern half faced the desert its agricultural land will have lain to the north in the area ostensibly flooded by this alleged *Speichersee*.[117] Still, Garbrecht claims that the relative lack of pre-modern settlement in the region apart from the villages of Tuṭūn and Qalamshāh, which lie at a higher elevation than the lake's proposed surface, indicate that the area was largely uninhabited in the period before modern irrigation practices. This is entirely incorrect. There were, in fact, a great number of villages in the Tuṭūn basin in antiquity, as is immediately apparent in my topographical appendix. Additionally, in al-Nābulusī's time there were still several villages lying along the Baḥr Tanaḅtawīyya including Tuṭūn and Qambasha, the latter large and productive. Still, the basin was very sparsely settled at this period and al-Nābulusī does not comment upon the dam nor does he make any mention whatsoever of large-scale inundation in the area, let alone a giant lake, which would have been rather difficult to overlook. The structure may have been non-functional at this period, perhaps rendering irrigation difficult and contributing to the sparseness of Tuṭūn's population.[118]

Referring to a statement in Hanbury-Brown's 1892 study of the Fayyūm and the lake, Paola Davoli has already proposed that the dyke was simply a device used to retain water in the Tuṭūn basin briefly for the purposes of traditional basin irrigation. At this period the wall had been out of use for only six years:

> On the south side of the Fayūm there was, until late years, a large basin known as "Hod-el-Tuyūr" (the Basin of the Birds), which was formed by building an immense wall across a fold contour of R.L. 15.00 ["reduced level", i.e. 15 mbsl]. The top of this wall is about R.L. 16.00. The bed of the basin it as R.L. 12.00, so we may conclude that, when this wall was built, the lake levels must have been at any rate below R.L. 12.00. This basin was abolished in 1886 and ordinary perennial irrigation introduced over the area formerly included within the basin limits.[119]

While Garbrecht cites this passage as support for the storage-lake theory, Hanbury-Brown clearly does not refer to the area as a lake or as covered by a large body of water even semi-permanently.[120] Rather, the brief notice occurs within a discussion of the old-style inundation basins that obtained in many parts of the Fayyūm before the then-recent introduction of perennial irrigation. His description of the area as a "large basin" is simply meant to complement his mention of the many smaller basins previously in use throughout the depression.

That this was the purpose of the structure is made abundantly clear in additional writings from the period. Justin Ross, who refers to Ḥūḍ al-Ṭuyūr in the context of the fluctuating levels

[117] Davoli (1998), 270.

[118] In a paper delivered at the 2010 International Congress of Papyrology in Geneva, Cornelia Römer suggested that the dam controlled water flow down the Nezla and somehow contributed to the irrigation of the Themistos. She argues that it broke at some point in the fourth century, contributing to the desertion of the *meris*. I show in my topographical appendix that the Themistos was not, in fact, deserted by the later period but I cannot yet engage more closely her arguments since the paper is not yet published nor circulated. I rely for the above summary of Römer's work upon brief email exchanges and personal conversation in Fayyūm in November of 2011.

[119] Hanbury-Brown (1892), 96

[120] See Garbrecht (1996) at 54, 59, and 65 for this misunderstanding of Brown's statement.

of the Birkat Qārūn, claims that the annual draining of this "old basin" had contributed to a deleterious rise in the lake's surface level between 1870-83. It was thus decided to "abolish the basin irrigation of the Hud et Tuyûr, making it *sêfi*" that is, introducing perennial irrigation and the cultivation of summer crops as a measure to help control the level of the lake.[121]

These issues are described in more detail in several annual Irrigation Reports published by the Ministry of Public Works. In the 1887 report, Colin Scott-Moncrieff notes the recent decision to abolish this basin of 12,000 feddans and replace it with perennial irrigation, in order to halt the annual swamping of good lakeshore farmland that was caused by the yearly draining of the Tuṭūn.[122] In an appendix to the report added by Ross, the basin is explicitly referred to as "the 'Malaqah' or the last flood basin in the Fayum." Ross reports that the annual October draining of this massive irrigation basin would cause a 40-60 cm rise in the lake and subsequent land loss. It was thus decided to make the basin "*Misqâwi,* or irrigated by water courses both winter, flood time, and summer." Canals and drains were subsequently excavated, creating a regular, modern, perennially irrigated region.[123]

The suspicions of the storage-lake theory voiced by Paola Davoli, as well as by Dominic Rathbone, are thus wholly justified.[124] The terrain of this portion of the ancient Polemon—flat and unencumbered by ridges or other topographical hindrances—is eminently suited for use as a massive, contiguous irrigation basin, hence its name al-Mala'a, from the verb *mala'a* used in Egyptian Arabic to refer to inundation irrigation.[125] Indeed, the only impediment is the head of the Wādī al-Nezla. This confronted ancient basin irrigators with an engineering challenge that they cleverly solved with a massive dyke. The Tuṭūn, then, was simply an irrigation basin of traditional Egyptian style, if on a grander scale.

[121] Ross (1893), 185

[122] Colin Scott-Moncrieff, *Irrigation Report for the Year 1887* (National Printing Office, Cairo, 1888), 14. See also the "Appendix C" by Justin Ross at 61, merely repeating the same information.

[123] *ibid.* 63. The *Irrigation Report for the Year 1889* (National Printing Office, Cairo, 1890) by Ross discusses at 32 recent water supply problems that have caused problems for the introduction of perennial irrigation in the Tuṭūn. It is suggested that the region may have to be returned to old style basin irrigation. The *Report* of 1890, again by Ross, notes at 88 that the project is proceeding apace and some 10,000 *feddan*s of land along the lake had been dried and reclaimed, since that the basin no longer contributed to waterlogging and the annual rise of the Qārūn.

[124] Davoli (1998) 270, Rathbone (2001), 1113 and pers. comm. February 11, 2011.

[125] See ملا /*mala* in El-Said Bedawi and Martin Hinds, *A Dictionary of Egyptian Arabic* (Libraire du Liban, 1986). Formally, the word is ملأ/*mala'*.

Fig. 19: A rubble core section of the dam near Iṭsā. In the distance the modern road has used the dam as a foundation and follows its route for a brief period. Photo: B. Haug, November 18, 2011.

In a recent discussion of the 18th century Ottoman Fayyūm, Alan Mikhail has made available additional Turkish evidence for the dam and the water it retained.[126] That damage to the dam would result in considerable hardship is reflected in the documentation, full of the "rhetoric of complaint and of impending doom and danger related to the breaking of one of these dams and to the resulting decreases in food production."[127] In the first half of 18th century alone almost twenty major repair operations were undertaken. They began in 1709 with a *firman* (decree) from the sultan Ahmet III's *divan* sent to the governor in Cairo. Apparently, however, continuing repair operations were unsuccessful and the complaints and petitions continued to stream into the governor's offices. Finally in 1743 the then governor Mehmed Pasha was ordered to oversee repair work himself. He repaired only a few sections and those inadequately, pocketing some of the monies set aside for the work. Theft and incompetence cost him his position and the dyke was only repaired properly in 1746 after the previous year's flood destroyed not only its already damaged sections but also portions that had previously been functional.

[126] Mikhail (2010). The following paragraph is drawn from this work. The sources at Prof. Mikhail's disposal refer to the dam as the "dam of el-Gharaq." Yet the descriptions of the structure are too massive to be anything other than the Iṭsā-Shidmū seawall. For instance, at p. 578 he notes a report of the second decade of the 18th century that documented 10,809 m^2 of damage to the dam, something that could only correspond to the massive dam. The Gharaq was also largely deserted at this period as can be seen on Bellefonds' map dating from sometime later in the 1830s (so also Rathbone [2001], 1117). In a brief email exchange (March 8, 2011) Prof. Mikhail noted that the petitions and other documents upon which his article is based are very imprecise as to the villages affected by problems with the dam, referring to petitioners only as "the people around the dam" or "the people of the area" and he was unable to more precisely locate the structure through the textual material alone.

[127] Mikhail (2010), 575

Apart from the barrage at al-Lāhūn, then, the Iṭsā-Shidmū seawall is clearly the infrastructural feature of the Fayyūm's irrigated landscape whose functionality is most closely tied to continuing agricultural prosperity, at least in a sizeable portion of the southern Fayyūm. That is, if one is seeking monocausal, infrastructural explanations for Fayyūm decline, this dyke is a likely suspect. As I noted above, the Tuṭūn basin in al-Nābulusī's period seems to have been if not deserted certainly quite sparsely settled. Could the dam have been non-functional in the period? Until Cornelia Römer's work (see above, n. 118) is published we cannot even begin to answer these questions. Also, since fully half of the dam is either covered by roads or obliterated, it may remain difficult if not impossible to date damage to the structure with precision.

4.5.2: The Gharaq

I turn lastly to a very brief accounting of the Gharaq ("flooded") basin: brief and last because there is no substantial information available regarding its premodern irrigation apart from the archive of Menches, which has already been studied in depth by Dorothy Thompson.[128] The Gharaq also does not feature in al-Nābulusī's survey for, as Rathbone notes, the basin was largely deserted by the mid 7th century. Like the marginal regions of the east and west, resettlement did not begin in earnest until the end of the 19th and the introduction of perennial irrigation.[129] It was thus not a region of any particular interest to the European engineers and thus rarely appears in their writings, save in conjunction with the long-in-gestation project to transform the Wādī Rayyān depression in the desert to its west into another drainage sump.[130]

In truth, the Gharaq could be included with the eastern and western border regions. It too was irrigated by a long border canal that features the same deficiencies in design: like its eastern and western counterparts, the *diōryx Polemonos,* the modern Baḥr al-Gharaq, travels over relatively flat topography with a mere 3.7% gradient over its roughly 43 km course. In antiquity, this canal could occasionally leave tail end villages like Kerkeosiris without water.[131] But the Gharaq itself remains a unique location. As mentioned above, it is a mini-Fayyūm. It is an endorheic basin surrounded by low hills, which contained a lake year round in antiquity of between 5-10 masl. Like the Qārūn in the north, the water that irrigated the Gharaq's fields drained to its lowest region in the small Ghoran depression forming the lake. That is, the Gharaq's mini-lake was a drainage sump and susceptible to the same problems that afflicted the large Birkat Qārūn (salinity, brackishness) as well as being prone to changes in size depending on the amount of water entering it during the year, something that could damage and salinize nearby fields.[132] The site of Medīnat al-Nihas (Magdola) preserves ancient eroded lake bottom

[128] Crawford [Thompson] (1971), 106-21.

[129] Rathbone (2001), 1116-7.

[130] The project was only completed in 1973. The Baḥr al-Gharaq now receives more water on average than the other two border canals because the southwestern Fayyūm makes use of the Rayyān lakes and can expel drainage without having to bother with the Birkat Qārūn. See DeVeer (1993).

[131] *P.Tebt.* IV 1126 (ca. 114 BCE) is a list of men, land, and dues pertaining to unirrigated fields: l. 1 κ̣α̣τ̣᾽ ἄ̣[ν]δρα τῆς ἔτι ἀπο̣τ̣ίστου.

[132] See Moustafa (1990) for drainage issues in the modern Itsa district, which includes the Gharaq. *P.Tebt.* III 998 (3rd-2nd BCE) mentions 52 arouras of apparently lake-side land, 10 of which were salinized due to flooding by the *aigialos*: [νβ η΄, (ὧν) ἐστὶν ἀλμυ(ρίδος) [διὰ τὸ κατα]κεκλ(ῦσθαι) ὑπὸ τοῦ αἰγιαλοῦ ι, (γίνονται) μ̣β η΄, (l. 4-5). The Gharaq village of Berenikis Thesmophorou is mentioned later in the text although it is not certain that the flooded salt land belonged to farmers in that particular settlement.

while other areas around the site show scattered fish bones and the occasional net weight, indicating that the inhabitants near the small lake included at least some fish in their diet.[133]

Like the other marginal regions, the Gharaq's soils are degraded and its terrain rather generally rocky and forbidding. As Thomspon already noted, "the picture of agriculture as illustrated in the Kerkeosiris surveys is far from healthy."[134] I will say little about it here because my work has been anticipated by a forthcoming article by Andrew Monson, who convincingly demonstrates that papyri from this small region have fostered the widespread belief that the Fayyūm was the most productive area of Egypt in antiquity. The highest wheat rents preserved in papyri from the Fayyūm all come from texts on the eastern edge of the tiny depression that was once the Gharaq's lake, the Ghoran depression (e.g. Tebtunis, Theogonis, and Kerkeosiris). Critically, Monson notes that most of these rents come from the archive of the descendents of Patron, wealthy landholders, not small peasant farmers.[135]

Why these villages in this part of the Fayyūm should have preserved higher yields than other regions is an as-yet unsolved mystery. The Gharaq's soils were no more fertile than other border regions and salinization and general degradation were as problematic here as elsewhere.[136] The unique topography sloping quickly down toward the mini-lake in the Ghoran may have made irrigation easier and there is some indication of water storage on a relatively large scale, at least in the Ptolemaic period. A large basin referred to as the "great *perichōma* of Theogonis" is mentioned in the dossier of Menches, though it is brought up here only because it had collapsed causing massive waterlogging and soil salinization around Menches' village of Kerkeosiris.[137] It may be that its alleged greater productivity is simply a trick of the evidence, the result of our chance possession of the papers of a local estate capable of watering the land more effectively than smallholders.

4.6: Conclusion: A Fundamental Scarcity

> *Ahmed Ali has worked the same plot of [Fayyūm] land since his youth, yet only in the past few years has he faced any sort of water deficits. Ali used to grow a variety of fruits in his field, including apricots and grapes. Due to water shortages the farmer has slowly switched to other fruits that consume less water like mangoes, olives, prickly pears and a variety of citrus fruits. Many of Ali's neighbors have moved away, leaving their old lands parched and covered in yellow grass and thorns under barren fruit trees...*
>
> *Clenching a solitary bunch of grapes on one of his barren vines, Mostafa explains that the few plants he has kept alive in his garden are watered with jerrycans, which he purchases from a distant location. Like many of his neighbors, Mostafa's farming days here are coming to an end. Abuxta*[138] *lies at the end of the Nile's water distribution line that reaches the district. Village residents explain that people up the canal*

[133] Rathbone (2001), 1113
[134] Thompson (1971), 117
[135] Monson (forthcoming) calculates a median 9.5 artaba/aroura rent for the Polemon compared to 5 and 4 artabas/aroura for the Herakleides and the Themistos.
[136] See chapter 3 above.
[137] *P.Tebt.* I 72 (113 BCE), ll. 78-9 and *P.Tebt.* I 61b (117 BCE), ll. 165-6. 72: ἔκπτωμα[τοῦ κα]τὰ Θεογονίδα [μ]εγάλου περιχώμ[α]τος). See Monson (forthcoming). Both reports appear to date from March-April, well into the growing season. The break must then have occurred earlier in the year, perhaps during the flood. The purpose of the large basin is entirely unclear. The word could indicate a massive embanked field or perhaps even a reservoir. Monson speculates that a large reservoir may have been intended to regulate the flow of water into the Gharaq basin, possibly allowing some manner of perennial irrigation.
[138] More properly Abū Ksā.

have exceeded their share of water in recent years, such that nothing reaches those at the bottom of the canal in the end.

--"Water scarcity in the fields: A glimpse from Fayoum," Philip Rizk, *Al-Masry Al-Youm,* 12 July 2010[139]

Premodern Fayyūm's irrigation system was characterized above all by its marginality. Since it lies at a great remove from the Nile, the depression has always been marginal in absolute terms. During the low water season Fayyūm villagers could not simply walk down to the river for their drinking water, nor could they raise water from it by *shadūf* for riverside summer garden plots. Their primary water supply both for drinking and for agriculture was provided by a once-yearly influx through a Nile side channel that dried up as the flood ebbed. The water it carried to the well known, tail-end border settlements of the northeast and northwest was also minimal, quickly petering out altogether. Irrigation and cultivation in the Fayyūm was thus always a rather precarious business that required localized adaptations to the realities of topography and a fundamental water scarcity.

But adaptation has its limits and water scarcity remained an ever present dilemma. Even the parts of the marshy central area ran up against supply problems in the summer, as we have seen. Especially on the borders, the only sensible response was to bank whatever excess the ephemeral flood brought down in local reservoirs or basins, the *khazzān* mentioned by Justin Ross in the epigraph to this chapter. Cornelia Römer's survey of the western village of Philoteris, for instance, has revealed the storage infrastructure of this tail end western village. The sites shows the remains of six large embanked areas, some with dykes preserved to a height of 2.3 m, covering a total area of 26.95 arouras. Since their surface area is too small and the dykes too high to represent agricultural *perichōmata*, the structures are surely instead water storage basins with a potential volume of between 148,550-171,375 m^3. Indeed, two appear to be directly fed by a nearby canal.[140] The mechanics of such basins is described in *P.Bacch.* 19 (171 CE). In ll. 7-11 the priests of the temple of Bacchias describe a canal, the *diōryx Patsōntis*, which waters the fields around the villages and fills local *hydrostasia* (basins or reservoirs) below it (*ta hydrostasia ta hyp' autē katerchetai*). But the filling of basins during the inundation required a sufficient flood, something that could not always be guaranteed, as *P.Fay.* 131 in particular makes clear.[141] The writer of the letter instructs the recipient to do his utmost to fill a basin (*hydrostasion*) if the water comes down, although the irrigation of vegetables take priority. Receiving enough water to put some aside for later seems to be an added benefit.

Successful storage would offer at least a minimal supply of water year-round but full reliance upon basins was risky. If a reservoir was breached and its contents spilled the dependent areas remained dry. In the Karanis text *P.Col.* VII 174 (325-50 CE), for instance, Sambathion and Heras claim to have farmed a total of 190 arouras of land in the village until the collapse of a reservoir (*hydreuma*) rendered them unable to water their fields, which subsequently dried up. In *P.Ryl.* II 81 (104 CE), a rather damaged official letter dated to the month of Epeiph (the penultimate month of the year), we see also that even successful storage could not guarantee year-round water. A "shore guard" (*aigialophylax*) writes to the *stratēgos* of the Themistos regarding the opening of the gates (*pylai*) of a word in the genitive plural lost in a

[139] http://www.almasryalyoum.com/node/55793. Last accessed March 1, 2012.
[140] Römer (2004), 297
[141] Both texts cited in Römer (2004) at 297.

lacuna, presumably referring to the storage basins. At this late date, however, the basins were running dry: "and they are nearly all out of water, as you know."[142]

But did this scarcity increase over time? Based upon the salt tax (i.e capitation) records from the early Ptolemaic period, the population of the Fayyūm in the 3rd century BCE has been estimated at 85,000-100,000.[143] Conversely, taking the estimated densities of Roman Philadelphia, Theadelphia, and Karanis as representative of the Fayyūm as a whole (120, 124, and 106 persons per km^2 respectively), Andrew Monson guess a range of some 170,000-200,000 persons in the Roman period.[144] Yet it is possible that this is a substantial underestimate. Monson himself notes that population density in Ptolemaic and Roman Egypt was most likely determined by agricultural productivity, while I have argued, these tail-end villages were the most marginal and water-poor settlements in an already marginal region.[145] While I cannot prove this supposition, it is at least possible that the better-watered regions supported a greater population density than that of the margins. If we posit that the more reliably irrigated regions supported a density similar to that estimated for the Valley—ca. 200-300 per km^2—we would arrive at a rather higher aggregate, even if the rest of the depression was peopled only to an extent comparable to that on the edges.

Whatever the case, any increase in population will have concurrently increased water use and competition over this meager resource. Since much was conducted through canals, upstream farmers were always served first. If their numbers slowly grew over the centuries and their cultivation subsequently intensified, every drop they used was a drop unavailable downstream.[146] The farmers of the modern Fayyūm mentioned in the newspaper piece excerpted above have run up against this problem as population growth and problematic water use policies have left those at the tail ends with little.[147] So too the medieval villagers of al-Nābulusī's tail-end village of Old Shāna, who were adversely impacted by an increase in water-intensive sugarcane farming elsewhere.[148] In antiquity, any progressive increase water scarcity downstream, while not determinative of human action, must surely have informed the eventual decision by many to emigrate, seeking better lands in the interior or elsewhere in Egypt. And so it is to the human element, the social relations of canal irrigation in the context of endemic scarcity, that I turn to in the final chapter.

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[142] *P.Ryl*. II 81, ll. 7-8: [κα]ὶ γὰρ σχεδὸν πᾶσαι ἀφ᾽ ὕδατους (*pap.* l. ὕδατος) εἰσί, ὥσπερ οἶδας.

[143] Thompson and Clarysse (2006) Vol. 2, 95.

[144] Monson (2012), 39-40. *Pace* Monson, I am unwilling to see the densities of these border regions as representative of the whole of the Fayyūm. The fragility of the environment here could not support a population as dense as the better watered central regions. Nonetheless, he is absolutely correct to note that the estimates of Fayyūm density cannot be used to extrapolate a hypothetical population for the whole of Roman Egypt, which has been estimated at a density of density of 200-300 persons per km^2 by Scheidel (2001), 115, 178 n.137, 223, 246.

[145] Monson (2012), 36

[146] This is not to discount the possible effects of the Antonine plague. I briefly elaborate on this difficult issue in the conclusion to this dissertation.

[147] See also Barnes (2010) chapter two.

[148] Cane is a notorious water-thief. A 1999 United Nations FAO report rated sugarcane in Egypt as one of the most highly profitable crops for private farmers since they do not have to pay for their water. Yet it is simultaneously deleterious to the Egyptian economy as a whole since its great thirst makes a great demand upon Egypt's already scarce and increasingly uncertain water supply. Cited from Khalid Ikram, *The Egyptian Economy, 1952-2000: Performance Policies and Issues* (Routledge: London, 2006), 319-20, n. 9.

CHAPTER 5
AT THE TAIL END
Scarcity and Society on the Margins

> *You can argue that the character of a man or woman can be as much formed by genetic and cultural material as by the location of their garden or chile patch along the length of a ditch, toward the beginning where water is plentiful or at the tail end where it will always be fitful and scarce. "He's that way because he lives at the bottom of a ditch and never gets any water," is an accepted explanation for even the most aberrant behavior in this valley. The man who lives at the bottom of a ditch is forever expectant, forever disappointed.*[1]

5.1: INTRODUCTION

5.1.1: Water and Community

In irrigated rural environments the labor of directing the flow of water demands collective action, an inescapable reality that draws individual farmers together into a community. As has recently been written of the modern Fayyūm:

> It is the community that makes the water flow; a community that is generated...by blocking, unblocking, digging, and weeding an irrigation ditch. It is a community generated not through a collective imagination, but through the shared work of maintaining the flow of water.[2]

In the first pages of his autobiography, late Egyptian president Anwār al-Sadāt offers his own idyllic reminiscences about the cooperative, communal nature of village irrigation in his childhood home of Mit Abūl-Kūm in the southern Nile Delta:

> [The village had water for two weeks during the winter] our "statutory" irrigation period, during which all land in the village had to be watered. It was obviously necessary to do it quickly and collectively. We worked together on one person's land for a whole day, then moved to another's, using any *tunbar* (Archimedean screw) that was available, regardless of who owned it. The main thing was to ensure that at the end of the "statutory" period all the land in the village was irrigated. That kind of collective work—with and for other men, with no profit or any kind of individual reward in prospect—made me feel that I belonged not merely to my immediate family at home, or even to the big family of the village, but to something vaster and more significant: the land.[3]

But what happens to such a community if the water flow around which it is built slows or ceases? Egyptian novelist 'Abdel Raḥmān al-Sharqāwī presents one possible outcome in his classic 1954 novel *Al-Arḍ* (*The Land*).[4] In a fictional mid-1930s Delta village, farmers receive

[1] Crawford (1988) at 24, referring to *acequia* communities in northern New Mexico.
[2] Barnes (2010), 161
[3] Anwār al-Sadāt, *In Search of Identity* (Harper and Row: New York, 1977), 3-4.
[4] The following is drawn from pages 117-123 of Desmond Stewart's English translation of *Al-Arḍ*, entitled *Egyptian Earth* (University of Texas Press, Austin, 1990). The unnamed fictional village is likely based upon al-Sharqāwī's hometown in the Shibin al-Kum district of the southern Delta governorate of Minūfiyya.

ten days of water per month, which they raise by turns to their fields via a single animal-driven *sāqiya*. Although this waterwheel sits upon the land of one Abdul Hadi and is nominally owned by him, villagers hold time-based shares in it in proportion to the amount of money each had contributed toward its construction, shares in turn adapted to the set amount of water provided under the ten-day irrigation regime. But to the detriment of the villagers, the royalist government of prime minister Isma'īl Ṣidqī (1930-33) has halved the village's monthly irrigation time to five days in order to transfer the extra water to nearby wealthy cultivators.

When the decision is implemented the reduced flow soon throws the village into chaos. While irrigating his fields with the waterwheel, Abdul Hadi walks along the canal that separates his plots from those of his neighbor Diab. Nothing is amiss:

> [T]ill suddenly [the flow] diminished and became a mere trickle...crawling like a drunkard. The wall of the canal had been broken in a number of places; the water was flowing through these holes into the fields which Diab was working with his hoe. He was furious that Diab had dared to steal his water in this way, taking the water raised by Abdul Hadi's own wheel before he had taken what he needed himself.

Abdul Hadi demands that Diab repair the damage. Diab stubbornly refuses, so Abdul Hadi himself patches the breeches with mud. Diab and his own neighbor, who had likewise been drawing upon this stolen water, cluck their tongues at Abdul Hadi's high-handedness and Diab simply hacks the canal walls open again, protesting that "he was not stealing water or anything else, he was taking his rights:"

> Listen, Abdul Hadi. I have one day of the water-wheel, and so has my neighbour Massoud. You say it's your water-wheel, do you? We have a day's use of it, so has Massoud, and the eastern sector they have two days. I'm taking my day now. You take your animal off, for here comes Massoud's wife with his beast.

Before the matter can be settled, the villagers of the eastern sector appear, demanding to take their two-day share of the wheel as well. In vain, Abdul Hadi attempts to remonstrate:

> [He] tried to point out to them how things were changed, that the [irrigation] period was reduced from ten days to five, and that if they took two days, as before, other fields would go thirsty. To Abdul Hadi's suggestion that their two days should in fairness now become one, the men and women replied with angry shouts and screams...In the violence of the argument each felt that the other was trying to deprive him of life itself…In a surge of violent feelings, to protect the land, to give it water, the villagers set upon each other, beating and being beaten, without thought or care: as if they were strangers to each other, as if there had never been between them ties of love...as if it was impossible that they could ever be friends again; as if each could do anything, however terrible, to his brother...cut from him...eat him...do anything to obtain water.

Several elder *sheikh*s try in vain to calm the violence but their pleas go unheard. Only when Massoud's water buffalo falls into a well does the brawl cease and a semblance of communal solidarity return as the villagers work together to raise the animal back to dry land: "a calamity like this fell on them all equally, and they must all confront it, standing side by side."

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Such, from the bucolic to the bloody, are the social relations of water sharing. Irrigation, canal irrigation in particular, creates communal groups such as these, bound together by their shared

dependence upon both a steady water flow and the structural integrity of the conveyances.[5] As we will see, in a communally managed irrigation system like that of the premodern Fayyūm all water users cooperate to distribute water equitably and to maintain the physical infrastructure. Ideally, that is; reality is messier. While the need to maintain unimpeded flow through a canal network may demand cooperation and foster interdependency, this same connectivity simultaneously creates multiple spaces for conflict and discord. No agricultural water community is forever free from people "beating and being beaten."[6]

First, as I have noted in previous contexts, since canal systems are highly networked, the water demands of each user automatically impact water availability downstream.[7] This is a critical issue, particularly in a system like the Fayyūm's, which was heavily dependent upon a once-yearly influx of variable and perhaps often insufficient amounts. Position in the network can thus be the principal factor that determines field productivity and individual prosperity: farmers nearest to the head of a canal who receive water first forever maintain an inherent advantage over their tail end neighbors. Secondly, conveyance loss is a nearly insurmountable obstacle that progressively disadvantages water users at greater and greater distances from the head of the system. In the premodern Fayyūm where water was scarce, its delivery inefficient, the canals mere earthen ditches, and the rate of evaporation high, conveyance loss was an important factor, even if exact measurements of its effects remains impossible.[8] If insufficient water reaches the tail end, farmers there have an incentive to steal water from one another in the attempt to make up for personal losses.

Maintenance issues will demonstrate a similarly high level of interdependency. Even at the private field level, one farmer's poor maintenance can be destructive to his neighbors. Here too, upstream users are similarly well-placed to the disadvantage the those downstream. If even a poorly maintained canal provides upstream farmers with adequate service, they may be tempted to ignore the repair work necessary to ensure that water continues to flow downstream unhindered and in sufficient quantity. In general, any irrigator might attempt to avoid contributing to the communal labor of canal maintenance if he believes that the consequences of avoidance (fines, etc.) are minimal and that others will pick up their slack. Tail enders are also particularly likely to avoid maintenance duties if experience tells them that upstream profligacy

[5] The precise nature and extent of so-called "water communities" are difficult to pin down. Barnes (2010) at 183-4 comments that to define a community geographically simply as those clustered near the resource is to take a blinkered view that ignores "the fact that community is also generated through economic, political, cultural, and social relations." To see the community as something connected to and constituted only by its resource (water) dependence obscures the larger cultural, social, and political context. The water resource itself is also a hybrid, comprising both the canal and the water it conducts. But while the canal is static, the water is always flowing, a fluidity that creates difficulties in defining communal boundaries and relationships.

[6] On conflict in irrigation communities in general see Mabry (1996), 18-19. So also Shaw (1982) at 69: "conflict is often endemic to irrigation systems." See Vandermeer (1971) and Price (1995) for water theft in modern Taiwan and Fayyūm respectively. Crawford (1988) documents throughout the difficulties of managing an *acequia* community in New Mexico. See also Sheridan (1996).

[7] Cf. Molle *et al.* (2004) at 32 on irrigation in a modern central Iranian village: "What is stored, conserved or depleted at one point dictates what is available at another point, further downstream. Whenever an individual, a village or the state taps a new source of water or alters the allocation of an existing one, it is tantamount, in reality, to a mere reallocation: in other words, one may be almost sure to be robbing Yadullah's water to irrigate Saeid's garden."

[8] See Price (1995b) for a general survey of the cultural effects of conveyance loss in gravity-driven systems. Conveyance loss can be minimized or almost entirely eliminated by the use of lined and covered canals like subterranean *qanats*. Both the ancient and much of the modern Fayyūm's network, however, flows through unlined and uncovered earthen canals, making conveyance loss an unavoidable reality.

and conveyance loss will deny them an adequate water share regardless of the amount of labor they contribute.[9]

None of this is meant to argue that conflict in gravity-driven canal networks is an environmentally determined inevitability.[10] Nonetheless, these fundamental realities ensure that the potential for conflict remains ever-present, if latent. As such, canal irrigation tends to encourage farmers to maintain a constant awareness of the water needs of their closest neighbors and to monitor one another in the attempt to ensure a broadly satisfactory distribution of water and labor.[11]

5.1.2: The Border Fayyūm: La cola de agua[12]

Since we lack detailed papyrological evidence from the well-watered central portions of the ancient Fayyūm this chapter will focus on the marginal border villages, the sources of our papyri. It will emerge that the communal practices of the ancient Fayyūm's irrigation communities adhere in general, if not in full, to three principles identified by Thomas Glick as common to Mediterranean irrigation: proportional water allotment; individual responsibility to the community; and the local governance of the water community.[13] Drawing upon considerable comparative material I discuss the social relations of irrigation from the environmental perspective elaborated in the preceding chapters: the tail-end location of these villages, their unpredictable water supply, endemic and increasing scarcity, and progressive land degradation.[14]

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[9] See Ostrom and Gardner (1993) who at p. 94 note that at least in theory an "individually rational" cultivator will *never* maintain the portions of shared canals that traverse his territory. If the farmer assumes that his neighbors will not do the same and that the benefits of his own labor will be minimal, he will not bother. Similarly, if many are investing in the maintenance of the canals on their land, the rational individual has a high incentive to free-ride, incurring substantial benefit with no contribution. Although these scenarios are obviously mere thought experiments they remind us of the inherent difficulties in maintaining a communal system and have indeed been documented. Senzanje and van der Zaag (2004) note the tendency amongst Zimbabwean farmers along the Odzi river in Manicaland to avoid paying their "levy" (irrigation fee) to the water company, which goes toward overall system repair and maintenance. Many farmers here simultaneously neglect the maintenance of their own private canals, seeing it as an unnecessary investment in infrastructural elements that work tolerably at the individual field level, a practice that nonetheless serves to damage the integrity of the network as a whole.

[10] For increased cooperation provoked by water scarcity see the study of Moroccan communal irrigation in Welch (1996), e.g. p. 69: "In the descent from the smaller, wetter upland systems to the larger, drier lowland fields, increasing water scarcity causes greater competition until, in the lowest and driest system, cooperation reemerges as a dominant theme in stress mitigation and water use."

[11] Barnes (2010) at 161-2 relays a telling anecdote from the contemporary Fayyūm: "Before we leave, the community organizers need data. They ask the farmer for the names of the other people who draw from the same mesqa [i.e. local opening on a branch canal]. The son stays silent as his father wrinkles his forehead in concentration and starts relaying a stream of names. Without a pause, he gives the names of 31 farmers and their precise areas of agricultural land, down to the exact qirat [1/24 *feddān*]. As we drive away, I express my wonder at the ease with which this elderly man reeled off the names of each farmer and his landholding. The community organizers look at me in surprise. 'But this is his life, he lives it every day,' one of them says to me."

[12] "The tail end of water," an expression from Sonora, Mexico: Sheridan (1996), 42

[13] Glick (1970), 187-8: "These concepts are found not only in the Code of Hammurabi (Middle Assyrian Laws), but are also characteristic of the medieval Valencian system."

[14] I have derived considerable insight into communal water management from the Ottoman Egyptian material discussed by Mikhail (2010 and 2011a), the Andean communities in Trawick (2001a and 2001b), the Mexican and Mexican-American *acequia* traditions in Crawford (1988), Sheridan (1996), Rodriguez (2006 and 2007), village irrigation in contemporary central Iran in Molle *et al.* (2004), Morocco in Welch (1996) and the modern Fayyūm in Mehanna *et al.* (1984), Price (1993 and 1995a and b), and Barnes (2010). The Roman and late antique material from North Africa in Shaw (1982) and Leone (2012) and Spain in Richardson (1983) and Beltrán-Lloris (2006) have also been highly illustrative, especially when placed in a comparative context.

The analysis is divided into two sections that explore cooperation and conflict surrounding (1) the apportionment of water and (2) the maintenance of the canals network. The red thread running throughout this discussion is the fact that the Fayyūm's border settlements occupied the disadvantageous tail end position in an already water-insecure irrigation network.[15] These tail enders were thus compelled to participate in water- and labor-sharing regimes from which they were not guaranteed to derive a substantial benefit, increasingly so over time. Contrasting the situation on the margins with the precisely articulated system of proportional allotment permitted by the water rich environment of the medieval central Fayyūm, I will argue that the type of proportional allotment practiced on the margins was, in the end, ill-adapted to increasing water insecurity. Irrigation thus remained rather opportunistic and progressively more precarious.

Regarding the maintenance of the physical infrastructure, canal communities often require from their members a public and personal contribution of labor in exchange for later water use. Although we suffer from a predictable dearth of papyrological evidence for such customary practices, several texts indicate that contributions to communal labor on the canals was an expected social norm. Shirking one's responsibilities could provoke the ire of the larger community, or at least a neighbor. Only when one or more members of the community chose to draw local officialdom and its documentary practices into the dispute was evidence for the range of customary social behaviors preserved.[16]

But in the case of maintenance, officialdom was not merely reactive. No Egyptian state could control water but it could control people (or try to do so). At least during the early Roman period (mid 1st to mid 3rd CE) the state's local representatives coordinated communal labor in the Fayyūm via a unique system commonly known in the scholarly literature as the *penthēmeros*, so named from the five obligatory days of annual labor required of able-bodied adult males.[17] It is commonly held that the disappearance of this so-called "corvée" from the papyrological record presaged the ruin of the canals and the decline of the Fayyūm. Rather than viewing the *penthēmeros* as a despotic imposition without which the irrigation system fell apart, however, I argue that we may more profitably understand it as an institutionalization of extant communal behavior. That is, the *penthēmeros* reveals a state that supervised and enforced local customs whose performance helped to guarantee its own revenue stream. By making participation in communal labor a state requirement, the system simultaneously served to bind border farmers to their water-scarce and failing marginal villages. Yet human mobility cannot be fully curtailed and as the margins progressively degraded, these farmers voted with their feet.

5.2: WATER MANAGEMENT

5.2.1: Proportional Allocation

[15] For tail end problems in the modern Egyptian Delta see Radwan (1998). On water distribution, theft, and tail end conditions in the contemporary Fayyūm see Price (1995a).

[16] Cf. Shaw (1982) at 68 on the cutting and erection of the 3rd century irrigation decree at Lamasba ('Ain Merwāna) in North Africa: "It was only *after* the customary controls governing the distribution of water had broken down that specific action was required that resulted in the composition of the irrigation inscription and its engraving on stone."

[17] The *penthēmeros* also covered work on roads (*hodopoiia*). See the series of receipts published as *P.Louvre* I 31 (185 CE), which cover work both on canals and dykes as well as road repairs.

Al-Sharqāwī's artfully rendered chaos can serve as an illustration of a recent assessment of water sharing in the medieval Fayyūm, which was characterized by "an interdependency among villages deriving from the need to communally distribute and use water for agricultural production. Any breakdown of the communal system resulted in struggles for water among the villages."[18] But what might cause such breakdowns? As the fictional Delta village row makes plain, conflicts over water can result from an inability (or unwillingness) to cope with scarcity and over-allocation by reducing demand across the board. Each of the villagers demanding to use Abdul Hadi's *sāqiya* have valid claims upon the shared water, fully legitimate shares that the available resources of the new five-day irrigation regime cannot fulfill. But at least at first, no one is willing to give up any part of their share.[19]

This situation, which had only recently befallen al-Sharqāwī's villagers, was, as I have argued earlier, a constant reality on the ancient Fayyūm's border regions where an "*ean to hydōr katelthēi*" uncertainty reigned.[20] Every farmer might have some manner of legitimate claim upon a portion of the irrigation water but the total amount that travelled down the canals each year will have varied. In practice, this will have presented serious practical problems.

Determining the underlying strategies for water apportionment under such conditions is thus a matter of considerable importance. While the papyri offer no completely unambiguous clues as to the guiding principles of Fayyūm water allocation, we can gain at least some purchase on the issue by looking at the two general strategies in use around the world and eliminating one as almost certainly unworkable. The first—time-based allotment—grants each user a specific amount of time during which they may draw upon the common pool resources. By contrast, proportional allocation allots water in proportion to the amount of land under cultivation (and sometimes also the particular crops grown upon it) or it strikes a more egalitarian posture by allotting each cultivator an identical share of the total supply.[21]

Time-based water allotment was not alien to premodern Egypt. A small collection of 5th century BCE demotic ostraka from 'Ain Manāwir in the Kharga oasis preserve evidence for sophisticated legal rights to irrigation time. The documents refer in various contexts to so-called "days of water:" i.e. lengths of time marked in full days and fractions of days during which one was allowed to draw irrigation water from a specific and occasionally named water source. These "days of water" were inextricably bound to the plot of land they irrigated; when the land was ceded the attached water rights also passed to the new owner.[22]

But as al-Sharqāwī's novel plainly shows, time-based shares are only effective when the water supply is predictable and sufficiently plentiful such that all users are able to make full use of their time-share; when the aggregate supply diminishes, shares must be reduced across the

[18] Sato (1997), 223-4

[19] For a modern large-scale case of over-allocation and the various problems and strategies adopted to deal with competing and equally valid rights to insufficient water see April R. Summitt, "Marketing the Colorado River: Water Allocations in the American Southwest," *Water History* 3.1 (2011), 45-62.

[20] In the simple and matter-of-fact words of the author of *P.Fay.* 131 (3rd-early 4th CE).

[21] These systems are sometimes referred to in the literature as the "Syrian" (proportional) and "Yemenite" (time) systems, e.g. by Scarborough (2003) at 97-9. The terms appear to originate in Glick (1970) at 213-4, where he contrasts a proportional system used in the agricultural area surrounding Damascus in Syria (the *Ghūṭa*) and also in medieval Valencia, with a system in Yemen based upon 24-hour blocks of irrigation time (*farḍ*).

[22] Additional documents show "days of water" used to guarantee loans as well as leased out in connection with the plot of land their water irrigated. The above is drawn from Michel Chaveau, "Les *qanāts* dans les ostaca de Manâwir," in Pierre Briant *ed., Irrigation et drainage dans l'antiquité,* qanāts *et canalizations souterraines in Iran, en Égypte et en Grèce* (Thotm Éditions, 2001), 137-142. Thanks to Andreas Winkler of the Universitet Uppsala for this reference.

board in order to spread the hardship equally. In still-water irrigation systems like that of the Egyptian oases, the community of Lamasba (‘Ain Merwāna) in North Africa,[23] or the highlands of modern Yemen, for instance, interannually reliable and largely unchanging flows of spring water are collected from their sources and stored in common reservoirs, from which they are distributed. Most importantly, the volume of these reservoirs or cisterns can be determined with precision before irrigation begins.[24] In strictly time-based *canal* networks, however, tail end users are consistently penalized by conveyance loss since “the amount of discharge into feeder canals at the tail end of a trunk canal is always less that at the head-end locality, even with identical periods of timed release…during extreme drought, a tail-end user is unlikely to receive water.”[25] This is an aspect of the water scarcity problems in the contemporary Fayyūm, where allocation is measured in large chunks of minutes. Although conveyance loss is understood and farmers try to correct for it, the traditional methods fail to make up for downstream losses. Water scarcity and incidences of water theft increase at greater distances from the water sources.[26]

Time-sharing under the conditions of the annually flood-dependent Fayyūm will have been for all intents and purposes impossible. Time-based irrigation is itself time-intensive, requiring precise measurements of the available water and the subsequent assignment of irrigation times prior to any draws upon the cistern. This is a scenario ill-suited to the ephemeral nature of annual flood recession irrigation. The fevered rush of activity that was required to distribute floodwater as it arrived at al-Lāhūn will have hindered the ability of irrigators and local officials to perform such tasks.[27] In any case, the strict application of timed water draws upstream determined, say, by the size of irrigators’ plots will have left downstream farmers in the premodern Fayyūm highly vulnerable in years of a lower flood. As we have already seen, the water supply in these marginal villages was variable and uncertain. Here, a nebulously defined system of proportional allocation was likely in force, a strategy often adopted in other regions to cope with conditions of scarcity.[28]

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[23] Shaw (1982) and (1984) are the classic studies. See now Leone (2012) for correctives to Shaw’s work and valuable new insights on North African water management in general.

[24] So in the Yemeni highland valley of al-Ahjur, where reliable spring flows are collected in cisterns or dammed basins for later distribution on a rotation cycle throughout the year. One turn in the cycle is “measured at the cistern according to either a defined time unit or a measure of volume.” One studied cistern has a 17-day rotation cycle, the smallest unit of irrigation time in which is the *rub‘* or “quarter” (of a 12-hour day). In other areas, water is distributed only after the contents of a cistern have been measured in “hand widths.” The irrigator’s turn is then measured in hand widths, converted into a time unit (an easy process when the total volume is known). Few disputes occur since the aggregate water supply is strictly quantifiable and everyone knows what is coming to him. Source: Varisco (1983), 271-3. For water in the desert oases of Egypt see Shmuel Burmil, “Landscape and water in the oases of Egypt’s western desert,” *Landscape Research* 28.4 (2003), 427-40.

[25] Scarborough (2003), 99.

[26] Price (1995), discussed further below. DeVeer (1993) discusses how the non-uniformity of water deliveries to different portions of the modern Fayyūm affects cropping intensity and forces constant adjustments in the watering schedule. For a schematic, prescriptive overview of apportionment strategies see Mehanna *et al.* (1984).

[27] Drawing on Varisco (1983) at 374-5 in reference to flood irrigation management in coastal lowland Yemen, as contrasted with the time-based strategies in the spring water irrigated highlands.

[28] Cf. modern Zimbabwe: Senzanje and van der Zaag (2004), esp. at 1346.

Fig. 20: A collection and distribution cistern in Egypt's Baḥriyya Oasis, which doubles as a communal bathing-*cum*-swimming hole. Photo: B. Haug, 6 June 2010.

5.2.2: Water Allocation and Certainty

Not all water apportionment issues in the Fayyūm were so fraught, however. Indeed, villages or groups of individuals might hold recognized and defensible rights to specific, identified water sources like reservoirs or wells. The text published as *P.Haun.* III 58 (439 CE) ought to be placed in this context and regarded as evidence for mundane disputes over water rights in a water scarce environment, rather than being seen as evidence for the late antique decline of the irrigation system.[29] In this difficult text farmers working lands adjacent to Karanis draft a signed declaration of their rights to the resources of a reservoir called Thanesamen and the fields (*klēroi*) around it.[30] They additionally threaten to demolish any attempt by the Karanitai to appropriate its water for their own use. Such actions, they flatly assert, "will incur no blame from any person from the village."[31] The text refers to itself as a cheirograph and on the verso as a *deixeis*, which Danielle Bonneau connects with an *apodeixis*, a "pièce pouvant servir d'élément

[29] In his discussion of late antique Karanis Van Minnen argues that *P.Haun.* III 58 graphically illustrates "the demise of the agricultural regime at Karanis" and the "difficulties the village experienced with the water supply." Van Minnen (1995), 50-1. Van Minnen uses the translation of Rea (1993) at 89-95, who discusses the peculiarities of the text, particularly its odd vocabulary.

[30] The oddities of the Greek are original to the text. ll. 8-10: μηδὶς τῆς κώμης ἐξουσεύσει ἀναλαβῖ⟨ν⟩ νειρὼν εἰς τὼ Θανεσαμὴν μηδέ τινα τῆς αὐτῆς κώμης ἐξουσεύσει κλήρων τῶν ἐμπροστὰ τὴς αὐτῆς Θανεσαμήν. διὰ τοῦτω πεποιήμεθα τήνδε τὴν χῖραν ("Nobody from the village shall have the authority to draw water at Thanesamen, nor shall any from the same village have authority over the allotments in front of the same Thanesamen. For this reason we have made this cheirograph"). Trans. Rea (1993).

[31] ll. 12-15: εἴ τί τινα εὑρήσκομεν κατῖνον τῆς αὐτῆς κώμης Καρανίδος ἀναλαμβάνον⟨τα⟩ νειρὼν εἰς Θανεσαμὴν καὶ συνκλάσομεν αὐτούς, οὐκ ἔχομεν μέμψιν παρά τινα τῆς κώμης ("if we find any basin of the same village of Caranis drawing any water (whatsoever ?) at Thanesamen and we smash them, we incur no blame from any person from the village"). *Katinon* was previously interpreted as an ancient variant of modern Greek κάτι ("something"). Rea (p. 93) prefers a derivation from Latin *catinus*, "natural hollow in rocks (Plin., NH 34.125), and the collecting chamber of a force pump, called in Latin the *Ctesibica machina* (Vitruv. 10.7.1-4; cf. RE XI col. 2076 sec. 4)."

de preuve."[32] Since Karanis' canals were most likely dry during the season of low water, its residents had considerable impetus to pilfer water from a nearby storage basin to supplement their own perhaps meager supplies.[33] That the text is simply an assertion of legal-customary rights is made clear by the postscript (ll. 18-19), where the farmers acknowledge the right of a pastoralist(s) to continue feeding flocks in the area unhindered, since this has been going on "since the beginning" (*apo exarchēs*) "en vertu d'une antique coutume" in Bonneau's words.[34]

Reservoirs like the so-called Thanesamen do not pose difficult theoretical issues of water rights since those who built and maintained them can make simple and compelling arguments in defense of their exclusive rights. But as we have seen, canals present rather thornier problems. Yet despite these difficulties, a reliable and predictable water supply that meets or even exceeds the needs of every user can act as a buffer in the event of upstream profligacy and obviate many potential sources of conflict.

This is the situation that obtained in al-Nābulusī's 13th century Fayyūm, in which settlement had retrenched to occupy only the best-watered, low-altitude section of the alluvial plain. Here, the dependable and abundant water supply could be more easily apportioned (all the more so since the needs of far-flung desert border villages were no longer a concern). Al-Nābulusī records that almost every village in his Fayyūm was entitled to a precisely defined amount of canal water allotted by means of a weir opening linearly measured in *qubaḍ*.[35] He indicates the canal(s) to which a village has rights (*ḥaqq*, pl. *ḥuqūq*), the amount of its water allotment, and occasionally the villages with which it shared a canal. In cases where several villages lay along the same canal and used the water in cooperation (*shirka*), each drew upon the canal according to a fixed share determined by customary right. The village of Abūksā, for instance, shared water with Babīg Anshū, Abshīyyat al-Rammān (ancient Pisais), Tubhār and Girdū (ancient Kieratou) and drew a share of 13 *qubaḍ*. The case of Būsīr Dafadnū provides an even clearer example. It shared water with the villages of Dafadnū (ancient Tebetny)[36] and Dumūshīyya (ancient Mouchis), and was entitled to one-third of the total (as were its two neighbors).[37]

Al-Nābulusī also preserves minimal evidence for the intra-village water rights of larger landholders, though unfortunately not for the methods used by the peasantry to distribute water amongst themselves.[38] For example, the village of Sinnūris (ancient Psenyris), one of the medieval Fayyūm's largest settlements, was watered by a canal called al-Nāhiya and was entitled to a total of 19 *qubaḍ* of its flow for winter crops, sugar cane, summer crops and privately owned land. Al-Nābulusī records the amounts of water allotted to higher-status land holders, owners of plots known as *rizaq*: 1 *qubda* for the priests (an uncertain reading),[39] ½ *qubḍa* for Friday

[32] Bonneau (1979), 17
[33] Cf. *P.Col*. VII 174 (325-50 CE) for the use of a reservoir in Karanis for agricultural purposes.
[34] Bonneau (1979), 19. The vocabulary and grammar of this passage and the text as a whole are problematic. See Rea (1993) at 94.
[35] Sato (1997), 222-3, citing *TF* 46. *Qubḍa,* pl. *qubaḍ,* the measurement of a weir-opening is discussed above in chapter four, page 147, at note 63.
[36] Modern Difinnū, 29° 14' 8" N, 30° 48' 19" E.
[37] Sato (1997), 222-3, citing *TF* 62.
[38] Sato (1997) 224, citing *TF* 107.
[39] The noun is *al-quṣṣāṣ*, a story teller. Rapoport and Shahar comment that this may be a mistake in the MS for *qasīs*, "priest."

preachers, 1 *qubḍa* for the watchman, ½ *qubḍa* for the village *shaykh*s, ¾ *qubḍa* for the so-called overseers and ¼ *qubḍa* for the monastery.[40]

Precision is this system's defining feature and water allotment is presented as a simple matter of linear measurement. The canal serving a community or an individual landholding is governed by a weir with an opening precisely measured in "fist lengths" that allowed a proportion of the canal's flow to pass through. But such precision depends upon plenty and the ease of distribution in this part of the Fayyūm: even if the canal flow was low, everyone, even those at the tail end, can be assured some share of the flowing water. Indeed, the only water scarcity al-Nābulusī notes occurs in the height of summer, when the canals had long since ceased to flow and villages depended on the residual seepage. But this was not how irrigation along the premodern margins functioned. Scarcity and the difficulty of delivery and distribution were the rule here, making allotment a more difficult proposition.

5.2.3.: Water Allocation and Uncertainty

Nowhere in the papyri from the margins is there even the slightest hint of specifically defined rights to canal water in a manner similar to that in the 13th century central Fayyūm. This was in large part a function of their altitude, as comparison with al-Nābulusī's Fayyūm makes clear. Even here, not every village was allotted a precise amount of water in *qubaḍ*, and six sites were served by canals without a water quota. That is, these canals were either fitted with a weir without a specified width or were entirely without a weir. In all cases such canals are said to be "without quota, due to the elevation of the land" (*bi-ghayr 'ibra bi-ḥukm 'uluwwi al-arḍ*).[41] The small village of Ṣanūfar (Greek Pseonnophris), for instance, referred to as one of the "ancient villages" (*al-bilād al-'itq*), lay just to the southeast of the capital.[42] It possessed, according to Nābulusī, a fair number of date palms and other trees and was watered by three different irrigation canals, none of which were assigned a water quota "due to the elevation of the land."[43] The same is true for the village of Qushūsh, a settlement somewhere in the environs of Medīnat al-Fayyūm. It received its water from the the Baḥr Yusuf via three irrigation ditches "without weirs or quota, due to the elevation of its land."[44] So too Abū 'Uṣayya, a small hamlet of a few houses attached to the village of Minyat Karbīs (probably ancient Karpe) about a half an hour's ride northwest of the capital. Once again, "it has no recorded [water] quota due to the elevation of its locality."[45] There is also the small village cluster of Minyat al-Dīk, Banū Majnūn and Shalmaṣ, again somewhere just to the northwest of Medīnat al-Fayyūm. The canal of Banū Majnūn is said to be equipped with "one sluicegate, without weir and without quota, due to the elevation of its land." Additional small canals serving this village cluster are also said to be "on high ground" and without quota.[46] Al-Nābulusī also mentions a canal here by the name of 'Anz Shalmaṣ, which was probably also connected to the nearby village known simply as 'Anz, a half an hour's ride somewhere to the

[40] The village had two churches, one out of use, as well as a monastery. As a whole, Rapoport and Shahar claim that Christian presences seems to be eroding in al-Nābulusī's period. Of the twenty-one churches and seven monasteries recorded in the *TF,* only fourteen churches and six monasteries remained in use. See the data presented in the authors' website: http://www.history.qmul.ac.uk/ruralsocietyislam/database/index.html.
[41] Rapoport and Shahar (2012), 19.
[42] Modern Sanūfar: 29º 16' 40" N, 30º 52' 01" E.
[43] *TF* 126.
[44] *TF* 143.
[45] *TF* 146.
[46] TF 166.

west of the capital.[47] This small village was irrigated by a single canal "with one sluice-gate, without quota," though Nābulusī makes no reference here to the village's elevation.[48] Lastly, Ghābat Bāja, a village just south of the Medīna was watered by two canals and a small irrigation ditch. Al-Nābulusī says that the village itself has a quota of five *qubaḍ* from the first canal but only four from the second, once again due to the elevation of the land. The ditch too had no weir or water quota.[49]

In contrast to the other settlements of the medieval period, the comparably high elevation of these anomalous locales clearly affected their ability to draw upon a predictable water flow from the nearby canals. Since water was delivered downhill by gravity in the Fayyūm, only the impetus of the flood could irrigate the more elevated "uphill" fields of these villages. The inherent variability of the flood would leave these settlements with a more erratic, variable water supply than their lower elevation neighbors. It would thus have been pointless here to assign a specific water quota if the stated allotment could not be guaranteed. Such locales were likely cultivated more opportunistically, based upon the amount of water they received.[50]

A similar situation, I argue, obtained on the ancient margins of the Fayyūm. The relatively high elevation of the marginal villages, the difficulties of water delivery, and the subsequently uncertain supply impacted the ability to develop a clearly articulated system of allotment. The papyri, in consequence, betray no evidence of systematization. Some manner of proportional allotment was the only viable water sharing strategy. As expected, of course, the papyri offer next to nothing regarding the routine business of apportionment. Still, the archive of Sakaon preserves a unique text, *P.Sakaon* 33 (320 CE), that allows us to see both the practice of traditional proportional allotment as well as its very serious weaknesses in a water insecure environment.

P.Sakaon 33 is a fragmentary bilingual (Latin and Greek) account of proceedings before a *praeses* regarding alleged water theft. Sakaon and the few remaining Theadelphians claim that the inhabitants of Andromachis, a village of the Themistos *meris* somewhere to the south of Theadelphia, have blocked the mouth of a canal (*diōryx*) leading to Theadelphia thus depriving the downstream village of water.[51] In the judgment of the *praeses* Quintius Iper, the villagers of Andromachis are to draw water in proportion to the needs of their own holdings of twenty arouras (*percepta sufficiente aqua iuxta terram quam possident*) and release the rest downstream (*superfluam…tradant*). This judgment adheres to a principal embodied in a decision of Pius and Verus preserved in *Dig*. 8.3.17 that states that "water from public streams ought to be divided for the irrigation of fields in proportion to the holdings."[52]

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[47] For the village of ʻAnz see *TF* 131-2.

[48] *TF* 166.

[49] *TF* 132.

[50] The papyri show similar attention to land typology based upon water provision. E.g. the annually shifting amount of shore land (*aigialos*) cultivated by the inhabitants of Soknopaiou Nesos (Hobson [1984]), and the marginal, underproductive marsh land (*limnitikē gē*) of the Delta (Blouin [2007], 148). Anthropologist Thomas Park notes a similar differentiation in modern Senegal where, as in premodern Egypt, flood recession agriculture is practiced: riverbank flood lands (*falo*), higher, rarely flooded lands (*fonde*), basic flood plain (*waalo*), and lands where only rain-fed agriculture is possible (*jeeri*). Park (1992), 94.

[51] The claimants note that something had been done to the canal in the past (*eti toinun palai*) by one Alypios. Rathbone (1991) at 227 connects this with canal works undertaken by Alypios, the general manager of the Appianus estate.

[52] "*Imperatores Antoninus et Verus Augusti rescripserunt aquam de illumine publico pro modo possessionum ad irrigandos agros dividi oportere.*" Cited and translated in Beltrán-Lloris (2006), 170 at n. 78. So also on private estates. When land was divided into two parcels and sold separately, the water that had once served the whole

Whatever its use elsewhere in the Empire, the superficially fair practice of absolute proportionality would have been deeply problematic in the flood-dependent Fayyūm, the problems increasing at greater distances from the Lāhūn gap. First, as demonstrated earlier, the only predictable aspect of water delivery on the margins was its unpredictability. The gross amount of water that entered the depression each year varied in line with the size of the annual flood and the tail end villages might receive only a negligible flow. If each village along the major border canals made only "fair" water withdrawals in direct proportion to the land under cultivation, the chances of shortages increased at every stop along the route. By the time even a largely sufficient flood reached a tail-end village like Theadelphia, conveyance loss will have also consumed its own proportion of the aggregate supply. It is possible that the most distant settlements were only truly water-secure during a larger than average flood or during the earliest periods of the Fayyūm's reclamation when population, the cultivated area, and thus overall water demand were all considerably smaller.

The deficiencies of such a system of water allocation have been recognized elsewhere in the empire. Dennis Kehoe has drawn attention to *CJ* 11.63.1 (319 CE), which concerns some manner of water dispute in Roman North Africa between emphyteutic possessors of certain lands and their *coloni*.[53] The constitution states that the *coloni* had usurped spring waters on unimproved lands for their own use although they were legally permitted to use water only on lands that they were currently cultivating and improving. According to the terms of the constitution, control over all water was to be returned to the *emphyteuticarii* while the *coloni* were "to be permitted only so much water as is manifestly sufficient for the cultivation of those lands that they themselves cultivate."[54] As Kehoe rightly notes, this formulation presents considerable difficulties by simply giving the *coloni* a right of access to water rather than setting down a specific amount or time-based system: "the water the *coloni* could legally consume might increase as they brought more land under cultivation. Farmers with guaranteed rights to water would have every incentive to use more of it, even to exhaust it."[55]

The Fayyūm presents similar difficulties. Water apportionment was certainly not anarchic, for it appears to have been treated as a common pool resource regulated by a customary principle of proportionality (expressed more legalistically by the prefect Iper as *aqua iuxta terram*). Nevertheless, the rules seem to have been difficult to enforce. Taxation was a constant and endemic water scarcity provided the ostensibly "rational" upstream farmer with perverse incentives to take more than his proportional "fair share." The situation faced by the inhabitants of the medieval tail end village of Old Shāna mentioned in chapter four is a case in point. Although Old Shāna presumably had a proportional water allotment identical or at least similar to New Shāna's twenty-four *qabḍa*s, al-Nābulusī writes that one of the reasons for the population's inward migration was the expansion of sugar cane cultivation elsewhere in the Fayyūm, a matter that apparently affected Old Shāna's water supply.[56] In short, if upstream

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property was to be divided equally between the two separate portions, regardless of the interests of the new owners and the use to which they intended to put the land. From *Dig.* 8.3.25: "there should be a sharing of the water in proportion to the amount of land that is retained or alienated (*sed pro modo agri detenti aut alienati fiat eius aquae divisio*): Cited and translated in Bannon (2009), 201-2.

[53] Emphyteutic possessors are a sort of permanent public tenant. As Kehoe describes them, they "held perpetual rights to land granted to them by the state in exchange for the payment of a fixed yearly rent (*canon*)." Kehoe (2008), 247.

[54] Kehoe (2008), 247

[55] Kehoe (2008), 248

[56] *TF* 122.

Fayyūm villages chose to expand cultivation and water consumption (including through the construction of additional cisterns) they created a negative externality impacting downstream cultivators, particularly in years of dearth.

5.2.4: Stealing to Survive

The fundamental scarcity of water and the inevitable inequity of its apportionment created perverse incentives for tail enders in antiquity. Faced with an uncertain and occasionally insufficient water supply, downstream farmers had to resort to water theft in order to make up the deficits. We do, in fact, have a small corpus of papyri documenting such practices since the victims occasionally penned complaints to local government officials.

I begin with surely the most famous of these documents, although it is not as clear a case of theft as other texts in the corpus. The well known *P.Sakaon* 35 (ca. 332) was composed in the name of Sakaon and two other villagers of Theadelphia, who claim to be the sole remaining inhabitants. The text is a statement of case, a *narratio*, (unannotated and thus never formally used[57]), which concerns the taxes owing on 500 arouras of uninundated land. Water has failed to reach Theadelphia, Sakaon and his co-complainants allege, because three upstream villages along the *diōryx Psinaleitidos* (Baḥr al-Nezla), Narmouthis, Hermopolis and Theoxenis, have stolen Theadelphia's share: "the nearest villages...steal our water and prevent our land from being irrigated (ll. 6-10)." This illicit appropriation of Theadelphia's water is possible since the three other villages "are at the front of the *pagi* [i.e. upstream to the south] and we are at the far end of the *pagus* [i.e. downstream to the north]" (ll. 10-12).[58]

Although this papyrus continues to be cited as evidence for the decline of the canal system in late antiquity and the subsequent need for villagers to resort to theft,[59] in the context of this and the previous chapter, we have cause to be suspicious. After all, the weakness of its flow at Theadelphia and the difficulties of traditional basin irrigation was already clear by the 3rd century.[60] Can Sakaon have known with absolute certainty that it was theft rather than the basic inefficiency of the system that was to blame? As has been noted of the modern Fayyūm, farmers tend not to know every user even along a branch canal (canals stemming from the major modern waterways). They may be intimately familiar with those who farm in close proximity to their own holdings, but distances as few as ten kilometers away are foreign territory.[61] It may be perverse to be so skeptical. After all, in *P.Sakaon* 44, Sakaon claims to have ferreted out Theadelphian tax fugitives to the south of the Fayyūm in the Oxyrhynchite and Kynopolite nomes. Nevertheless, we would do well to at least be aware that Sakaon may have made a deliberate choice to adopt the rhetoric of theft and victimhood. As we will shortly see, water theft was indeed rampant in the Fayyūm in all periods (at least within villages) and Roman legislation was well aware of the problems of upstream-downstream relations.[62] Still, this is a case that might have had more to do with the general conditions of scarcity, the emigration of most of the Theadelphians, and the subsequent disrepair of the infrastructure they had once managed.

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[57] So Bagnall (1982), 57. See this article for details on the population of Theadelphia in the fourth century CE.
[58] Trans. G. Parássoglu in *P.Sakaon*.
[59] E.g. Bagnall (1985), 296-7, Grey (2011), 114.
[60] See the letter published as *P.Prag.Varcl* II 52., already discussed above in chapter four at page 146.
[61] Barnes (2010), 171
[62] Beltrán-Lloris (2006) at 174 discusses this issue with reference to Sec. 3b (I.34-8) of the *Lex rivi Hiberiensis*, which recognizes that bridges or dams installed in or across a canal present problems for downstream irrigators and must be kept free of any debris that would affect downstream flow.

Suspicions aside, the papyri preserve additional documents that rather more clearly document the occasional nefarious conduct of Fayyūm irrigators. In 225 BCE, for instance, Zenon received a letter about conflict between residents of the neighboring villages of Philadelphia and Ammonias concerning water and the vandalism of channels (*P.Lond.* VII 1967). The letter is brief and somewhat damaged but it seems to relate to the villagers of Philadelphia damaging local waterways and depriving the villagers of Ammonias of water. More seriously, Menches' dossier preserves the complaints of residents of Kerkeosiris installed on royal lands, who claim that their crop has been planted too late and that their attempts to water it had been hindered by residents of neighboring Berenikis Thesmophorou (*P.Tebt.* I 61B ll. 350-80, 118-7 BCE). The most likely scenario places both Ammonias and Kerkeosiris downstream from Philadelphia and Berenikis Thesmophorou and thus more vulnerable to their upstream neighbors.[63]

But the most substantial and informative text from the period is *P.Tebt.* I 50 (112/111 BCE). The papyrus preserves a complete petition to Menches from one Pasis also of the village of Kerkeosiris. Pasis claims that he has been watering the royal land belonging to him "from old established custom" (*tōn emprosthen chronōn ethismou ontos*) via a canal that runs to his plot after passing through the land of his upstream neighbor Lykos as well as the fields of other unnamed farmers. Pasis further claims that, while he had been away on business, his neighbor Lykos opportunistically dammed his section of the canal causing Pasis' plot to go unirrigated. Although an earlier legal decision had favored Pasis, he claims that Lykos had procrastinated in its implementation and Pasis' land subsequently lacked adequate water for a full five years. Regardless of the veracity of the allegations, Lykos must be the upstream irrigator, where he possessed the ability to use his position to the detriment of his neighbor. The situation recalls the similar need in the modern Fayyūm to closely monitor one's canal neighbor, just in case.

The Roman period preserves two additional examples of water theft and conflict. In *P.Ryl*. II 133 (33 CE), Penneis, a cultivator in Euhemeria, sends to Euandros, a priest of the cult of Tiberius, complaining that one Onnophris purposely broke a transverse dike (*emblēma*) that Penneis claims to have built at no small expense. The petitioner Penneis gives no motive for Onnophris' behavior nor is the geographical relationship between the two made clear. It seems plausible, however, that Onnophris was somewhere downstream and desired quicker access to the water being detained and diverted onto Penneis' field by the *emblēma* in question. The text is dated to the 17th of the month of Neos Sebastos, i.e. the middle of November and near the end of the Fayyūm's irrigation season. Since the village of Euhemeria already lay near the very end of the canal system with only Philoteris and Dionysias still farther down the line, it is at least possible that Onnophris was desperate to secure his own water supply at the expense of his upstream neighbor.

P.Merton I 11 (39/40), an unfortunately abraded text, preserves the petition of the Philadelphian farmer Harpaesis to the *stratēgos* (governor) of the Themistos. Harpaesis, a cultivator of 100 arouras of royal land, claims to have done a proper job of farming his plot and monitoring the integrity of its dykes. His stated and obviously calculated wish in the petition is to water the aforementioned arouras "so that no deficit should occur in the 820 artabas of wheat which I pay to the state." Harpaesis goes on to claim that he has been prevented (*ekōluthēn*) from watering by one Sambas and a crowd (*synodos*) of fifty men. The text is heavily damaged

[63] If this suspicion is correct, Berenikis should be moved eastward on the map appearing in Derda (2006), which itself draws upon Mueller (2004).

at this crucial point though it seems that the petitioner claims that Sambas appropriated the water for his own use: there is mention of water and, after a short lacuna, a reference to "his own *klēros* neighboring my aforementioned [land]."[64] As with *P.Ryl*. II 133, we have no further background information and are reduced to speculation. Here, it does seem clearer that one cultivator "stole" water from a neighbor by diverting it to his own holdings. Once again, we might with reason look to conditions of water scarcity at the downstream village of Philadelphia. Harpaesis' 100 arouras will have consumed a far greater amount of the available water than the lands of smallholders in the village. That the main offender Sambas (allegedly) appeared in the company of fifty other men at least suggests a widespread dissatisfaction with Harpaesis' water use in the village and the desire to reallocate the scarce resources to others, even if this required acts of violence.

Finally, to return to Theadelphia, *P.Sakaon* 45 (334 CE) preserves a straightforward account of theft. In this petition to an eirenarch, Sakaon complains that at the time of the flood (*kairon tōn hydatōn*) several individuals, presumably fellow villagers since their origins are unstated, placed a transverse dyke (*emblēma*) in the canal (*diōryx*) "contrary to what is permitted" by imperial law.[65] It would seem that Sakaon's upstream neighbors had installed a transverse dyke on the canal in question to channel more of its flow to their own plots, thus depriving Sakaon's fields.[66]

These few papyri represent just the sorts of troubles we should expect to see at the tail ends of the Fayyūm's irrigation network. With a scarce, ephemeral water supply, villages towards the bottoms of the canals will have had more difficulty in allocating water without provoking occasional strife. For the most part, these papyri bear out Beltrán-Lloris' proposition that where records of conflict are preserved, "those who initiate an appeal before a higher authority are usually those who consider themselves the injured party (the other party, obviously, does not usually show so much interest in having the matter settled) and they are the ones who are usually downstream in the irrigation system, and therefore in a weaker position."[67] As his own study of the Latin *Lex rivi Hiberensis* demonstrates, the settlement and regulations preserved in the inscription seem to have originated in a complaint by the downstream irrigators of the community of Caesaraugusta, who had been adversely affected in some way by the water use of the upstream Belsinonenses. This is obviously not a hard-and-fast rule since the Rylands and Merton texts mentioned above seem to come from upstream irrigators who had been—allegedly—wronged by downstream neighbors. Whatever the case, the papyri nevertheless show that water theft was a fact of life in the downstream Fayyūm, something to which Sakaon could make legitimate appeal in *P.Sakaon* 35.

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[64] At ll. 21-4: ὕ-]δωρ . . . . . [εἰς τὸν] αὐτοῦ κλῆρον γ[ειτνιῶ(ντα)] ἐμοῦ προκιμένου.

[65] ll. 9-12: ἔμβλημα βαλών[τ]ες ἐ[ν τ]ῇ διώρυχου (*pap.* l. διώρυχι) παρὰ τὸ μὴ [ἐ]ξόν — [καὶ] θῖος (*pap.* l. θεῖος) νόμος ἐφύτευσεν μὴ βαλέσθ[α]ι ἔμβλημα. On *emblēmata* see Bonneau (1993), 39-44.

[66] The appeal to "imperial law" need not be a wholly rhetorical posture. *CJ* 9.38.1 (*de Nili aggeribus non rumpendis*) threatens with the customary spectacular punishment "any man in Egypt [who] hereafter diverts any flow of water from its customary use, contrary to law and the custom of antiquity, before the Nile has risen twelve cubits." Although the immediate point of reference in the law is tampering with flood control structures during the initial rising of the Nile, it is possible that there were other laws on the destruction of irrigation works or the illicit diversions of water flows. Thanks to Ari Bryen for this reference.

[67] Beltrán-Lloris (2006), 189.

5.2.5: Still Stealing: The Modern Parallel

A prescriptive study of water allotment in the modern Fayyūm states that "everyone gets his fair share of water (more or less), but at the cost of watching not to be cheated, which means that when someone is irrigating, someone else must stay at the branching point on the canal to make sure that nobody comes and diverts the water."[68] According to anthropologist David Price, however, this description papers over the "degree of water theft, social dissatisfaction, and irrigation conflict" that affects contemporary irrigators. For Price, water theft in the Fayyūm is a daily fact of life and "a vital cultural element of agricultural production" especially for those at greater and greater distances downstream from the water source.[69] Indeed, an anecdote related by Dutch journalist Joris Luyendijk captures its ordinariness. A Dutch NGO project leader asks a farmer how local responses to water theft had changed after the introduction of cooperative "water user associations" in the Fayyūm:

> "We smash [the thief's] face in!" they said. The farmers did what all Egyptians do after a joke—they shook hands. "But afterwards we call an emergency meeting of the board" the older farmer said. "On behalf of the Egyptian people, I'd like to thank the Dutch for their help," he said, now with disarming solemnity. "There are fewer stabbings now, and I have more harvest."[70]

But why resort to theft? The reasons are the same as those adduced in the discussion of theft in antiquity. In general, because of the reliable and perennial availability of water, the contemporary system of distribution is time-based and structured around local scheduling groups. Each group determines when their members may divert water from main canals into feeder/branch canals and from there into their private fields. The effects of conveyance loss are recognized and irrigators adjust for it through a system dubbed *magrūr*. A small stick or piece of straw is dropped into the intake canal and the time it takes the stick to travel downstream to the farmer's field is measured and added on to the farmer's total irrigation time. Although it is widely trusted, the practice fails to make up for the totality of water lost in transmission.

As such, even the copious perennial water supply is distributed unequally: farmers towards the end of an irrigation group inevitably receive less than their fair share of water when compared to those nearer to the main feeder canals. In an irrigation group of twenty members (the largest group Price sampled) the member at the head of the canal received a flow of 25 liters per second to his fields while the farmer at the tail-end of the group received only 5 l/s. Paradoxically, although farmers generally claim to have faith in the efficacy of the *magrūr* system in correcting for conveyance loss, incidences of water theft increase at greater distances from source canals.

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[68] Mehanna, *et al.* (1984), 109.

[69] Price (1995a), quotes at 100 and 108. The following section is based upon this study.

[70] Joris Luyendijk, (trans. Michele Huchinson) *People Like Us: Misrepresenting the Middle East*, (Soft Skull Press, Berkeley, 2009), 55-6. Originally published as *Het zijn net mensen* (Uitgeverij Podium, Holland, 2006). The long-running Dutch project to institute "WUAs" in the modern Fayyūm is discussed in depth by Barnes (2010) at chapter two, 134-200.

Fig. 21: A sluicegate on a branch canal in ʻIzbat Tūnsī. The simple gate is not watertight and a small amount of water constantly trickles into the field channel (conveyance loss). Photo: B. Haug, November 15, 2011.

The modern parallel of life along a single village canal can serve as a snapshot of the Fayyūm in miniature. Those farmers toward the head of the canal remain more prosperous due to a heavy water flow, while those at the tail struggle and are highly motivated to steal. Price notes that such theft is generally referred to as defensive ("I steal only as *he* forces me") and remains a fact of life, generally tolerated to a degree since, at one point or another, everyone has stolen.[71]

Yet the social relationships of water flow in the contemporary Fayyūm are shaped in large part by the existence of widespread, fully private land ownership. A private landowner at the head of a canal and his tail-end neighbor are to a great extent anchored in their respective positions. Unless these are somehow reversed, one of the two will forever suffer the adverse consequences of his position along the shared waterway, being "forever expectant, forever disappointed."[72] This was not necessarily always the case in Graeco-Roman Egypt, where a fair amount of the country's total land was nominally public and leased out by the state: so-called "royal land" (*basilikē gē*) in the Ptolemaic period and "public land" (*dēmosia gē*) in the Roman period.[73] Although tenancy of such lands could become permanent through a sort of hereditary lease, the tenure of public land in the Fayyūm was periodically shuffled and lands redistributed. A single text from Tebtunis has garnered much commentary although numerous other papyri from Theadelphia, Karanis, and Soknopaiou Nesos refer to redivisions of village land.[74] The Tebtunis papyrus (*P.Tebt.* II 376, 162 CE), a contract of sublease, refers explicitly to "the

[71] Price (1995), 105-6.
[72] Crawford (1988), 24. Quoted above in the epigraph to this chapter.
[73] Monson (2012) remarks at 93 that the terms are not entirely synonymous and are distinguished in several texts "perhaps because public land included not only the former Ptolemaic royal land but also land that the Roman state acquired through subsequent confiscations."
[74] For these papyri see Monson (2012) at 150 with n. 240 to 242.

coming joint leasing-out (*diamisthōsis*) of farmers."[75] In Fayyūm villages, these tenants of public lands self-identified as a collective, the *dēmosioi gēorgoi*, and were headed by a *hēgoumenos* and a body of "elders" (*presbyteroi*), and a scribe.[76]

Largely unattested in the Nile Valley, these Fayyūm collectives are but one aspect of the strong regionalism of land tenure regimes in Graeco-Roman Egypt, now fully documented by Andrew Monson.[77] Fayyūm public farmers periodically shuffled their own deck, redistributing public lands amongst the members of their community. Jane Rowlandson compares this to a system of redistribution documented in rural Vietnam, in which the tenure of marginal land of variable quality is periodically shifted from farmer to farmer.[78] One might also compare the Egyptian situation to the system of rotating tenure in Palestine (*musha'*), abolished by the British Mandatory authority in favor of private ownership on the basis of its supposed archaism and economic irrationality. Generally rotating every two years, the system spread risk widely and acted to reduce disputes amongst farmers.[79] Rowlandson rightly notes that in a marginal environment like that of the Fayyūm's borders, of rotating tenure "would have a particular point where villages lay on the desert edge, with some of the land poorly irrigated and subject to sand erosion."[80]

The particularities of water flow on the margins of the Fayyūm informed the relationships between cultivators. As we will see in the second section of this chapter, these conditions also surely informed the maintenance of the irrigation system, which remained a matter of local responsibility. Although the state maintained a keen interest in the upkeep and profitability of irrigated Fayyūm agriculture, its powers to keep cultivators anchored to their villages and their canals was not absolute.

5.3: Infrastructure and Commnuity

5.3.1: Good dykes, good neighbors

This section of the chapter examines the problems inherent in the maintenance of irrigation canals in a degrading and underproductive agricultural environment. I will not delve into the nature of Fayyūm irrigation officialdom, a matter already dealt with in great detail by Danielle Bonneau.[81] Indeed, too narrow a focus upon the governmental side of things obscures the communal hyperlocalism of canal labor. The local nature of labor has already been noted by Dominic Rathbone, who writes that canal maintenance was "a communal obligation in theory directed and enforced by the local authorities, while the smaller local canals and dykes were the responsibility of the landowners whose fields they served."[82] This being the case, every Fayyūm

[75] ll. 14-15: μέχρι τῆς ἐσομένης κοινῆς γεωργῶν διαμισθώσεως

[76] Rowlandson (2005), 189, citing *P.Mich.* V 189, receipt for rent payment from a public farmer, witnessed by the *hēgoumenos, presbyteroi*, and the scribe of the collective. In the Fayyūm, she further notes, these public farmers may have had assets in addition to their public lands, but are known to be owners of private land.

[77] Monson (2012), 73-107.

[78] Rowlansdon (1996), 82, citing S.L. Popkin, *The Rational Peasant: The Political Economy of Rural Society in Vietnam* (Berkeley, 1979), 104.

[79] See Amos Nadan, "Colonial Misunderstanding of an Efficient Peasant Institution: Land Settlement and *Musha'* Tenure in Mandate Palestine, 1921-47," *JESHO* 46.3 (2003), 320-54. Cf. Monson (2012), 153, who notes the utility of land redistribution in Egypt "for spreading the risk of unpredictable floods and excessive tax burdens."

[80] Rowlandson (1996), 82.

[81] Bonneau (1993).

[82] Rathbone (1991), 220. Rapoport and Shahar (2012) reveal in detail the localism of Fayyūm irrigation labor in the 13th century.

farmer who relocated represented a reduction of a local community's ability to maintain the infrastructure upon which it depended.

I do not stress the localism of labor in an attempt to depict some sort of independent, autonomous rural idyll. Corralling and cajoling everyone to do his or her part was surely never an easy task: the responsible local in a modern Sonora, Mexico *acequia* community, the *juez de aguas,*[83] has an unenviable position:

> Because floods and other natural insults to the system cannot be predicted, water-users or their journaleros [hired laborers] have to be rounded up after the fact. Some are busy. Others are not at home. The water judge has the power to fine those who do not show up, but many prefer to pay the money rather than invest the labor. As a result, the juez de agua spends more time bringing together fewer people, and the ones he does manage to corral often grumble about doing more than their fair share.[84]

Before getting into the problems of communal maintenance, however, we will look at a more basic problem, one that illustrates the unique interdependency created by Fayyūm irrigation: the difficulties of practicing small-scale basin irrigation in close proximity to a neighbor in a drainage-poor environment. After the flood had irrigated land contained within private *perichōmata* (ring dykes), the water had to be sufficiently well-drained to allow for planting. Yet unlike the larger basins of the Nile valley that simply drained directly back into the flowing river, the Fayyūm's complex system of canals and drains was more prone to failure or sabotage at the field level, posing a danger both to the field owner and his neighbors. Farmers could breach one another's field dykes, accidentally or purposefully drain their own fields onto those of their neighbors, or cause other types of water-related damage through negligence or spite. For instance, in 113 BCE one Apollophanes of Kerkeosiris complained to the *kōmogrammateus* Menches that his neighbor released (*eklyontos*) the water from his land thus flooding (*katakeklyken*) Apollophanes' own two and one-fourth arouras, which were at that time being plowed (*P.Tebt*. I 49). The same situation is evident in *P.Tebt*. I 54 (86 BCE). Here, one Melas of Theogonis complains to a *hipparchēs* that the ten arouras he farmed had been flooded when three brothers from the neighboring town of Kerkeosiris had entered his fields by night and released (*eklelykan*) the water of their land into his own, flooding it (*kataklysthēnai*).[85] Both texts date to the month of Phaophi, the second month of the annual flood, a time at which one would expect the draining of fields to begin.

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[83] A position originating in Islamic Spain, whence stems the Mexican *acequia* (Ar. *al-sāqiya*) tradition. *Qāḍī al-miyah* (lit. "judge of the waters") a position in Al-Andalus, survived in the post-Islamic period as *alcalde de las aguas*, the latinate *juez* later replacing the Arabic-derived *alcalde* (*al-qāḍī*). See in general Enric Guinot Rodríguez, "El gobierno del agua en las huertas medievales mediterráneas: los casos de Valencia y Murcia," *Espacios de Poder y Formas en la Edad Media,* Gregorio Del Ser Quijano and Iñaki Martín Viso *edd.* (Ediciones Universidad de Salamanca, 2007), 99-118.

[84] Sheridan (1996), 42. Throughout his momograph, Crawford (1988) vividly depicts the difficulties faced by the *mayordomo,* an *acequia* ditch-boss, in keeping his workers corralled and working during such activitess as the annual cleaning (*limpia*).

[85] The verb *katakluzō* appears, *e.g.*, in a 2nd CE list of private property described as "inundated arouras": αἱ κατακλυσθ(εῖσαι) (ἄρουραι) and seems to indicate lands harmfully flooded.

Fig. 22: Embanked fields near Hawara. Modern "*perichōmata*" are shallow since perennial irrigation allows for more frequent, smaller-scale watering than annual basin irrigation. Photo: B. Haug, 24 November 2011.

These complaints need not immediately indicate criminality and malice aforethought. Rather, they may at times simply illustrate the mundane complexities of Fayyūm basin irrigation and the negative effects that poor dyke maintenance can have upon neighbors. Nonetheless, Melas of *P.Tebt*. I 54 certainly implies malice on his neighbors' part, claiming that the brothers came against or invaded his *klēros* by night (*tēi nykti...epelthontes...epi ton diapheroumenon mou klēron*). Similarly, in *PSI* XV 1529 (169-72 CE) a farmer in Tebtunis claims that a freedman (*apeleutheros*) named Nilos flooded his field (*kataklyston epoiēsen*) through stupidity and stubbornness.[86] Yet by contrast the language of *P.Tebt*. I 49 is more neutral and the petitioner does not appear to suggest any ill intent on his neighbor's part; he simply requests recompense for his losses. The earlier *P.Enteux*. 60 (218 BCE) is similarly neutral. One Idomeneus of Kaminoi in the *meris* of Polemon simply claims that after sowing his field in *arakos* (grass pea, *Lathyrus sativus*[87]), two neighbors "Petobastis and Horos, the aforementioned, flooded (*kataklyson*) my seed so that my *arakos* [seed] became useless."[88] Idomeneus petitions that the king order the offenders to take over his now useless land and pay the rent due upon it, while Idomeneus himself would in turn take over an equal amount of the land belonging to Petobastis

[86] ll.10-12: ὁ προγεγρ(αμμένος) Νε̣ῖ̣λ̣ος [α]ὐ̣θά̣[δω]ς̣ ἀναστρα[φεὶς] καὶ ἀπονοίᾳ̣ χρησάμενος κατάκλυστον [ἐποί]ησεν τὴν προκειμένην γῆ̣[ν].

[87] Protein-rich *Lathyrus sativus* is famously both drought and flood resistant and grows even in marginal soils. In other words, a crop perfectly adapted for use in the border Fayyūm. In modern times it is often intermixed with other field crops as insurance should the rest of the crop succumb to extreme weather: Clayton G. Campbell, *Grass Pea.* Lathyrus sativus L. *Promoting the Conservation and Use of Underutilized and Neglected Crops 18* (International Plant Genetic Resources Institute, Rome, 1997), at 7 and 50.

[88] ll. 4-5: Πετοβάστις καὶ Ὧρος οἱ πρ[ο]γεγραμμένοι κατέκλυσάμ [l. κατέκλυσάν] μου τὸν σπόρον, ὥστε ἀχρεῖομ [l. ἀχρεῖον] μου γενέσθαι τὸν ἄρακον.

and Horos in compensation. Again, though the damage could have been intentional, Idomeneus makes no such claims and the flooding seems entirely accidental.

The constant danger of accidental flooding is especially clear in the Menches archive, which preserves two reports of the collapse at Kerkeosiris of a structure of uncertain purpose, "the great *perichōma* of Theogonis." Its collapse caused considerable waterlogging and salinization in the affected lands, rendering them useless.[89] The sudden failure of the embankments (*chōmata*) on large canals during the flood could cause similar problems. A report of unproductive land from 139 BCE records 76 arouras flooded by the waters that burst forth from the bend (*ōmia*) of a "river" (large canal) near the towns of Hiera Nesos and Tebetny (modern Difinnū), as well as from the *drymoi* of Kerkeesis (reed-growing, irrigated marshes) and Ptolemais Melissourgon.[90] Accidents such as this were surely common, and it is also clear that a quarrel between neighbors could rapidly descend into petty sabotage of the fragile *perichōmata* in which irrigation waters were contained.

5.3.2: Dyke Work: Sharing the Load

These sorts of maintenance problems were hyperlocal and contained. The annual cleaning and repair of the irrigation system, however, was of much wider regional importance. Since many canals, particularly the major border waterways, had to carry water over a considerable distance, labor had to be applied in all parts of the Fayyūm before the flood to ensure that the canals and embankments were sound and able to convey water to each and every settlement. Broadly referred to as "dyke and canal work" (*chōmatika kai diōrychika erga*) such labor more often appears in the documents simply as *chōmatika erga*.[91] In general, the maintenance comprised two separate but interrelated tasks during the low water season: removing silt from the canal bed, removing obstructive plant growth from within and along the canal (*aphylismos* or *parylismos*[92]), and maintaining the dykes or embankments to ensure the canals' ability to contain and channel floodwaters effectively.[93] That these tasks were the responsibility of those who used a canal is asserted in a papyrus of the second century BCE from the *meris* of Herakleides. The text states that it is "longstanding custom (*ontos ethismou eti anōthen*) for the *klēroi* and the other lands lying below the canal…to dig out the mud in the canal for [sc. the reinforcement of] the dykes (*chōmata*), so that the lands are not flooded."[94]

In a canal system like that of the Fayyūm all irrigators depend upon one another's contribution to such efforts since a poorly maintained canal adversely impacts every farmer downstream from the point of failure. This reality does not mean that collective action comes

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[89] *P.Tebt.* I 72 (113 BCE), ll. 78-9 and *P.Tebt.* I 61b (117 BCE), ll. 165-6. 72: ἔκπτωμα[τοῦ κα]τὰ Θεογονίδα [μ]εγάλου περιχώμ[α]τος). See Monson (forthcoming). Both reports appear to date from March-April, well into the growing season. The break must then have occurred earlier in the year, perhaps during the flood. The purpose of the large basin is entirely unclear. The word could indicate a massive embanked field or perhaps even a reservoir. Monson speculates that a large reservoir may have been intended to regulate the flow of water into the Gharaq basin, possibly providing for perennial irrigation.

[90] *P.Tebt.* III 828 (139 BCE)

[91] E.g. *tōn chōmatikōn kai diōrychikōn ergōn*: *SB* XVI 12989 ll. 5-6 (Memphite nome, 214 CE). As *chōmatika erga*, e.g. *BGU* II 513 (178 CE, Arsinoite), *BGU* II 618 (213/4 CE, Arsinoite)

[92] For an analysis of the Greek terms see Westermann (1925) and Boak (1926b). It should be noted that *parylismos* appears in only a single text *BGU* I 14, frag. 3 l. 13 (255 CE).

[93] Brown (1994), 118-9

[94] *SB* XVIII 13735, ll. 4-10: ὄντος ἐθιζμου (*pap* l. ἐθισμου.) ἔτι ἄνωθεν τοὺς ὑποκειμένους κλήρους καὶ τὰς ἄλλας γᾶς τῇ φερούσῃ ἐκ τοῦ Ἀττίνου Εἰσιήου διώρυγι ἥ ἐστιν ποτίστρα, τούτους δὲ ἀνασκάπτιν (*pap.*) τὸν ἐν τῇ διώρυγι χοῦν ἐπὶ τὰ χώματα πρὸς τὸ μὴ κατακλυσθῆναι τὰς γᾶς.

easily, of course. Indeed, although the text quoted above claims that such work is a custom (*ethismos*), the writer seems to require help. The text is in fact a petition to a local official, the *kōmogrammateus* of Attinou Eisieion, and may have been provoked by the insufficient performance by villagers of their local duties. The petitioner, one Protomachos, requests that, after he has himself called locals together, the *kōmogrammateus* set them to work digging trenches and making the dyke walls watertight "before the coming of the flood" so that his lands are not flooded.[95] Similarly, the Philadelphian komarchs of *P.Wisc.* I 32 (305 CE), a text discussed above in the previous chapter, request that the nome *stratēgos* order that an inspection of canals at Tanis be conducted so that the downstream village of Philadelphia may "enjoy the rising of the Nile" and thus a secure water supply.[96] These village officials evince a concern that the Tanitai were not caring for the portion of the shared canal traversing their territory, a situation that they claim has long since (*makrothen*) been deleterious to Philadelphia.

But the Roman government was not merely reactive. In the attempt to ensure its own revenue and to head off problems amongst cultivators, it engaged in a sort of "coordinated localism," to borrow once again the terminology of Alan Mikhail. That is, although the labor of canal maintenance was performed by locals within their own territory, the government exhorted local officials to ensure that the required annual tasks were completed. A third-century circular from the *dioikētēs* Ulpius Aurelius to the *stratēgoi* of the Oxyrhynchite and the Arsinoite nomes provides offers perhaps the best evidence for the operation of this system. In the letter, published as *P.Oxy.* XII 1409 (278 CE) and originally penned in the season preceding the flood, a *dioikētēs* reminds the officials of the nomes:

> The season for the building up of the dykes and the cleansing of the canals having arrived, I thought it necessary to announce to you by this letter that all the cultivators and […] ought now to build these up with all zeal on the [sc. lands or canals?] belonging to them, persuaded that every one is aware of the benefit resulting from these works.[97]

The *dioikētēs* continues to exhort the lower officials to make certain that local overseers are chosen from "magistrates or private persons" (l. 14: *archontōn ē kai idiōtōn*), who will make certain that each cultivator performs the proper tasks himself (l. 14-5: *ta prosēkonta erga autois sōmasin apophērōsai*) and does not attempt to substitute money in exchange for labor (l. 20: *anti tōn ergōn argurion*). The work should be completed to the best of everyone's ability in order that the canals be able to withstand the approaching onrush of the flood and provide for the common good (l. 17-19: *tē esomenē eutuchōs plēmura tou hierōtatou Neilou…toutou koinōphelous tynchanontos*). Although this is a patently "official" document, it clearly indicates the localism of canal maintenance in Roman Egypt, a system in which the routine tasks of labor were the responsibility of those who used the irrigation features.

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[95] ll. 10-18b: ἐπιδίδωμι ὅπως προσκαλεσάμενος τούς τε γεωργοῦντας καὶ τοὺς κυρίους τῶν τό̣[πων] διὰ τοῦ παρ᾽ ἐμοῦ γεωργοῦ συ̣ν̣τάξῃς ποιήσασθαι τὰ σκάμματα καὶ τὴν στέγ[ν]ωσιν τῶν χωμάτων τῆ[ς] διώ[ρυ]γος πρὸ τῆς ὕδατος ἐμβολῆ̣ς ἢ ὅτι ποτιζομένης

[96] The text refers to the water works, seemingly stone-lined, at ll. 16-7 as τ̣ῶν ῥίθου (*pap.* l. ῥιθρῶν) καὶ λι̣θικῶν; ll. 18: τῆς τοῦ <Νίλ>ου παροχῆς

[97] At ll. 7-11 τοῦ καιροῦ τῆς τῶν] χωμάτων ἀπεργασίας καὶ τῆ[ς] τῶν διωρύχων ἀνακαθάρσεως ἐνεστη[κότος παραγγέλλειν ὑμῖν ἀναγ]καῖον ἡγησάμην διὰ τῶνδε τῶν γραμμάτων ὡς χρὴ σύμπαντας τοὺς γε̣[ωργοὺς---] ταῦτα ἀπεργάζεσθαι ἤδη μετὰ πάσης προθυμίας ἐπὶ τὰ διαφέροντα αὐτοῖς π̣.[.....] πρὸ[ς τὸ δ]η[μοσίᾳ τε] πᾶσιν καὶ ἰδίᾳ ἑκάστῳ συμφέρον.

Another papyrus, *SB* XIV 11478 (210-11 CE), offers the other side of the equation: the perspective of villagers participating in this system of imperially coordinated localism.[98] In this collective petition from the cultivators and landowners of Kerkesoucha—a village in the vicinity of Karanis—the writers remark that the prefect of Egypt is from "time to time" (l. 6: *kata kairon*[99]) wont to issue orders regarding canals and dykes (surely resembling the above letter of the *dioikētēs*). They complain, however, that although they had been "most zealously prepared" (l. 8-9: *hōs kai aei prothymotata*) to undertake the required tasks, the local officials assigned to supervise and coordinate canal maintenance in Kerkesoucha had failed in their duties:

> "[They] did not produce the wood and materials which are annually provided by them for the reconstruction of the wattled weir, in the vicinity of the same village…nor did they in any way provide for maintenance, as if (sc. without the least?) suspicion that canals make the difference (sc. between success and failure)."[100]

The petitioners note that the land risks going dry, a serious threat to the revenues normally paid upon it, and they request that the prefect order that the work be accomplished in order to ensure yearly tax revenues (and the farmers' own share, of course).

But it is a papyrus of the Oxyrhynchite nome to the south that more immediately reveals the difficulties and occasional failures inherent in supposedly "cooperative" communal labor. The text, *P.Oxy*. XXXVIII 2853 (AD245/6), probably concerns work on a canal that served one or more inundation basins in the area:

> To Julius Ammonios, also called Euangelios, *strategos*, from the Aurelii Areios son of Triadelphos and Ammonius son of Dionysios, both in charge of the canal of Chiliarourae. Today, that is the 5th of Tybi, we came upon Soter and his brother, or however they call themselves, and we asked them to do the work on the canal which they are obligated to do. But for no reason they attacked us and shamed us with blows. Therefore we submit this petition asking first of all that they receive punishment, and then that they do their share (*to meros autōn*) of the canal-work so that we are able to attend to the other parts.[101]

Unfortunately, apart from these few texts, the routine mundanity of canal maintenance is virtually invisible in the papyri. As such, our knowledge of local labor is to a great extent

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[98] Originally published by Boak and reprinted as *SB* IV 7361, the text was reedited and translated by Youtie in *ZPE* 15 (1974), 149-52 and reprinted in *SB* XIV.

[99] As *keron* in the text.

[100] So ll. 10-17. Supplements proposed by Youtie.

[101] Ἰουλίωι Ἀμμωνίωι τῶι καὶ Εὐαγγε[λίῳ] στρα(τηγῶ) παρὰ Αὐρηλίων Ἀρείου Τριαδέλφου καὶ Ἀμμωνίου Διονυσίου ἐπιμελητῶν διώρυγος (Χιλιαρουρῶν). σήμερον ἥτις ἔστιν Τῦβι ε προσεληλύθαμεν Σωτῆρι καὶ ἀδελφῷ αὐτοῦ καὶ ὡς χρηματίζουσιν ἀξιοῦντες αὐτοὺς τὸ ἐπιβάλλον αὐτοῖς μέρος τῆς διώρυγος ἐργάσασθαι. οἱ δὲ μηδενὶ λόγῳ χρησάμενοι ἐπῆλθον ἡμῖν καὶ πληγαῖς ἠκίσαντο. ὅθεν ἐπιδίδομεν τόδε τὸ βιβλίδιον ἀξιοῦντες πρῶτον μὲν τῆς δεούσης ἐκ[δ]ικίας τυχεῖν, ἔπειτα δὲ καὶ τὸ μέρος αὐ[τ]ῶν τῆς διώρυγος ἐρ[γά]σασ[θ]αι πρὸς τὸ δύν[ασθαι ἡμᾶς τοῖς ἄλλοις(?)] μέρεσι προσευκ[αιρεῖν. -ca.?- διευτύχει.] [(ἔτους) -ca.?- α]ὐτοκρατό[ρων -ca.?-]. Trans. Ari Z. Bryen, to whom I owe this reference. The name of this canal, "Thousand Aroura," perhaps indicates the size of the basin it served. Cf. The description of a recent *limpia* in tiny El Cerrito, New Mexico: "This was [Ricardo Patricio Quintana's] first year as *mayordomo*, the keeper of the village's *acequia*, or communal irrigation system. The last *mayordomo*, a member of the Aragon family, was voted out. Few Aragons came to clean the ditch this year. They and the Quintanas had been the first families to settle El Cerrito, and the trouble between them began long ago: A fence post was moved, there was a fistfight. No one talked openly about it." Sierra Crane-Murdoch and Sharon Stewart, "Spring-Cleaning the Acequia: a photo essay," *High Country News*: https://www.hcn.org/issues/43.10/spring-cleaning-the-acequia-a-photo-essay. Accessed 13 June 2011.

mediated through the documentation produced by the early Roman period institutionalization of canal labor as an annual obligation. Beginning in the early first century CE able-bodied adult male farmers were obliged to perform five days of labor annually (more or less[102]) upon on the canals and dykes—the so-called *penthēmeros*—for which they afterwards received a short receipt confirming the discharge of their responsibilities.[103] The system seems occasionally to have sacrificed efficiency in favor of a strict all-encompassing communalism by compelling cultivators from all parts of the depression to work on the infrastructural elements upon which the entirety of the system depended. Sijpesteijn notes, for example, ten, two, and five instances of work performed by villagers of, respectively, Bakchias, Philadelphia, and Tebtunis on the *diōryx Argaitidos* (Baḥr Yusuf), while twenty one receipts attest work on the *hexathyros* at Ptolemais Hormou by villagers of Soknopaiou Nesos, Theadelphia, Narmouthis, Tebtunis, and Karanis.[104] Still, as Sijpetsteijn notes, laborers most often worked on the portions of the canals that traversed their own territory.[105] This helps to explain the preponderance in the preserved receipts of the known border canals and the constant repetition of certain canal names.[106]

That much of this labor was in fact conducted in the farmers' own home territory is telling. Indeed, there are many historical and contemporary parallels for customary communal labor on shared irrigation features, and it will thus be useful to place Fayyūm once again in a comparative context. To take a Roman-period example, for instance, the *Lex rivi Hiberiensis* states clearly that "to the clearing and repairing of the channel Hiberiensis Capitonianus from its uppermost part as far as the bottom dam...all the *pagani* must contribute each in proportion to his share."[107] So too in 18th century Ottoman Egypt, where canal workers are often described as *ahālī al-nāḥiya* ("the people of the village") or more precisely as *man yasta'īnūnuhu bihi* ("one who benefits from it," i.e. the locals who use the canal).[108] During this period it was the job of village officials to organize and oversee the cleaning of all but the largest canals in their area, these latter under the purview of provincial governors.[109] At roughly the same period in pre-colonial Punjab and Sind (late 18th-19th centuries), canal sharers were customarily obliged to

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[102] There might be more than one *penthēmeros* during a year and the actual number of days worked at one time could vary between two and seven. See P. Sijpesteijn, "Some remarks on the πενθήμερος-corvée," *ZPE* 64, 1986, 125-9.

[103] *P.Bon*. 31 of 44-5 CE is the earliest surviving proper *penthēmeros* receipt. A common formulation in the texts confirms completion of "five days on behalf of dyke work" (*hēmeras pente hyper chōmatikōn* [*ergōn*]). There is evidence that priests were exempted from the work (*BGU* I 176 and *P.Aberd.* 16, both 2nd CE). *Ergōn* may appear (e.g. *SB* XVIII 13980, Tebtunis, CE 140/1) or be elided (e.g. *SB* XVIII 13366, Tebtunis, CE 103/4). The simpler "on behalf of the dykes," *hyper chōmatōn,* is also attested. See Fred F. Jenkins, "A Penthemeros Certificate from the Berkeley Collection," *ZPE* 41 (1981), 260-262 at n. 4 on 261. See also Sijpesteijn (1964) for a thorough analysis of the *penthēmeros*. In later articles Sijpesteijn clarified minor points of interpretation but the general picture presented in his earlier monograph remains the best summary guide to the corpus.

[104] Sijpesteijn (1964), 80 for work on the Baḥr Yūsuf. Count of texts mentioning the *hexathyros* from DDBDP.

[105] Sijpesteijn (1964), 79.

[106] See, e.g. the texts from Tebtunis in Sijpesteijn (1986) which show several instances of work on the "desert canal," surely the *diōryx Polemōnos* (the ancient Baḥr Gharaq) as well as the "canal of Hermiothes," either a variant name for the desert canal at or around Tebtunis or another nearby canal of some importance (cf. the varying names of the eastern. border canal, the "desert canal," "canal of Patsontis").

[107] From § 2b.21-6: *ạd ṛịvom Hiberiensem Capitonianum purgạndụm reficiendumve ab sụmmo usque ad molem...omnes pagani pro parṭẹ* (*vacat* 4) *suq quisque praesṭare debẹạnt.* Text in Beltrán-Lloris (2006), 154 with English translation at 173.

[108] Mikhail (2011), 175.

[109] Brown (1994), 119.

clean silt annually from the canals they used in exchange for rights to draw water, though they could provide laborers to work in their stead (*chher*s).[110]

In contemporary times, anthropologist Paul Trawick has documented an irrigation-labor ideology in Andean communities in which work is to be shared and "no one subsists or lives primarily off of the labor of others." Even the labor of irrigating is a public act and "larger landowners in particular, who get more water than most people, must assert and protect their rights personally, and quite publicly, with a shovel in the act of irrigating."[111] Mexico and the modern American Southwest also preserve small communities centered around now less than *acequias*, small irrigation canals serving villages or even just a few families, each presided over by an elected *mayordomo*.[112] Their annual cleaning (*limpia*) is undertaken by the canal's dependents and their labor is directly tied to water rights. The written 1919 code of the *acequia* of Corrales, NM, entitled the *mayordomo* to prosecute any community member who attempted to draw water from the canal if he/she has failed to provide an annual day of labor or a cash equivalent. All those with property bordering the ditch are responsible for those sections that traverse their property and must keep them in a state of good repair for the good of the community as a whole.[113]

Unfortunately, our reliance upon the *penthēmeros* for information on Fayyūm canal maintenance tends to reinforce a statist view of Fayyūm irrigation: no "corvée," no water. The brief efflorescence of this system and its sudden disappearance from the papyri in the early 3rd century CE have accordingly been held to indicate both the heights of Fayyūm prosperity and its coming decline, perhaps the only piece of evidence yet adduced in support of the traditional narrative.[114] Of course, it is not as if canal maintenance did not occur before *P.Bon*. 31 (44-5 CE, the earliest proper *penthēmeros* receipt) or afterwards.[115] Several documents dating to the period after the disappearance of the *penthēmeros* record cash payments for canal cleaning (*hyper aphylismou*) or contributions of labor measured in *naubia*, the volume of earth moved.[116]

Is it correct, then, to continue to refer to dyke work as a corvée? Yes and no. We must remember that the necessary tasks of canal maintenance would have been communally conducted in the Fayyūm with or without state coordination and regulation. In and of itself, this labor was not a form of state coercion but rather a fundamental aspect of the rhythms of life in irrigated agriculture. Nevertheless, unlike a tiny *acequia* community, Roman Egyptian agricultural production had an outward face: a portion of its local labor helped feed imperial capitals and Rome maintained a keen interest in the prompt completion of customary canal maintenance tasks in the Fayyūm. Like taxation, the dyke work requirement bound cultivators

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[110] Gilmartin (1994), 1130.
[111] Trawick (2001b), 368.
[112] From the Arabic *al-sāqiya* (pron. *as-sāqiya*). Although the rules and regulations governing each *acequia* community were formalized (although not standardized) over the 20th century the underlying relationships reflect customary practices dating from the Spanish colonial era and evident as early as the medieval period in Spain.
[113] Rivera (1998), 95.
[114] Sijpesteijn (1964), 83.
[115] The earlier *P.Fay*. 25 (36 CE) is a list of men from Euhemeria who have performed work on a dyke (*chōma*) at Magais in the south-western portion of the Themistos. It is not strictly considered a *penthemeros* document since it does not mention the discharge of a five-day obligation. It may be representative, however, of the early development of the regulated and coordinated labor.
[116] *SB* XIV 11444 (late 3rd CE); *SB* XX 14378 (mid-late 4th CE, for *aphylismos* in Ptolemais Hormou); *O.Mich.* II 802 (296 CE); *P.Col.* VII 166 ro. (345-6 CE), *P.Col.* VII 168 (373 CE), *P.Sakaon* 53 (late 3rd/early 4th CE). Rathbone (1991) at 186 has already referred to the *naubia* as "state-supervised contribution to the communal canal system."

to their village by assigning the village a quantum of labor to be fulfilled by its male residents. As O.M. Pearl already noted of the *penthēmeros* in 1951, "the situation is analogous to that prevailing in taxation, where the machinery of collection and control utilizes the village as the administrative unit"[117] Yet as argued in previous sections of this dissertation, the lands to which we owe our evidence for the governmental management of rural labor are the same lands that were themselves progressively degraded by the continued practice of traditional Egyptian flood recession irrigation. Regardless of state requirements, it would have been impossible to bind people eternally to such locales, working to no profit:

> Some were standing knee-deep in the slush, out of which they were grubbing up handfuls of the stuff, which there were throwing into the outstretched hands of men just above them on the slope. These men were handing it on to others higher up, until what remained of the slime reached the man on the top of the bank, who flapped his fingers and deposited over the reverse slope about one-tenth of the material which had started.[118]

If this sort of arduous labor was what irrigated agriculture in the Fayyūm demanded each year, surely its farmers would have chosen to continue living and working on the margins only if they foresaw a harvest commensurate to their input of muscle and sweat. As such, we would do well to reverse the theory on village abandonment proposed by Bonneau (mentioned above in the first chapter) which argues that the removal of state support for increasingly underproductive Fayyūm agriculture resulted in the eventual degradation of the irrigation system. The impetus for state oversight of agriculture was, in her words, entirely fiscal: poor returns from the marginal lands of the Fayyūm's border made continued state investment in its cultivation simply not worth the effort.[119]

While this dissertation has shown that Bonneau's suspicions about the relative underproductivity of border Fayyūm agriculture were entirely accurate, her hypothesis nonetheless puts the cart before the horse. It was not the state that removed itself from the fields but rather the cultivators themselves. The imprecisely dated *P.Sakaon* 53, for instance, (late 3rd to early 4th CE) preserves an extract from an official *brevium* recording work on the *diōryx Psinaleitidos* to which the western villages of Pyrrheia-Narmouthis,[120] *pedion* Anoubias,[121] Sakaon's Theadelphia and Euhemeria all contributed labor, their work quantified by the number of *naubia* of earth moved.[122] While three of the villages moved more than 100 *naubia* while Theadelphia was responsible for only 69.[123] While work on this large border canal was still

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[117] Pearl (1951), 226.

[118] Willcocks (1935), 90 observing corvée labor in 19th century Egypt.

[119] Bonneau (1979c), 64-5. For an earlier but, in my view, invalid critique of Bonneau's hypothesis see Bagnall (1985), particularly 296-8

[120] Originally two separate villages as already recognized in Jouguet's *ed. pr.* (*P.Thead.* 53). Narmouthis was in the Gharaq portion of the old *meris* of Polemon near the border of the Themistos, while TMGeo places Pyrrheia in the Themistos. Apart from this Sakaon text *SB* XVI 13001 (earth fourth CE) is the latest mention of Pyrrheia, which may have been joined at this late stage of its life with the larger and longer-lived Narmouthis.

[121] So-called in this papyrus. The settlement of Anoubias appears in papyri from the third century BCE until at least the fourth CE as a *kōmē*. In Wessely's *Topographie* at p. 37 mentions the appearance of a *chōrion Anoub*[a seventh century papyrus that I have been unable to identify. TMGeo provides only the reference to Wessely.

[122] 1 Roman *naubion* = 3.9 m^3. See Roger Bagnall, "Practical Help: chronology, geography, measures, currency, names, prosopography, and technical vocabulary," in Roger Bagnall *ed*. *The Oxford Handbook of Papyrology* (Oxford, 2009), 179-96 at 186.

[123] Just over 269 m^3.

going on in this late period, Theadelphia's population may have already been rather smaller than those of the other locales, considering its lesser input of labor.

Lastly, in *P.Sakaon* 44 (331/2 CE), our protagonist complains that he and two others are the only villagers left and thus responsible for the taxes on five hundred uninundated arouras. Sakaon claims that a search (*anazētēsis*) had revealed several of his fellow villagers (*homokomētoi*) residing in the Oxyrhynchite and the Kynopolite nomes. The newly-minted Oxyrhynchites could not be apprehended since their new landlord and others repulsed Sakaon's advances "with violence" (*meth' hybreōn*). In the Kynopolite, three hardly-destitute former Theadelphians were in possession of more than one hundred arouras of royal land (*arouras hekaton kai pros*). Sakaon's petition makes it clear that the state still demanded revenue from this nearly deserted village—a tax burden that could no longer be met with the much-reduced human resources—and our village liturgist was compelled to attempt to track down his former neighbors. The state had thus not removed its support for local cultivation, as Bonneau would have it. Rather, the Theadelphians, it would seem, had removed themselves.

5.4: CONCLUSION

This final chapter has sketched a picture of life on the Fayyūm's ancient margins that was anything but secure. As we have seen earlier, the lands these villagers occupied were not the Fayyūm's best and were subjected to persistent water shortages and progressive degradation. Farmers were compelled to occasionally engage in water theft to secure the irrigation of their own fields. Taxation requirement similarly compelled them, year in, year out, to perform the customary labor that obtains in many small-scale, communally-managed irrigation systems. Yet the marginality of the land did not guarantee a substantial return on their "investment" of labor and sweat.

Yet this is not to say that the margins of the Fayyūm were doomed, that the natural environments of arid regions make eventual desertification and abandonment a foregone conclusion. As Graeme Barker's study of the Tripolitanian pre-desert in Libya and Jordan's Wadi Faynan makes clear, arid regions similarly subjected to floodwater irrigation regimes during the Roman period may show remarkably divergent degradation histories (a gradual return to pastoralism in the former and wholesale abandonment in the latter). The evolution of a landscape cannot be predicted simply by enumerating basic natural characteristics; the human element is vital. Above all, Barker emphasizes "the complexity of ancient societies' perceptions of these marginal and precarious environments, of their responses to the constraints and opportunities presented to them, and of the manner in which their activities impacted on the landscape."[124] Nonetheless, life in marginal, water-stressed regions leaves little room for error. Even the smallest changes—in demography, climate, agricultural practice, state demands, etc.—can be enough to upset the balance and compel migration. The conclusion to this dissertation will briefly touch upon some possible changes that may have helped to push the margins of the Fayyūm over the edge.

[124] Barker (2002), 504.

CONCLUSION:
Missing Persons

> *We need these folks. If you want managed water, you've got to have people on the ground with the motivation to manage it...If you eliminate the livelihood of the people who live in the marinas, towns and farms, no one will watch the Delta. Somebody who flies over every six months doesn't have much motive to catch stuff.* [1]

Irrigation is as much about people as it is about water. Farmers draw water from its sources and alter natural flow patterns to channel it to their fields and to drain away the excess. They must take constant care of the infrastructure they have built to perform these tasks—this landesque capital—lest it fall into complete disrepair. Barring unforeseen natural disasters, this infrastructure decays only when it has outlived its usefulness or when farmers have left it behind and moved elsewhere. For this reason we have almost no written testimony for the abandonment of irrigation infrastructure in the Fayyūm. By definition, missing persons leave few clues as to their whereabouts; they are evident only in their absence. Still, we have some hints. A plaintive letter from a father to his son from the first century CE for instance (*BGU* II 530) reveals the hardship that accompanies the loss of manpower in the fields:

> Hermocrates to his son Chairas. Above [all] I hope that you [are well]. I ask you […] to write about your health and what you desire, and at other times I wrote you about t[ ]psya[2] but you neither replied nor came. And now, if you do not come, I risk abandoning the place I possess. Our partner was of no help and the well was not even cleaned out and the canal was also filled up with sand and the holding is uncultivated. None of the tenants wanted to farm it. I am simply paying the taxes with no benefit, for the water scarcely irrigates one garden plot. So by all means come, for the plants risk coming to harm. Your sister Helen sends her greetings and your mother is angry because you didn't write back to her. Besides, she is being hounded well enough by the tax collectors because you didn't send them to yourself. So send to her right now (sc. 'what the tax collectors demand'). Farewell. The 9th of Pauni.

Since we are speaking of missing people, it is worth at least mentioning the possibly significant demographic effects of the Antonine plague, the epidemic that struck the empire in the latter years of the second century CE. Its extent and effects are hotly debated but if it did indeed have an impact upon the population of Egypt, the irrigation system of the Fayyūm would have suffered greatly due to a reduction in available labor. The question is far too complex to be addressed in full here, but it must be noted that the evidence for the plague in Egypt is limited and deeply problematic (as it is for the later Justinianic plague).[3] A telling case in point is

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[1] From the blog *The California Spigot,* January 31, 2012, "California Delta as National Heritage Could Help Save It's People." Quote from Prof. Robert Benedetti, University of the Pacific, Stockton. http://californiaspigot.blogspot.com/2012/01/california-delta-as-national-heritage.html. Accessed March 10, 2012.

[2] As τῆς τ[..]ψυα in the text. Restored as a feminine name "Tapsoia" by Bror Olsson, *Papyrusbriefe aus der frühesten Römerzeit* (Uppsala, 1925), 190.

[3] See Peter Sarris, "The Justinianic Plague: Origins and Effects," *Continuity and Change* 17.2 (2002), 169-82.

P.Oxy. LXVI 4527 (185 CE), a document recording taxes in wheat to be levied in the Herakleides *meris*. The text records an amount of 814,862 artabas in line 7. Later in ll. 14-15 we observe the month of Mesore and an amount of 223,581 artabas. Yet the papyrus is broken at ll. 14-15 before 'Mesore' and depending upon how one restores the text lost in the lacuna, the papyrus can be made to support two diametrically opposed positions: either a level of income commensurate with administrative predictions or a devastating decline in state receipts.[4] And this is but one small example of the much larger evidentiary problem that hinders and definitive statements about the demographic effects of the plague. For the moment, it would be best to remain agnostic and follow Paul Schubert, who notes that the current state of our knowledge precludes any firm conclusions on the plague's demographic impact: "l'impact, s'il existé, n'a laissé que peu de traces identifiables de façon univoque."[5]

Clearly then, although I have argued that water scarcity and environmental degradation along the margins formed a powerful impetus for human mobility, these factors were surely not the sole drivers of settlement shift. Indeed, contemporary literature on so-called environmental migration cautions us against linking population movement in water-stressed regions only to water scarcity. In doing so we deprive human beings of agency, "reduc[ing] migrants to automatons acting out a stimulus-response cycle."[6] Furthermore, water scarcity need not be an existential problem in and of itself, since many populations have developed strategies to adapt to perpetual or seasonal scarcity (e.g. the cisterns common in the premodern Fayyūm, the *khazzān* in Arabic).[7] Yet these traditional adaptations may be overwhelmed by additional pressures that emerge unforeseen.[8] In Egypt and the Fayyūm as well there was an array of environmental, social, and governmental pressures and demands incumbent upon farmers as well as a range of responses available to them (permanent flight, *anachōrēsis*, declarations of uninundated fields, etc.). Under a more adaptive taxation regime, for instance, might farmers in these water scarce regions have been less inclined to abandon their marginal, underproductive villages? We cannot know for certain but in conjunction with water stress, the difficulties of "paying the taxes with no benefit," as the above letter writer claims, surely figured prominently in the eventual decision to pull up roots.

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[4] See the discussion in Schubert (2007), 149-151 where he compares the articles of Bagnall (2000) and Van Minnen (2001). Bagnall's restoration sees the 223,531 artabas as taxes collected only in Mesore, an amount that accords well with an annual total estimated income of 814,862. Van Minnen restores the text before Mesore to read "up to and including the fifth epagomenal day following Mesore," that is, amounts collected up to the end of the Egyptian year, far short of the earlier estimate.

[5] Schubert (2007), 156

[6] From p. 21 of Kirstin Dow, Edward R. Carr, Annelieka Douman, Gouyi Han and Karl Hallding, "Linking Water Scarcity to Population Movement: From Global Models to Local Experiences." Stockholm Environment Institute Poverty and Vulnerability Programme Report, Stockholm, Sweden, 2005. Available online: http://sei-international.org/mediamanager/documents/Publications/Risk-livelihoods/SEI_Dow_Water_Migration_2005.pdf. Accessed September 1, 2011.

[7] See the epigraph to chapter four above at page 125 for Justin Ross' brief notice regarding water-*khazzān* in the 19th century.

[8] A brief but excellent Red Cross press release on migration in contemporary Somalia comments upon the various developments that have served to transform recent droughts into a full-blown humanitarian crisis by undermining traditional strategies adopted over generations to deal with water scarcity, e.g. artificial state boundaries that restrict pastoralists' movements within their traditional grazing lands, political upheaval, large numbers of small arms and the transformation of small conflicts into armed battles, the cultivation of a population dependent upon emergency international aid, demographic upswings, etc. "Politics, war, migration: the anatomy of a humanitarian crisis," Alexander Matheou, 15 July 2011. http://www.ifrc.org/fr/nouvelles/discours-et-points-de-vue/points-de-vue/2011/horn-of-africa/

Whatever the case, a full appraisal of the shifting landscape of the Fayyūm and the changes in its irrigation system must take account of a population constantly in motion regardless of the state's desire to keep them in place. Such mobility has long been a fixture of descriptions of ancient Egyptian agriculture, if from a decidedly gloomier perspective. It has customarily been viewed through the prism of utter despondency, the ultimate sacrifice of peasants otherwise irrevocably tied to the land. It was "a counsel of despair, a last resort to which men were driven...when they had lost all hope of being able to meet the inexorable demands of the Roman administration for taxes and liturgic services."[9] This could well apply to the situation in Theadelphia, which cultivators may have left behind due to its marginal and underproductive agriculture. But what of their attainment of a better life elsewhere in the Oxyrhynchite and Kynopolite? From this perspective, abandonment becomes something other than a grim "counsel of despair."

Obviously, then, farmers need not be attached to the same piece of land, day in day out, immobile for all time. As we have seen above, the population of the village known to al-Nābulusī as Old Shāna simply migrated inward to create New Shāna due to a combination of environmental pressures (water stress) and the easy availability of better lands nearby. We hear elsewhere in his first chapter that 62 of the Fayyūm's 242 waterwheels had of late gone out of use.[10] In one case al-Nābulusī reports a well and waterwheel in Dumūshiyya (ancient Mouchis or Tmoushi), which raised water in an area that used to be a salt mine. When the price of salt became too low to cover the cost of the wheel's operation, however, it was simply abandoned.[11] Such cycles of use/disuse were constant, for abandonment, especially in marginal areas, is a normal feature of the life of a site. As archaeologist Michael Willcox has written, abandoned sites are not necessarily the corpses of societies but rather their shells: "the living organism creates [the shell], inhabits it, and then moves from it only to construct a new home and to preserve the life inside somewhere else."[12]

The preliminary results of my toponymic and topographical study of the late antique Fayyūm have begun to reveal just such movements across the whole of the settled area, finally revealing something of the landscape after border abandonment. In this later period, settlement has moved inward, grouping more tightly within the central floodplain. Many new villages appear in the late period, joining much older and well-established central settlements of the Ptolemies. While their counterparts on the margins had failed, these more centrally-located Ptolemaic foundations (places such as Pisais, Tamauis and Psenyris) survived through late antiquity and the middle ages and remain inhabited to this day (as Ibshawāy, Ṭamiyya, and Sinnūris), securely anchored to this well irrigated region.

This view from the center offers an entirely different perspective on the abandonment of the margins and the continuity of the Fayyūm. Gone was the sprawl of earlier antiquity, where widely-spaced villages clung tenuously to long, inefficient canals with the desert at their backs. The new Fayyūm of late antiquity and the middle ages wisely left these difficult regions behind. It was more compact and rooted solidly in the wetter, more fertile earth of the center. After

[9] Lewis (1983), 203. There is much of the orientalizing "Eternal Egypt" in this view. Just as the "Egyptian peasant" as concept remains static and unchanging throughout time, so too is each peasant an immobile object, as rooted to his land as a tree in the field.
[10] *TF* 6-7
[11] *TF* 94
[12] Willcox (2010), 137.

many centuries, the Fayyūm had finally achieved something approaching agro-environmental sustainability.

But this is, of course, not what the archive of Sakaon tells us. As reflected in his papers, the same human mobility that was building a better Fayyūm was squarely at odds with the desires of the Roman state. In political scientist James C. Scott's now classic words, states attempt "to make a society legible, to arrange the population in ways that simplif[y] the classic state functions of taxation, conscription, and prevention of rebellion."[13] This desire is plainly manifest in some of Sakaon's documents. They radiate with the frustration of a state and a local official trying and failing to find missing taxable bodies and bind them to a place they no longer considered home. Sakaon's complaints are thus the response of the one unlucky soul left beholden to a state whose society had become illegible: in a tiny corner of the Empire the text of the landscape had been rewritten and the state failed to read.[14]

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Whatever his motives were, when a Fayyūmī relocated, the irrigation features of his land soon filled with sand and returned to the desert, overwhelmed by the nature that his daily labor had once kept at bay. After leaving his village of record our migrant may have disappeared entirely for a time, escaping even the eyes of the state (at least until the dogged Sakaon caught up with him on his new farm in the Kynopolite and recorded his name for the prefect). But when he abandoned his home, our migrant permanently escaped our gaze, for he left no more papyri behind. And though the growth of settlement in the center tells us that life went on, those many lives must forever remain invisible, their stories untold. For by departing the failing desert edge in search of something better, our migrant left the dry lands that preserved his voice—his tax receipts, petitions, leases, and letters—and moved to fields where the written word dissolves in water and returns to the earth.

[13] James C. Scott, *Seeing Like a State: How Certain Schemes to Improve the Human Condition Have Failed* (Yale, 1998), 2.

[14] For a first-century comparison see the archive of Nemesion son of Zoilos, a money tax collector (*praktōr argyrikōn*) from Philadelphia. Documents from this archive show a keen attention to the locations of registered Philadelphians residing elsewhere. *P.Mich.* XII 638 (41-54 CE), for instance, contains a list of Philadelphians in the village of Arabon. A more impressive example is *P.Mich.* XII 642 (48/9 or 62/3 CE), which preserves a list of Philadelphian taxpayers residing in some thirty other villages, including the nome metropolis of Arsinoe.

APPENDIX:

Prolegomena to a Topography of the Late Antique Fayyūm: Sixth to Eighth Centuries CE

The following is a partial topographical dictionary or gazetteer of the late antique Fayyūm derived from the papyri excated at the site of Shedet, ancient Arsinoe. The majority of these texts were published in several volumes of the series S*tudien zur Palaeographie und Papyruskunde* (*SPP*), particularly volumes III, X, and XX although relevant documents appear in other editions as well. The dictionary is divided into three main sections denominated by the Ptolemaic and early Roman administrative divisions of the Fayyūm (*Arsinoitēs nomos*), the *merides* of Herakleides, Themistos, and Polemon (abbreviated as H, T, and P throughout). Although these divisions no longer obtained in the period in question they are retained here—as they are in the online topographical resoursesTrismegistos Geo (TMGeo) and the Fayyūm Village Project (FVP)—as an organizational method that divides the geography of the Fayyūm into more manageable pieces and allows the researcher to immediately identify the general area of the Fayyūm he or she is working with. Unfortunately, a full accounting of all toponyms attested in this period (well over 400) has proved beyond my capabilities gien the current constraints of time. Thus, this remains a work in progress. Nontheless, the work as it stands clearly demonstrates what can be accomplished from a close attention to a corpus of texts, in large part simple village lists, that initially appears wholly unappealing and uninformative. I will continue to expand upon this work in the future and hope to see it incorporated into the topographical apparatus of TMGeo.

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In contrast to the earlier period, the late antique Fayyūm may at some point to have been divided into only sections, the Arsinoite and the Theodosiopolite nomes, the latter perhaps roughly, if not completely, coterminous with the old Polemon *meris* in the southwest. This division appears to have existed from sometime in the fifth century up to near the middle of the seventh and is last attested in *BGU* II 340 (644).[1] The Theodosiopolite appears to have extended into the territory of the old Themistos to the north and to have excluded some known Polemon settlements.[2] If this division indeed represented a Fayyūm divided into two separately administered *nomoi,* the Theodosiopolite will have required a *polis*, an administrative center, though no site has yet been identified as "Theodosiopolis" without reservation. G. Fantoni has proposed Tebtunis as the only likely candidate; the village is unattested between the fifth and the seventh centuries, roughly equivalent to the proposed chronology of the Theodosiopolite.[3] The recently published Leipzig papyrus *P.Lips.* inv. FF3 appears to support the hypothesis. The papyrus may have been excavated at the site of Tebtunis in 1931-32 and it is the first text that appears to stem from "Theodosiopolis" itself.[4]

[1] The fullest account is by G. Fantoni in *CPR* XIV, pp. 41-8.
[2] See Hickey (2008), 136 n. 5
[3] *CPR* XIV, p. 46
[4] Hickey (2008), 138. *SPP* VIII 1091 mentions the city as well but there is no compelling reason to assign to the *polis*

While it had previously been proposed that this supposed division is an illusion resulting from the existence of a new name for the Fayyūm, the "Arsinoite or Theodosiopolite nome", the two now used interchangeably, there is now greater cause to suspect that the administrative division was indeed a reality.[5] There are still difficulties to be worked out however. The toponym "Tebtunis" (as Teptunis) reemerges in the documentation in the 7th century.[6] By itself this is not damning; Hickey notes Hermopolis and Apollonopolis Magna, "which shed Greek names for Egyptian ones (with Pharaonic) antecedents in Late Antiquity."[7] Closer to home, as it were, the Fayyūm village of Philagris, attested from the 3rd century BCE, possessed the Greco-Demotic double name of Philagris-*Pr-grg-DHwty* ("foundation of Thot"). At some point in late antiquity the Greek Philagris was dropped and is attested until the end of antiquity in Greek transcription as Perkethaut.[8]

Perhaps more critical is the case of Eleusis in the Polemon/Theodosiopolite. In *SPP* III 32 (6th/7th) Eleusis is expressly located in the Theodosiopolite nome. The date of the papyrus is approximate but corresponds to the proposed chronology of the newer nome. *SB* VI 9596 (579) and *BGU* II 366 (645 or 660), however, place Eleusis in the Arsinoite. The latter text may fall outside the chronological boundaries of the Theodosiopolite but the former is clearly within them. Eleusis was located towards the NE of the territory that comprised the former Polemon and it may be that this liminal position allowed its administrative status to fluctuate over time. Whatever the case, all occurrences of administrative assignment—Arsinoite and Theodosiopolite—will be noted below in the list.

Throughout the gazetteer there will be occasional reference to villages no longer extant in the late period if their locations help to more accurately place a later site. To avoid possible confusion, the names of extant late villages will appear in plain text while extinct or no longer attested villages will be CAPITALIZED. These toponyms also do not appear on the master alphabetical list. TMGeo and FVP are frequently cited below. To avoid burdensome footnotes with complicated URLs both projects are cited in the text as TMGeo and FVP and interested readers may consult these sites and locate the relavent villages with great ease. The authors of articles on villages included in FVP, however, are naturally cited by name. Geographic coodordinates will also be supplied, if available, since they allow a reader to locate a site with ease in Google Maps or Google Earth. Precise coordinates for extant locales are easily available online. I have made particular use of www.traveljournals.net. Distances between locations can be calculated at distancecalculator.globefeed.com or in Google Earth. The main geographic point of reference will always be the nome capital, modern Medīnet al-Fayyūm, but distances between other locales are occasionally provided. Unless otherwise indicated, all dates are CE.

EAST-NORTHEAST (FORMER HERAKLEIDOU MERIS)

Useful Texts with collections of (semi) contiguous villages/regional villages:
P.Ross.Georg. V 73 (with outliers)

[5] *P.Tebt.* II, 363-5
[6] *SPP* X 80, 108, 138, 158, 287v and XX 229
[7] Hickey (2008), 136 at n. 9
[8] FVP, W. Clarysse and B. Van Beek, "Philagris (meris of Themistos)." Perkethaut, as Perkethauoun, appears first in *SPP* III 88 (6th/7th)

SPP X 57, 73, 74, 76, 171

Aithiopon (6th-8th)
Not located in TMGeo. There is insufficient evidence to accurately locate Aithiopon; its inclusion in this section is simply a best guess. The village occurs numerous times in the late period but most often in alphabetical lists. There are only two papyri that provide any useable information. *SPP* X 281 (7th-8th) is a list of persons, payment amounts and villages, all of which were in the former Polemon.[9] Aithiopon heads the list, which may move in a generally N-S (or more accurately, NE-SW) direction. If so Aithiopon would be farther north than any of the villages that follow. The other text, *SPP* X 76 (8th) is another list of villages and money amounts, but this list includes Aithiopon with a group of toponyms securely located in the territory of the former Herakleides (Pouet is not yet located).[10] If the suspicions about the geography of *SPP* X 281 are correct then Aithiopon likely lay somewhere in the area of the western Herakleides.

Akanthonos
Not located in TMGeo. The village occurs in numerous alphabetical lists. Only five texts provide any topographical evidence none of which is particularly coherent. Akanthonos appears three times with several Herakleides toponyms: Pantikou,[11] Phanamet,[12] and Psineuris.[13] The village is mentioned in *SPP* X 138 (early 7th) with Kna, Phanamet and Psineuris, all four villages under the administration of a single *comes*. *SPP* X 275 (6th-7th) is a list of what looks to be almost entirely Polemon villages except for Pantikou, which TMGeo takes to be medieval Bandīq in the far east (since there were two villages with the name Pantikou I am inclined to disagree with the identification in this instance).[14] *SPP* X 262 (7th-8th) appears to list villages largely in the Herakleides followed by villages in the Polemon, Akanthonos falling in the middle of the list.[15] *SPP* X 180 is a short list of toponyms, two in the Themistos, one in the Herakleides and one not located.[16] Lastly *P.Ross.Georg.* V 65 (7th-8th) contains three toponyms, Phatheboei (attested only here), Thambator (Polemon) and Akanthonos.[17] The evidence is not clear but I am tempted to loacte Akanthonos in the northern Polemon; this is, to me, the only location that makes sense of the available evidence. If this is correct then the villages administered together with Akanthonos in *SPP* X 138 move from east to west and then south towards the former Polemon.

Alabanthis (3rd BCE to 8th CE)

[9] Aithiopon, Kai[nou?], Tristomon, Hiera N(esos?), Oxyrhyncha, Paniskou, Kerkesephis, Narmouthis
[10] Distichia, Pouet, Phanesis, Episkopou, Aithiopon, Zizonos, Sebennytos, Tourobestis
[11] *SPP* X 275 and 262
[12] *SPP* X 138 and 180
[13] *SPP* X 138 and 262
[14] Pantikou, Beki, Hermopolis, Aphaniou, Psinteo, Akanthonos, Eter, Armatoura, Areos Kome
[15] Embolou Epoikion, Psineuris, Kos, Zinnis, Sintoou, Pantikou, Akanthonos, Kerkesoucha Orous, Ann, Tristomon, Kaminoi
[16] Phanamet, Akanthonos, Patres, Mouei, Arabon
[17] The reading of the toponym Phatheboei appears secure from the publication but since there is no image available I cannot verify it.

TMGeo locates Alabanthis in the Herakleides near Tamauis (see below) in the NE of the nome.[18] *P.Lond.* III 1165 (2nd CE) provides the most explicit evidence, referring to fodder from the *pedion* of Alabanthis and the *drymos* of Tamauis (ll. 12-13), the latter being modern Tāmiya. Alabanthis was also near Syron Kome; *P.Tebt*. III 701 (210?) records a loan of seed grain for land in both Syron and Alabanthis (FVP).[19] In the late documents Tamauis reappears in a section of *SB* VI 9583 (650-99) recording an individual from Onniton making payments on behalf of a short list of villages.[20] A fragment of a lease shows a resident of Alabanthis leasing six arouras of land in or around Nikes (*SB* I 4869 [4th-7th]). Alabanthis was surely close to Nikes and possibly also to Atammonos, both of which appear three times.[21] Alabanthis appears twice with Eustochiou[22] and Elia.[23] *SB* VI 9583 probably provides the best evidence for Alabanthis' surrounding topography.

Anthou (4th/5th to 8th)

Not located in TMGeo. Anthou appears multiple times with a large array of villages (76 in total) in each *meris* although the far south of the Polemon is unrepresented.[24] As such the initial impression is of a relatively central location. Grenfell and Hunt guessed at a Polemon location based on its appearance in *SPP* X 250 (6th). Anthou is the first village mentioned and is followed by Arabon, which was in the Herakleides. The rest of the list, save Elia at the end, can be securely tied to the northern half of the Polemon. Yet Anthou also appears in *SPP* X 7 (4th/5th) with a short list of definite Herakleides toponyms, one (Onniton) probably in the NE section of the *meris*.[25] *BGU* II 402 (582-602) locates Anthou in the Arsinoite rather than the Theodosiopolite nome. The text is dated to the period of the Theodosiopolite's existence; if the nome occupied much if not all of the former Polemon (possibly excluding the NE portion of the *meris*) and if Anthou can is indeed to be tied to this *meris* it must have lain similarly in the NE Polemon. The ecclesiastical accounts published as *CPR* XXII 60 (7th/8th) preserve a collection of villages again spanning both the N Polemon and W Herakleides,[26] as does *SPP* X 147 (8th), including Theoxenis and Kna in the Themistos.[27] Lastly the village list in *SPP* X 247 presents the same problem, collecting villages from the N Polemon, W Herakleides and the Themistos.[28] It is virtually impossible to determine in which *meris* Anthou should be located. Its connections clearly imply a relatively central location. In consideration of this and the current theories regarding the Theodosiopolite the village is perhaps best located in the Herakleides near the western border; close enough to for its connections to be entirely western but not so near the former Polemon as to fall into the administrative area of the Theodosiopolite. Anthou is mentioned three times with Aninou and Belou and twice with a large number of toponyms:

[18] P.Petrie III 37b vo. and 121, *P.Lond.* 1165
[19] I. Uytterhoeven, W. Clarysse, "Alabanthis"
[20] Onniton, Atammonos, Tamauis, Pa*SB*oubou, Pansoue, Alabanthis, Nikes, Metrodorou
[21] Nikes: *SB* I 4869 and VI 9583, *SPP* X 141; Atammonos: *SPP* XX 225, *SB* VI 9583, *SPP* X 158
[22] *SPP* XX 239, *CPR* XXII 60
[23] *SPP* XX 225, *SPP* X 158
[24] The most southerly village occurring with Anthou is Narmouthis in *SB* I 5339 and *SPP* X 147
[25] Distichia, Metrodorou, Herakleia, Anthou, Onniton
[26] Kalliphanous, Alabanthis, Phentemin, Belou, Eustochiou, Aninou, Phourtin, Tetrathyron, Anthou, Elia
[27] Syrou, Nestou, Anthou, Zinnis, Stratonos, Psenyris, Beki, Eter, Theoxenis, Narmouthis, Perkethaut, Eustochiou, Pouet, Severou, Aphaniou, Kna, Aphrodites
[28] Distichia, Apoph[ ], Andreou, Anthou, Phthrys, Belou, Patres, Sebennytos, Skollidos, Phanou, Chalothis, Arabon, Lenou, Panthare

Distichia, Andreou, Theoxenis, Stratonos, Sebennytos, Patres, Kainou, Armatoura, Eter, Narmouthis, Thambator, Arabon, Ouo, Elia, Aithiopon, Phentemin and Eustochiou.

Anoges (6th to 8th/9th)
Not located in TMGeo however there is an article at FVP which locates the village near al-Lāhūn: *P.Fay.Copt*. 34 (8th-mid 9th) mentions the village (as Tanoge) with al-Lāhūn. This and several other documents were excavated at the monastery of Deir al-Hamman 5 km N of Lāhūn. Thus, the Ptolemais mentioned with Anoges in *SPP* XX 271 (7th-8th) is surely Ptolemais Hormou/al-Lāhūn.[29] The rest of the documention supports such a location. There are three instances of Anoges with Herakleonos[30] and Skelos.[31] It appears twice with Syron[32] and Tmouei.[33] A section of *SB* VI 9583 (650-99) groups Anoges with several villages making payments through an intermediary: Skelos, Monti, Herakleonos, Ouo, Anoges, Arotheou and Tmouei. Some of these villages are P while others are H. The closest connection observed is that with Herakleonos. *CPR* XIX 32 (622), a receipt for reeds, mentions vineland in the *epoikion* Anoges and *kome* Herakleonos. Anoges appears just before Herakleonos in P.Vind.Tand. 17 (7th) and the two are separated by Ouo in *SB* VI 9583. A location near al-Lāhūn is appropriate for a village with such connections.

Arabon (3rd BCE to 8th CE)
TMGeo places the village in the Herakleides and the relevant article and map in FVP locate the village somewhere in the eastern half of the *meris*. A strong connection to Letous is noted: the two are mentioned eighteen times in the same texts and may have shared a granary.[34] FVP also notes connections to Sebennytos and Psenyris, which it refers to as villages in the northern reaches of the *meris*. My own work suggests a more central location for Sebennytos and Psenyris itself is nearly in the center of the Herakleides (as represented in Derda [2006], p. 21). An initial survey of the late documentation produces numerous references to villages in the N Polemon and Themistos. Arabon appears in *SPP* X 250 (6th), a list of almost entirely Polemon villages along with Elia in the Herakleides, which is mentioned several times in connection with N Polemon, W Herakleides and Themistos villages. This alone is enough to begin to suspect a more western orientation. *SPP* X 278 (7th) reinforces this suspicion although the list contains Sele as well (far east near the border of the nome).[35] *SB* XVIII 13264 presents a short list of villages again clustering towards the W border of the Herakleides and into the Themistos.[36] *SB* XVIII 13267 (7th) is a similar sort of short list but with a more easterly orientation, Tamauis being the farthest east of the group.[37] The longer list in *SPP* X 247 (7th-8th) does not include any far eastern village but rather central/W Herakleides and Themistos toponyms.[38] In fact the

[29] T. Derda in FVP, "Anoge/Tanoge (Meris of Herakleides)"
[30] *SPP* X 149, *CPR* XIX 32, *SB* VI 9583
[31] *SPP* X 149, *P.Vind.Tand.* 17, *SB* VI 9583
[32] *SPP* X 149, *P.Vind.Tand.* 17
[33] *SPP* XX 271, *SB* VI 9583
[34] See below, "Letous"
[35] [two unread toponyms], Arabon, Ampeliou, Magais, Phourtin, Psenaparek, Sele, Theogonis, Ammonos
[36] Psineuris, Arabon, Stratonos, Patres, Tassat
[37] Belou, Stratonos, Tamauis, Pelkeesis, Phanou, Arabon
[38] Distichia, Apoph[ ], Andreou, Anthou, Phthrys, Belou, Patres, Sebennytos, Phanou, Chalothis, Arabon, Lenou, Panthare

village with which Arabon appears the most (three instances) is Patres.[39] Patres cannot be located precisely but was somewhere in the Themistos. Arabon also occurs twice with Mouchis[40] (N Polemon), Belou[41] and Stratonos, which I tentatively assign to the central or western portion of the Herakleides.[42] I am thus inclined to place the village more towards the western or at least central portion of the *meris*; the late texts do not seem to allow for any far easterly connections.[43]

Arotheou (6th to 8th)
Not located in TMGeo. Arotheou is located in the Arsinoite nome in *P.Eirene* II 29 (591-3). Numerous varying readings of the village have been corrected by Morelli (*ZPE*, 2004) but do not appear as such in DDBDP.[44] The evidence for the location of Arotheou is almost nonexistent. Of the thirteen occurrences of the village seven are alphabetical village lists. The provide no topographical data except *SB* VI 9583 and *SPP* X 90 vo. The former is a village list with payments, wall of which are made through an intermediary from Skelos: Skelos, Monti, Herakleonos, Ouo, Anoges, Arotheou, and Tmouei. Herakleonos was in the former Herakleides near al-Lāhūn while Ouo was towards the north of the former Polemon. The other villages are as yet unplaced. *SPP* X 90 vo. is a brief account of wages with three toponyms: Belou, Severou and Arotheou. The first two were located towards the middle of the nome in the territory of the Herakleides. It is possible that should locate Arotheou somewhere in the same vicinity.

Atammonos (6th to 8th)
Not located in TMGeo. There are only five extant texts that provide topographical information. *SPP* XX 239 (6th) is a list of villages almost entirely in the Herakleides.[45] A section of *SB* VI 9583 (650-99) and *SPP* X 158 (8th) also group Atammonos with eastern toponyms.[46] Atammonos occurs three times with Alabanthis, which was near Tamauis and Nikes. It is possible that the village should be located here somewhere in the NE portion of the nome.

Belou epoikion (1st to 8th)
Not located in TMGeo. Apart from a single occurrence in a text of 49 or 49 CE (*P.Mich.* XII 642) the evidence for Belou is entirely from the 4th or 5th to the 8th CE. Belou's strongest connections are with villages of the west and western Herakleides. It occurs three times only with the Anthou[47] but twice with Pisais,[48] Karpe,[49] Patres,[50] (all T) Phanamet,[51] Lenou,[52]

[39] *SB* XVIII 13264, *SPP* X 180, *SPP* X 247
[40] *SPP* X 250 and 272
[41] *SB* XVIII 13267, *SPP* X 247
[42] *SB* XVIII 13264 and 13267
[43] The map in Derda (2006), p. 21 places Arabon just to the east of Psenyris. This is, of course, just a supposition based upon Mueller (2003) but it is as good a guess as any.
[44] The corrections are noted in TMGeo
[45] The list includes Psinteo, which was in the territory of the Polemon
[46] *SB* VI 9583: Onniton, Atammonos, Tamauis, Pa*SB*oubou, Pansoue, Alabanthis, Nikes, Metrodor(ou/on); *SPP* X 158: Elia, Alabanthis, Psenyris, Atammonos
[47] *SPP* X 247, 290, *CPR* XXII 60
[48] *SPP* X 254 and 78
[49] *SPP* X 78 and 290
[50] *SPP* X 247 and 93
[51] *SPP* X 254 and 93
[52] *SPP* X 247 and 288

Phanou,[53] Sebennytos,[54] and Arabon (all H).[55] The Herakleides willages were all in the western half of the former *meris*.

Distichia (4th or 5th to 8th)
TMGeo tentatively places Distichia in the Herakleides but there should be no doubt. Several lists are unhelpful and include Distichia with villages from all three *merides* (e.g. *SB* VI 9583, *SPP* XX 225). Still, the village occurs primarily with toponyms of the former Herakleides and neighboring regions of the other *merides*. The account *SPP* X 150 (6th) includes Distichia in a short list of Herakleides toponyms along with Alexandrou Nesos.[56] *SPP* X 76 and X 171 (8th) preserve lists of villages and payments, all locales in the Herakleides,[57] as does the short list *SPP* X 261 (8th).[58] Three texts lend a better sense of Distichia's general location. The receipt *SPP* VIII 813 (6th) records a payment by an individual from Phanou and appears to be written by another individual from Distichia. The short list in the center of the verso of *SPP* X 265 (8th) includes the toponyms Tassat, Distichia, Sebennytos. Tassat was in the Themistos while Sebennytos was towards the center of the Fayyūm in the Herakleides near the borders of the other *merides*. *SPP* X 151 recto (7th) preserves the list Kainou, Stratonos, Kaminoi, Episkopou, Psineuris, Phanesis, and Distichia. Stratonos and Phanesis were likely towards the western Herakleides and the center of the nome with Episkopou lying just SE of the capital; Psineuris was to the north at modern Sanhūr; Kaminoi was surely in the northern Polemon and Kainou may have been as well. Distichia occurs three times with Phanesis[59] and Sebennytos[60] and twice with Phanou,[61] Episkopou,[62] Ouraniou,[63] Ibion,[64] Chalothis,[65] Nestou[66] and Zizonos.[67] It is tempting to locate Distichia towards the western extent of the former Herakleides close to the other *merides*.

Embolou (4th? to 8th)
TMGeo tentatively places Embolou in the Herakleides but this should be regarded as certain. P.Gen. I 15 (6th-7th) locates the village in the Arsinoite nome. The toponym is most closely connected to Pantikou (med. Bandīq) in the far east of the Fayyūm and Piamouei 6.8 km NE of Medīnet al-Fayyūm (see further below). Embolou appears four times with Pantikou[68] and three times with Piamouei.[69] It appears twice with Kerkesoucha,[70] Zinnis,[71] Sebennytos,[72] Patres,[73]

[53] *SB* XVIII 13267, *SB* X 247
[54] *SPP* X 254 and 247
[55] *SB* XVIII 13267, *SPP* X 247
[56] Sintoou, Alexandrou Nesos, Pseou, Pseonnophris, Distichia
[57] *SPP* X 76: Distichia, Pouet, Phanesis, Episkopou, Aithiopon, Zizonos, Sebennytos, Touroubestis; *SPP* X 171 Phanesis, Zizonos, Distichia
[58] *SPP* X 261: Kal.ono( )?, Distichia, Nestou, Boubastos; 265: Tassat, Distichia, Sebennytos
[59] *SPP* X 151, 76 and 171
[60] *SPP* X 247, 76 and 265
[61] *SPP* VIII 813 and *SPP* X 247
[62] *SPP* X 151 and 76
[63] *SPP* X 68 vo. and 156
[64] *SPP* X 68 vo., *SPP* XX 225
[65] *SPP* X 247, *SB* VI 9583
[66] *SB* VI 9583, *SPP* X 261
[67] *SPP* X 76 and 171
[68] *SPP* VIII 886, *SPP* X 154, 246 and 267
[69] *SPP* X 146, 154 and 246

Kos[74] and Kerkesoucha Orous[75] (probably the village in the Polemon). The first four villages were in the east/Herakleides and the next three in the west/Themistos. Embolou appears in *SPP* X 154 as part of an estate with the villages of Pantikou and Piamouei. The same three villages in the same order also appear in *SPP* X 246 with Kerkesoucha, Sele, Syron and the *hapax* Psempter( ). Embolou is mentioned making payments along with Kerkesoucha and Piamouei in *SPP* X 146 (7th) further anchoring the village to the east. Several documents place Embolou in lists with toponyms from the northern Polemon and the Themistos as well. A standout is *SPP* X 80. The pertinent section groups Embolou with Patres and Andreou. Patres cannot be located with certainty but was surely in the territory of the former Themistos as was Andreou. The firm connections both to the east (Pantikou) as well as the Themistos (e.g. Patres) give the impression that the village should be located somewhere in the east between the far eastern edges of the Fayyūm and the eastern border of the Themistos. Banaji guessed at a location somewhere near modern Dimū 5.88 km east of Medīnat al-Fayyūm.[76] This may be inexact but does end up placing Embolou roughly equidistant from the far east and the Themistos.

Episkopou (7th to 8th)

TMGeo accepts Wessely's identification of the ancient village with medieval Minyet al-Usquf (*TF* 145).[77] The linguistic affinity makes this possible and the location of the medieval village is appropriate; it lay just to the south-east of the nome capital on the Bahr Yusuf, which would place it just outside the borders of the Polemon *meris*.[78] The papyrological evidence is slight and the village appears in only seven texts. It is sufficent, however, to document connections both to nearby villages in the former Herakleides as well the territory of the northern Polemon and the Themistos. *SPP* X 151 (7th) is a list of villages of the former Herakleides, save Kaminoi in the N. Polemon,[79] as is *SPP* X 76 (8th).[80] SPP X 74 vo. Col. 2 (7th) preserves a list of villages in the northern Polemon along with Magais in the south of the former Themistos.[81] *SPP* X 104 (7th) is a short list of Themistos toponyms along with Episkopou.[82] Fr. 5 of *SB* VI 9583 preserves a brief list of villages in (H) and (P) along with the nome capital.[83] *CPR* XXII 49 (8th) records the names of workers sent to Fustat/Babylon from Episkopou, Pisais and Psineuris. Episkopou appears twice with Psineuris,[84] Phanesis[85] and Distichia.[86] Episkopou's apparent connections to nearby villages in every cardinal direction suit a location proximate to the nome capital.

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[70] *SPP* X 146 and 246
[71] *SPP* X 77 and 262
[72] *SB* I 5339, *SPP* X 77
[73] *SB* I 5339, *SPP* X 80
[74] *SPP* X 77 and 262
[75] *SPP* X 77 and 262
[76] Banaji (2001), 245
[77] *Topographie,* 62
[78] cf. the map in König
[79] Kainou, Stratonos, Kaminoi, Episkopou, Psineuris, Phanesis, Distichia
[80] Distichia, Pouet, Phanesis, Episkopou, Aithiopon, Zizonos, Sebennytos, Touroubestis
[81] Kerkesoucha Orous, Magais, Narmouthis, Episkopou, Kouloupon, En[ ], B[ ], Mouchis, Kynon, Panse, Philoxenou
[82] Patres, Phentemin, Ankonos, Episkopou
[83] Aphrodites Berenikes Polis, Armatoura, Ouo, Boukolon Pedias, Episkopou, Krokodilopolis
[84] *SPP* X 151, *CPR* XXII 49
[85] *SPP* X 151, *SPP* X 76
[86] *SPP* X 151, *SPP* X 76

Zizonos (7th to 8th CE)
Not located in TMGeo. Zizonos is quite rare in the papyri, appearing only six times in texts; it is rendered in both Greek and Arabic in *P.Ross.Georg.* V 73, although the Arabic toponym bears only superficial resemblance to its Greek counterpart (منسيسنه; *Mensīsnah*). Zizonos appears more than once with ten north-central and eastern villages: Pisais,[87] Ptolemais Hormou,[88] Severou,[89] Phanou,[90] Phentemin,[91] Sebennytos,[92] Tourobestis,[93] Tassat,[94] Distichia,[95] Phanesis.[96] *SPP* X 57, 76 and *P.Ross.Georg.* V 73 (with Polemon outliers) probably best represent the surrounding village topography. Considering the appearance of Pisais, Phentemin and Tassat a location rather towards the west of the territory of the former Herakleides is possible.

Zinnis/Dinnis (3rd BCE to 8th CE)
The name of the village was spelled as Dinnis in earlier periods but in our period the spelling is universally Zinnis. According to TMGeo Zinnis was near Kerkeshoucha, which was itself near Karanis in the NE of the Fayyūm. In a brief note in Grenfell and Hunt's gazetteer the authors tentatively and impressionistically locate Zinnis towards the southern portion of the *meris*, "since so many villages are already assigned to the northern part."[97] Administratively the village was assigned to the Arsinoite nome in the late period (*CPR* XXIV 27). Zinnis has connections with villages throughout the Fayyūm although the strongest connections are with villages of the northern and central area. Zinnis appears three times with Patres and twice with Phentemin (both T.), and twice with Psineuris and Psenhyris (both H). The village also occurs with more easterly locations, appearing twice with Stratonos,[98] Embolou and Pantikou. The latter, medieval Bandīq, lay along the Baḥr al-Sharqiyya at the eastern edge of the Fayyūm, while Embolou *may* have been located somewhere in the vincinity of modern Dimū (29° 18' 0" North, 30° 54' 0" East). As noted above, TMGeo locates Zinnis towards the northeastern extremity of the Fayyum. *SPP* X 97 however preserves a short list of villages from the north-central cluster discussed above (see relavent entries): Tassat, Patres, Phentemin, Menas, Zinnis and Karpe. *SPP* X 138 places Zinnis under the responsibility of a *comes* Tzittas with the villages of Patres and Tetrakomia, the latter occurring only here and in one 4th CE document devoid of further topographical context.[99] The occurrence of Zinnis in the first half of *SPP* X 147 (all generally eastern villages) near Psenyris also leads me to locate the village away from the farthest extremes of the eastern Fayyūm. The series of villages—Surou, Nestou, Anthou, Zinnis, Stratonos and Psenhyris *may* move in a broadly east-west direction although this is far from certain. Nestou was surely in the far east while Psenyris/Sinnūris was more central. I am

[87] *SPP* X 57 and 73
[88] *SPP* X 57, *P.Ross.Georg.* V 73
[89] *SPP* X 57, *P.Ross.Georg.* V 73
[90] *SPP* X 57, *P.Ross.Georg.* V 73
[91] *SPP* X 57, *P.Ross.Georg.* V 73
[92] *P.Ross.Georg.* V 73, *SPP* X 76
[93] *P.Ross.Georg.* V 73, *SPP* X 76
[94] *P.Ross.Georg.* V 73, *SPP* X 73
[95] *SPP* X 76 and 171
[96] *SPP* X 76 and 171
[97] *P.Tebt.* II, p. 357; the reference is overlooked in TMGeo.
[98] *SPP* X 147 and 256
[99] *CPR* VI 82

tempted to place Zinnis in the northern and central region of the territory comprising the former Herakleides, locating it somewhere between Psineuris in the west and Pantikou in the east. This is admittedly impressionistic.

Elia (6th to 8th)
Not located in TMGeo. Grenfell and Hunt suspected a southern location based upon its appearance in *SPP* X 250 (6th). Elia often appears simply as an *epoikion* (i.e. without the designation *chorion*) even in the context of other villages bearing the designation of *chorion*.[100] This does not, however, preclude it appearing as a *chorion* as well.[101] Elia appears twice with Armatoura,[102] Phourtin,[103] and Alabanthis[104] as well as twice with Psenyris.[105] Several texts mention a monastery at Elia: *SPP* XX 238 (7th), *SPP* X 219 (7th-8th), *SPP* VIII 1286 (7th-8th). In the final text a single individual receives grain on behalf of both the monastery at Elia and the village of Phourtin, which was probably nearby in the Polemon. In the fragmentary verso of *SPP* XX 238 both the monastery and village of Phourtin appear. It is possible that the villages were proximate. Elia's surrounding topography seems to be largely of the Herakleides however. *SPP* XX 225 (7th-8th) for instance includes Psineuris, Psenyris, Letous (all H), Tristomon (P), Alabanthis (H), Kourabes, *mone* Barbarou and Skandips. *SPP* X 158 contains Alabanthis, Psenyris and Atammonos (H). *SPP* X 168 is somewhat scattered, grouping Pisais (T), Elia, Kaminoi (P) and a *megale ekklesia*, perhaps in the nome capital. Considering the preponderence of Herakleides villages Elia should probably have been in this general region. The lack of far eastern villages in the documentation as well as the appearance of the capital and villages of (T) and (P) should place it in the western part of the former Herakleides.

Herakleonos (2nd BCE to 8th CE)
Located in the Herakleides in TMGeo. *CPR* XIX 32 mentions the *epoikion* Anoges and the *kome* Herakleonos apparently in connection to vineland in both locales. If it is correct that Anoges was somewhere in the vicinity of Ptolemais Hormou (see above, Anoges) then the present village must be proximate. Earlier documents in the Petaus archive (late 2nd CE) firmly place the village in this SE portion of the nome. P.Petaus 69 (182-7) mentions the village (as an *epoikion*) along with Ptolemais Hormou, Syron, and Kerkesoucha Orous, while *P.Petaus* 84 (185) mentions a *komogrammateus* of Ptolemais Hormou and other villages (Syron, Herakleonos). *SPP* X 149 (6th), possibly listing locales on an estate (cf. the entry for Skelos below) appears to group several toponyms from the SE.[106] Finally *SB* VI 9583 (650-99) repeats this pattern. Marcus from Skelos makes payments for a short list of southern villages including Ouo in the north of the former Polemon.[107]

Hiera Nikolaou (1st to 8th)

[100] E.g. *SPP* X 27, *SPP* X 168 and P.Prag. I 30
[101] *SPP* X 250 and 158
[102] *SPP* X 250 and 27
[103] *SPP* VIII 1286, *SPP* XX 238
[104] *SPP* XX 225, *SPP* X 158
[105] *SPP* XX 225, *SPP* X 158
[106] Sebas?]tophorianon (*hapax*), Syron *megales ousias*, Anoges, Herakleonos, Apanokaiou, Skelos *kai* Herakleonos *mikras ousias*
[107] Skelos, Monti, Herakleonos, Ouo, Anoges, Arotheou, Tmouei

A confusing case. Grenfell and Hunt identified two villages named Hiera (Nesos): Hiera Severou (H) and Hiera Nikolaou (P). TMGeo places Hiera Nikolaou in the Herakleides near Karanis. Its first attestation is in the first-century list of toponyms, many of the Herakleides, published as *P.Mich*. XII 642 (62-3). The most pertinent text in this respect is a document that seems to reference a single granary of both Hiera Nikolaou and Karanis, *O.Mich*. III 1069 (298): θη(σαυροῦ) κώ(μης) Καρ(ανίδος) καὶ Ἱερᾶς Νεικ(ολάου). *O.Mich*. I 371 (late 3rd) records a delivery to the granary of Hiera Nikolaou via beasts from Narmouthis in the deep SW of the Fayyūm, a rather great distance from a supposed location near Karanis. Other documents from Karanis record deliveries to Karanis through animals from Hiera Nikolaou (*O.Mich.* I 408 [285/6], *O.Mich*. II 891 [290]). *P.Cair.Isid.* 39 (297) records the receipt of wheat from the granary of Karanis on behalf of Hiera Nikolaou. After one 4th century attestation the documentation is silent until the 7th. When the toponym reappears it confuses the issue somewhat; *SPP* X 292 (7th-8th) preserves a short village list including Hiera Nikolaou but also villages towards the central Herakleides (Stratonos, Phanamet) and Polemon (Ouo, Theogonis).[108] *SPP* X 60 Col. 2 (8th) is a similar type of list, preserving the names of toponyms from the Polemon (e.g. Ouo, Kouloupon), Herakleides (Ptolemais Hormou, Pantikou) and some as-yet unlocated villages.[109] *P.Horak* 64 (8th) is a list of prisoners and their villages of origin, the toponyms covering all three *merides.*[110] If the Hiera Nikolaou of the early period refers to the same village as the homonymous late toponym we are forced to conclude that the village was at least not next door to Karanis; certainly it was near enough to have relations with it but close enough to the Polemon to find itself in connection with villages of the northern portion of the latter *meris.*

Karpe (6th/7th to 8th)

Appearing once in Greek[111] with the masculine Coptic definite article as Pkarpe, Karpe is tentatively assigned to the Polemon in TMGeo, possibly following Timm's entry on the village.[112] Wessely conversely guessed at a location near Patres, Pisais and Phentemin, which Grenfell and Hunt regarded as "hardly justified," although they offered no alternative hypotheses.[113] I am more inclined to Wessely's opinion and follow Banaji's discussion.[114] While Timm claimed that no equivalent Arabic toponym exists to help further localize Karpe, Banaji ties the village to al-Nābulusī's Minyat Karbīs, to the north and west of Medinet al-Fayyūm, a half and hour's jurney on horseback (cf. König's map for a probable location).[115] As Banaji notes, this places the village to the south and east of Phentemin and Psineuris. The Greek evidence is not plentiful but presents helpful connections. Karpe is attested only seventeen times

[108] Ouo, Hiera Nikolaou, Kainou Borrinou, Pelkeesis, Stratonos, Phanamet, Lorou, Theogonis

[109] Ptolemais Hormou, Phanesis, Arphokra, Metrodoron Kome, Pantikou, Hiera Nikolaou, Ouo, Kouloupon, Ammou

[110] Naleou, Hiera Nikolaou, Beki, Pelkeesis, Tebetny, Boubastos, Tassat

[111] *SPP* X 138

[112] "Im Zusammenhang des Textes werden noch die Orte Pšaim, Kna und (chorion) Phana aufgeführt. Dementsprechend könnte man Karpe vielleicht im Süd(west)en des Fayyūm suchen," at 1230.

[113] *P.Tebt.* II, p. 382

[114] Banaji (2001) 246-7

[115] Banaji (2001), 246-7, misspelled as "Minya Karbīs"; location in *TF* 146: هي بحري الفيوم مما يلي الغرب بينها وبين مدينة الفيوم مسافة نصف ساعة للركاب

in fifteen papyri (a fair number alphabetical) but is mentioned three times with Patres[116] and Tassat,[117] and twice with Phentemin,[118] Belou,[119] Pisais,[120] and Berenikis Thesmophorou.[121] The final Gharaq basin village is the only outlier and as such Karpe-Minyat Karbīs fits nicely with the Phentemin-Patres-Pisas group to the north and east of the nome capital.

Letous (3rd BCE to 8th CE)
TMGeo places the village in the Herakleides. The relevant article and map in FVP gives a general location in the eastern half of the *meris* and notes connections to ANDRIANTES, PHARBAITHOS, Metrodorou, Psenyris and Sebennytos.[122] The three villages still extant in the late period were probably towards the center of the *meris* and not along the eastern extremities. The links with Arabon are the strongest; *P.Tebt.* III 848 and *SB* XIV 11307 suggest that the two may have had a common granary.[123]

Metrodoron (5th to 8th) and *Metrodorou* (3rd BCE to 6th CE)
There are three similarly-named entries in TMGeo's database: Metrodoron Kome, not placed in any *meris*, Metrodorou Epoikion in the Herakleides and METRODOROU EPOIKION in the Polemon, last attested in the 3rd century CE. The first two villages may be identical. The database entry for Metrodoron omits mention of *SPP* X 20 (7th-8th), which contains the toponyms Metrod( ) and Pasb(oubou). The latter restoration is unproblematic since the name is unique. Metrod( ) was however restored by the editors as Μητροδ(ώρων). In *SB* VI 9583--also unconnected with "Metrodoron Kome" in TMGeo--Pasboubou appears unabbreviated along with Metrodor( ). Here the editors restored Μητροδώρ(ου). Considering the presence of Pasboubou in both instances the toponymic surely refers to the same location. Of the texts listed as pertaining to Metrodoron in TMGeo *SPP* X 131 (518) and *SB* I 4496 (593) place the village in the Arsinoite but do not mention other villages. Only *SPP* X 23 (7th) and *SPP* X 60 (8th) provide useable topographical data; all the villages mentioned in them are of the Herakleides. Both texts contain Ptolemais Hormou and Pantikou, possibly Pantikou Allages (see forther below, Pantikou Allages). Of the late antique texts grouped under the entry "Metrodorou Epoikion" TMGeo includes texts variously referring to the village as a *chorion*,[124] *epoikion*,[125] *kome*[126] or with no additional signifier.[127] Even among these in *SPP* X 256 (6th), SP VI 9583 (750-99) and *SPP* III 289 (6th-7th) the toponym is printed as the unresolved abbreviation Μητροδωρ( ) twice and Μητροδορ( ) once respectively. P.Rainer Cent. 112 (509) has a κώμη [Μητροδ]ώρων. *SB* I 5338 (4th to 7th) reads Μετροτώρον, *P.Ross.Georg.* III 20 (7th) Μητροδώρον. The other villages mentioned in the texts attributed to Metrodorou Epoikion are all of the former

[116] *SB* I 5339, *SPP* X 97 and 90. The first text is not perfectly alphabetical but does appear to have alphabetical elements. As such it should be treated with some caution.
[117] *SPP* X 78, 97 and 90
[118] *SPP* X 1 and 97
[119] *SPP* X 78 and 290
[120] *SPP* X 78 and 90
[121] *SPP* X 1 and 78.
[122] I. Uytterhoeven, "Letous Polis (meris of Herakleides)"
[123] I. Uytterhoeven and W. Clarysse, "Ptolemais Arabon—Arabon Kome (meris of Herakleides)"
[124] *P.Ross.Georg.* III 20, *SB* VI 9583, *SPP* X 20
[125] *CPR* X 122
[126] *SPP* III 289, P.Rainer Cent. 112
[127] *SPP* X 256

Herakleides; Pa*SB*oubou[128] and Nikes[129] appear twice. Considering the flexibility of the terms *chorion*, *epoikion*, and *kome* I am tempted to identify both toponyms with the same village. If there were two villages with nearly the same name they were surely both towards the far east of the Fayyūm.

Nestou (3rd BCE to 8th CE)
TMGeo locates the village in the Herakleides. It appears in texts from Karanis and PHILADELPHIA and is frequently mentioned alongside other NE Fayyūm villages such as BAKCHIAS, HEPHAISTIAS, Hiera Nesos, Kerkesoucha, Neilopolis and Letous. P.L.Bat. I 8 (86) shows farmers from Nestou cultivating land in Philadelphia and a farmer in Karanis in *BGU* I 18 (164) owned land in Nestou. According to FVP Nestou may have had closer ties to PHILADELPHIA than Karanis.[130] In later texts Nestou generally appears with eastern villages. P.Stras. III 144 (391) preserves a divorce document involving parties from Nestou and Onniton. A section of *SB* VI 9583 lists villages making payments through Siro of Nestou: Nestou, Piamouei, Neuei, Tanis, Distichia, Chalothis, Letopolis, Kna, Kerkesoucha, Syron Kome, Amou. All but Kna and Chalothis (both Themistos) were in the Herakleides. Nestou appears in the usually-helpful *SPP* X 138 but it is in the first section under the heading † γνῶσι(ς) κωμ(ῶν) το[ῦ μ]εγαλοπρε(πεστάτου) which contains a widely scattered selection of villages.[131] Nestou appears twice with Zinnis,[132] Distichia[133] and Kna.[134]

Nikes (4th? to 9th?)
Not located in TMGeo. As noted above Nikes was probably close to Alabanthis, the only village with which it securely appears multiple times (three instances).[135] Since Alabanthis was somewhere near Tamauis this places Nikes towards the NE of the Fayyūm. Nikes is included in a list of villages paying taxes through an intermediary from Onniton, which is the best indication of its surroundings.[136] The list contains the toponyms Pasboubou and Metrodoron, which supports F. Morelli's reading of Nikes in l. 6 of the short village list in *SPP* X 20 (7th-8th), formerly read as Askk( ); Metrodoron and Pasboubou are read there with certainty in ll. 3 and 5, respectively.[137]

Onniton (3rd BCE to 7th-8th CE)
The full name of the village is Onniton Koitai but Koitai is dropped entirely in texts of the late period. TMGeo places the village in the Herakleides but includes a note speculating on a location near Narmouthis in the SW. This is not possible and probably stems from the relevant entry in Grenfell and Hunt's gazetteer where they note that the village may have been in the sixth *pagus*, an area that included Narmouthis.[138] Whatever the administrative situation Onniton was

[128] *SPP* X 20, *SB* VI 9583
[129] *SPP* X 20, *SB* VI 9583
[130] The preceding follows I. Uytterhoeven, "Nestou Epoikion (Meris of Herakleides)"
[131] Nestou, Pelkeesy, Hiera Nesos, Ptolemais Hormou, Oxyryncha, Tebetny, Tebtynis
[132] *SPP* X 41, 147
[133] *SB* VI 9583, *SPP* X 147
[134] *SB* VI 9583, *SPP* X 147
[135] *SB* I 4869 and VI 9583, *SPP* X 141
[136] *SB* VI 9583: Onniton, Atammonos, Tamauis, Pasboubou, Pansoue, Alabanthis, Nikes, Metrodorou
[137] Morelli (2004), 135
[138] "Koitai," *P.Tebt.* II, pp. 385-6. There is no citation of relevant documention on the sixth *pagus*.

nowhere near Narmouthis; apart from the list of widely scattered villages in *SPP* X 270 (7th-8th) Onniton occurs only with toponyms of the eastern part of the nome. The only village which appears more than once is Metrodorou (or Metrodoron).[139] *SPP* X 7 (4th-5th), *SPP* X 14 (7th-8th) and *SB* VI 9583 (650-99) all preserve village lists consisting entirely of Herakleides toponyms. *P.Strasb.* III 144 (391) also preserves a divorce document concerning parties from Onniton and Nestou, which was in the NE portion of the *meris*. The document also assigns Onniton to the Arsinoite. I am tempted to locate Onniton in the NE region; the appearance of the NE villages Atammonos, Tamauis, Alabanthis, Nikes and Metrodor(ou/on) with Onniton in *SB* VI 9583 is the clearest indication of such a location.

Pantikou Allages and *Pantikou Nouki* (6th to 8th)
Both located in the former Herakleides by TMGeo. There appear to have been two villages with the same initial name in the late antique Fayyūm; the alphabetical list *SPP* XX 229 (7th-8th) preserves two separate entries in column 1, Pant(ikou) Allag(es) at l. 18 and Pant(ikou) Nouki( ) at l. 22. One of the Pantikou's has to be medieval Bandīq (*TF* 80) in the far east of the Fayyūm.[140] Allages is a likely candidate, *allage* referring to a staging post for changing horses; the eastern edge of the nome is a likely spot for a change of animals. Apart from the village name itself there is one extant reference to a *stablites* of an *allage* at Pantikou.[141] From the texts listed with Pantikou Allages in TMGeo it is clear that the village was in the east. It is mentioned four times with Embolou,[142] three times with Zinnis[143] and Metrodoron (or Metrodorou, see above),[144] and twice with Syron,[145] Ptolemais Hormou,[146] Akanthonos,[147] Sele,[148] Piamouei,[149] Psinteo,[150] Beki[151] and Aphaniou.[152] The final three villages were somewhere in the former Polemon, with Beki and Aphaniou probably towards the *meris'* northern reaches (see below). On the whole, the villages occurring with Pantikou are predominantly eastern with the inclusion of a not insignificant number of Polemon toponyms; Themistos toponyms are very infrequent. *SPP* X 275 (6th-7th) is the only text in this group that stands out as unusual; it preserves a list of toponyms of the Polemon and Themistos regions but headed by Pantikou.[153] Although the toponym is restored as Παντ̣[ίκου], there are few other options.

Of the three texts pertaining to Pantikou Nouki, *SPP* X 263 (7th) contains Syron and Piamouei, two locales already seen with Pantikou Allages. *SPP* X 170 (8th) contains Pantikou Nouki, Alexandrou and Naleou, the latter two not represented in the documentation for Pantikou Allages.

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[139] *SPP* X 7, *SB* VI 9583
[140] Al-Nābulusī places it three hours east of Medīnet al-Fayyūm by horseback
[141] *P.Ross.Georg.* III 50
[142] *SPP* VIII 886, *SPP* X 154, 246 and 267
[143] *SPP* X 256, 14 and 262
[144] *SPP* X 256, 23 and 60
[145] *SPP* X 256 and 263
[146] *SPP* X 23 and 60
[147] *SPP* X 275 and 262
[148] *SPP* X 23 and 246
[149] *SPP* X 154 and 246
[150] *SPP* X 275 and 23
[151] *SPP* X 275 and 249
[152] *SPP* X 275 and 249
[153] Pantikou Chorion, Beki, Hermopolis, Aphaniou, Psinteo, Akanthonos, Eter, Armatoura, Areos

Banaji has examined the topography of Pantikou and its surroundings from *SPP* X 154 (7th), a list of three villages pertaining to an *ousia* of one Theodoros.[154] The villages—Embolou, Pantikou and Piamouei—appear in the same order in *SPP* X 246 (7th) supplemented by three additional eastern locales, Kerkesoucha, Sele, Syrou and the *hapax* Psempter( ).[155] Piamouei is surely modern Biyāhmū 6.8 km NE of Medīnat al-Fayyūm while Embolou should be roughly equidistant between the Themistos and the far eastern Fayyūm.

Pasboubou (7th to 8th)
Not located in TMGeo. The toponym appears only five times in the published papyri, three of those instances in alphabetical lists.[156] Only *SPP* X 20 and *SB* VI 9583 provide any useable evidence. The the toponym in line six of the former, originally read as Askk( ) has recently been emended to "Nikes", a village which also appears with Pasboubou in a list of villages making payments through an intermediary in *SB* VI 9583. Nikes' links with Tamauis place it in the NE of the Fayyūm where we may perhaps look for Pasboubou as well.

Piamouei (3rd BCE to 7th or 8th CE) *Bīyāhmū*/بياهمو (29° 22' 5 N 30° 51' 6 E)
The village was known as Andrianton until the name Piamouei appears in *BGU* III 873 (4th-6th), a text which also locates the village in the Arsinoite nome. Wessely identified Piamouei with medieval and modern Bīyāhmū to the north and east of Medīnat al-Fayyūm (بيهمو *TF* 66).[157] Piamouei appears with other villages in six papyri. It appears three times with Embolou[158] and Pantikou/Pantikou Nouki[159] and twice with Sele,[160] Syron,[161] Kerkesoucha,[162] and Syrou,[163] all but the last eastern toponyms. Piamouei/Bīyāhmū's location near the center of the former Herakleides would serve to allow the village connections to toponyms in the northern Polemon and western portion of the Themistos let alone the rest of the Herakleides. Piamouei's connections, however, seem to be largely to the east (e.g. Kerkesoucha, Kerkesoucha Orous, Syron, Pantikou). Embolou unfortunately cannot be precisely located. The only apparent standouts are the appearence of Kna and Chalothis (both Themistos toponyms) with Piamouei and other eastern villages in *SB* VI 9583.

Pouet (6th-8th)
Not located in TMGeo. The key text is *SPP* X 76 (8th), a list of definite Herakleides villages including Pouet.[164] The village list in *SPP* XX 239 (6th) also includes villages securely tied to the former Herakleides and some locales not yet identified. The short list *SPP* X 271 (8th) groups Pouet with Dikaiou Nesos (T) and Stratonos (H) although the reading of the former is

[154] Banaji (2001), 245-6
[155] The final toponym appears only here
[156] *SPP* X 13, 79 and XX 229
[157] According to an-Nābulsī Bīyāhmū was an hour's journey from the Nedīnet al-Fayyūm by horseback
[158] *SPP* X 146, 154 and 246
[159] *SPP* X 154, 246 and 263
[160] *SPP* X 148 and 246
[161] *SPP* X 263, *SB* VI 9583
[162] *SPP* X 246, *SB* VI 9583
[163] *SPP* X 148 and 246
[164] Distichia, Pouet, Phanesis, Episkopou, Aithiopon, Zizonos, Sebennytos, Touroubestis

uncertain. Pouet occurs twice with Severou (both times side by side),[165] Eustochiou,[166] and Stratonos.[167]

Severou (1st to 8th)
TMGeo places Severou near PERSEA and Sebennytos in the Herakleidou *meris* near the nome capital. This is based on a new reading of the first line of *P.Princ*. I 14 l. 1 (48/9 CE) referring to the *epoikion* Severou περὶ Περσέων.[168] *P.Mich*. XII 642 (48/9 CE), a list of PHILADELPHIA tax payers resident outside the village also place Severou with a cluster of surrounding villages among which are BAKCHIAS, Hiera Nikolaos, Kerkesoucha, Karanis, Stratonos, Sebennytos, Boubastos, Belou and PHILOTERIS. Following a single second century attestation[169] the documentation is silent until the sixth, after which the village is mentioned nine times. Severou appears multiple times only with villages of the former Herakleides: Phentemin,[170] Pouet,[171] Eustochiou,[172] Zinnis,[173] Zizonos,[174] Phanou,[175] *SPP* X 57 best represents the surrounding topography: Pisais, Ptolemais Hormou, Zinnis, Gemellou, Severou, Zizonos, Phanou, Phentemin.

Stratonos (1st-8th)
TMGeo locates the village in the Herakleides near Karanis, SOKNOPAIOU NESOS and Sebennytos.[176] Clearly, this set of villages is rather widely spread. In *BGU* III 835 (217) the *sitologoi* of Karanis list receipts and disbursements of grain from and to Hiera Nesos, Kerkesoucha, PTOLEMAIS NEA, HIERA SEVEROU and Stratonos. In the late texts Stratonos appears three times with Kainou[177] and Phanou.[178] It appears twice with Zinnis,[179] Phanesis,[180] Psineuris,[181] Mouchis[182] and Lorou.[183] If Kainou is identical with Kaine in the Polemon it is thus an outlier. Kainou may in fact be a different village (see SPP X 151 [E villages + Kainou] and *SPP* X 169). Stratonos largely appears with villages in the east/former Herakleides, though villages from the northern portion of the Polemon occasionally appear.[184] The closest connection that emerges from a single text is with Phanesis in P.Prag. II 154 (6th). Here the *elaiourgos* Sambas is ordered to provide twenty *xestai* of oil to *bucellarii* in Phanesis and Stratonos; the villages may have been close to one another. Considering the occurrence of northern Polemon

[165] *SPP* XX 239, *SPP* X 147
[166] *SPP* XX 239, *SPP* X 147
[167] *SPP* X 271 and 147
[168] The text itself is from PHILADELPHIA in the far east of the Fayyūm. The new reading is not included in DDBDP but is referenced by TMGeo in their pages on "Severi Epoikion."
[169] *SB* XVI 13069
[170] *SPP* X 57, *P.Ross.Georg.* V 73
[171] *SPP* XX 239, *SPP* X 147
[172] *SPP* XX 239, *SPP* X 147
[173] *SPP* X 57, *P.Ross.Georg.* V 73
[174] *SPP* X 57, *P.Ross.Georg.* V 73
[175] *SPP* X 57, *P.Ross.Georg.* V 73
[176] Grenfell and Hunt place the village in the NE based upon the connection to Karanis; *P.Tebt.* II, p. 402
[177] *SPP* X 151, 292, 169
[178] *SB* XVIII 13267, *SPP* X 74 and 169
[179] *SPP* X 256 and 147
[180] P.Prag. II 154, *SPP* X 151
[181] *SB* XVIII 13264, *SPP* X 15
[182] *SPP* X 74 and 106
[183] *SPP* X 292 and 165
[184] E.g. Mouchis, Melitonos, Ouo, Theogonis. See *SPP* X 74 and 292.

villages it is not unreasonable to suspect that the village was closer to the territory of the former Polemon than the NE and Karanis.

Syron (3rd BCE to 8th/9th CE)
Located in the Herakleides by TMGeo. There are two similar toponyms in the late period, Syrou Chorion (P) and Syron Kome (H). Grenfell and Hunt noted that the two were distinct based upon the appearance of both toponyms in *SPP* XX 229 but mistakenly identified Syrou with Syron in *SPP* X 250 (6th). The list of persons and villages in *SPP* X 108 (8th) also contains separate entries for Syron and Syrou. The first century BCE archive of the embalmers of Hawara locates Syron in the *exo topoi* of the *meris* of Herakleides; such locales were at the entrance to the *meris* in the east. A desert guard (χερσάνιππος) at Syron indicates a location at the edge of the cultivated area.[185] The Petaus archive documents administrative connections between Syron and Ptolemais Hormou while other villages mentioned with Syron further establish a liminal location in the east: Kerkesoucha Orous, HAUERIS, LABYRINTHOS, HEPHAISTIAS, Alabanthis and Karanis. *P.Lille Gr.* I 13 mentions a *hormos* (harbor) at Syron, placing the village on a navigable waterway. Finally, *P.Lugd.Bat.* 20A (259-8 BCE) describes a trip from TOUPHIS, through Syron to Ptolemais Hormou, LABYRINTHOS and the nome capital. FVP follows Derda's (2006) map and places Syron to the NE of Ptolemais Hormou.[186] In the late documentation Syron appears four times with Skelos[187] and three times with Pantikou[188] and Piamouei.[189] *SPP* X 246 (7th),[190] 263 (7th)[191] and possibly 87 (8th)[192] likely give the best indications of Syron's surrounding topography.

Tamauis (3rd BCE-8th CE) 29° 28' 60 N 30° 58' 0 E
TMGeo identifies Tamauis with modern Tāmīya approximately 23 km NE of Medinet el-Fayyūm. Although the village is attested forty one times in the later period the vast majority of these are receipts that mention Tamauis on its own. Only three late texts are of any help. In *SPP* X 293 the village is grouped with Attinou and *epoikion* Eter( ) under one *dioiketes*. The village of Eter was, however, in the north of the former Polemon or south of the former Themistos and it is not clear if the text is referring to the same location. Tamauis appears in *SB* XVIII 13267, an account of mattresses distributed, with a list of villages in the central or eastern portion of the Fayyūm/former Herakleides: Belou, Stratonos, Tamauis, Pelkeesis, Phanou, and Arabon. In *SB* VI 9583 one Apa Elia from Oniton makes a payment on behalf of Oniton, Atammonos, Tamauis, Pa*SB*oubou, Pansoue, Alabanthis, Nikes and Metrodorou. Again, the list appears to consist only of villages in the area of the former Herakleides, although Atammonos may be N. Polemon. The identification of Tamauis with modern Tāmiya seems secure based upon the surrounding topography of the ancient village.

Tenteel (7th/8th)

[185] PSO IV 399 (260-200 BCE)
[186] Drawn from I. Uytterhoeven, "Syron Kome (Meris of Herakleides)" at FVP
[187] *SPP* X 149, *P.Vind.Tand.* 17, *SPP* X 87, *SB* XXVI 16474
[188] *SPP* X 256, 246 and 263 (Pantikou Nouki)
[189] *SPP* X 246, 263, *SB* VI 9583
[190] Embolou, Pantikou, Piamouei, Kerkesoucha, Sele, Syron, Psempter
[191] Psimistou, Syron, Piamouei, Pantik(ou) No[uki], Ammo[, K[
[192] Arotheos, Aninou, Aithiopon, Syron, Skelos, Bousiris

Not located in TMGeo. There are only two extant references to the village: *SPP* X 82 and 14. The former, an alphabetical list of villages and payments, is heavily restored.[193] *SPP* X 14 preserves the usable list Psophthis, Pantikou, Tenteel, Onniton, Tzaali and Zinnis. Psophthis, Tenteel and Tzaali are too infrequent to locate more precisely but Pantikou, Onniton and Zinnis have secure locations in the Herakleides. Tenteel was probably in the territory of this *meris* as well.

Tzaali (7th/8th)
Not located in TMGeo. The village occurs only twice in the published papyri but this is sufficient to confuse, if little else. *SPP* X 56 is a list of payments from five villages. Only Phour(tin), Oxyrhyncha and Tza[ali] can be read with certainty. The first two villages were in the Polemon *meris*. Tzaali again appears in the village list in *SPP* X 14: Psophthis, Pantikou, Tenteel, Onniton, Tzaali and Zinnis. Since this latter list is almost surely composed of entirely Herakleides villages it is tempting to place Tzaali in this division of the nome. The appearance of the village next to Zinnis *may* indicate proximity. This is entirely speculative but would explain the appearance of the village with Polemon toponyms in *SPP* X 56; Zinnis was more centrally located and appears with villages of all three *merides*. If Tzaali were similarly located *SPP* X 56 becomes easily explicable.

Touroubestis, طرفسطه /*Turufestah* in *P.Ross.Georg.* V 73 (3rd/4th to 8th)
Not located in TMGeo. The village appears to have been in the territory of the former Herakleides. It is most often mentioned with Sebennytos (four times);[194] it appears twice with Zizonos,[195] Phanou,[196] Dikaiou,[197] Tassat,[198] Kynon[199] and Ibion.[200] *SPP* X 76 (villages and payments) probably best represents Touroubestis' surroundings since it contains a list of generally eastern villages.[201] If Touroubestis was closest to Sebennytos this would place it towards the central portion of the territory of the former Herakleides close to the border with the Themistos.

Phanesis (2nd -8th) *SPP* III 469: Phaneseos hyper ousias Eudoxiou
Located in the Herakleides near Kerkesoucha Orous (H) in TMGeo.[202] Kerkesoucha Orous does not appear in the late papyri but the location is secure. Phanesis appears most often with Distichia (three times)[203] and twice with Stratonos,[204] Kainou,[205] Episkopou[206] and Zizonos,[207] all

[193] Sele, Se[le?], Tassa[t], Ten[teel], (Tetra)thy[ron] and Ty[is]
[194] *SB* I 5338, *SPP* X 289, *P.Ross.Georg.* V 73, *SPP* X 76
[195] *P.Ross.Georg.* V 73, *SPP* X 76
[196] *SPP* X 74, *P.Ross.Georg.* V 73
[197] *SB* I 5338, *SPP* X 289
[198] *SB* I 5338, *P.Ross.Georg.* V 73
[199] *SB* I 5338, *SPP* X 74
[200]
[201] Distichia, Pouet, Phanesis, Ep. Episkopou, Aithiopon, Zizonos, Sebennytos, Tourobestis
[202] See *BGU* III 754 (after 245) for the Herakleides location and *SB* VI 9069 for Phanesis' proximity to Kerkesoucha Orous.
[203] *SPP* X 151, 76 and 171
[204] P.Prag. II 154, *SPP* X 151
[205] *SB* XXIV 16108, *SPP* X 151
[206] *SPP* X 151 and 76
[207] *SPP* X 76 and 171

villages in the territory of the former Herakleides. The late texts in which Phanesis appears contain almost entirely villages of the east/Herakleides, single occurrences of Ouo and Phentemin being exceptional. *SPP* X 151, 76 and 151 may provide the best evidence for its surroundings. The closest connection that appears in the late texts is with Stratonos (see above).

Phanou (فانو) approx. 29° 23' 60 N 30° 49' 0 E, near modern Naqalīfa
TMGeo accepts the likely identification of Phanou with medieval Fānū (فانوا in *P.Ross.Georg.* V 73) to the north of Medinet al-Fayyūm (*TF* 133).[208] The village of Fānū no longer exists but was joined with the village of Naqalīfa which is still extant, lying 10.5 km N of Medinet al-Fayyūm and 5.19 km W of Sinnūris. Phanou occurs once in a late 3rd century papyrus from Karanis (*P.Cairo Isid*. 81 [297 CE]) and a single fifth century text. Apart from these there are thirteen additional instances of the village up to the eighth century. *CPR* XXIV 24 (582-602) places the villages in the Arsinoite nome. The villages with which Phanou appears more than once are all of the north-central and eastern Fayyum. It appears twice with the following: Ptolemais Hormou,[209] Severou,[210] Zizonos,[211] Phentemin,[212] Belou,[213] Stratonos,[214] Arabon,[215] Tourobestis,[216] Sebennytos,[217] Skollidos,[218] Lenou,[219] and Kathieou.[220] *SPP* X 57 (a list of persons on their villages), *SB* XVIII 13267 (mattresses for prisoners), and *SPP* X 247 (village list) probably best represent the surround topography. *P.Ross.Georg.* V 73 is also helpful but includes some outlying villages in the former Polemon (Areos, Ibion).

*Psen(h)yris/Sinnūris/*سنّورس (3rd BCE to 8th CE)
Located in the former *meris* of Herakleides in TMGeo. As Banaji notes, Psenyris and the similarly named Psineuris 10.55 km to the east were different villages and not variant spellings: "Psenyris shows a strong connection with villages of the east and north-east…Psineuris, on the other hand, has no such eastern orientation."[221] Banaji thus identifies Psenyris with modern Sinnūris and Pseneuris with modern Sanhūr, reversing Wessely's hypothesis.[222] That there were two nearly homonymous villages in the region is clear: the *choria* list *SPP* XX 225 includes a Psine(ureos) in l. 1 and a Pseny(reos) in l. 3 while the alphabetical list *SPP* XX 229 has Psenyreos in l. 11 of column 3 followed by Psineure(os) in l. 17. The two villages were distinct and not closely connected but both fall into a cluster of north-central Fayyūm villages straddling the former Themistos-Herakleides border (e.g. Alexandrou Nesos, Pisais and Phentemin). Psenyris is administratively located in the Arsinoite nome in the earlier P.Köln. III 152 (477?).

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[208] TMGeo makes the identification but neglects to place Phanou in the Herakleidou *meris*, leaving it with only the Arsinoite geographical code 00.
[209] *SPP* X 57, *P.Ross.Georg.* V 73
[210] *SPP* X 57, *P.Ross.Georg.* V 73
[211] *SPP* X 57, *P.Ross.Georg.* V 73
[212] *SPP* X 57, *P.Ross.Georg.* V 73
[213] *SB* XVIII 13267, *SPP* X 247
[214] *SB* XVIII 13267, *SPP* X 74
[215] *SB* XVIII 13267, *SPP* X 247
[216] *SPP* X 74, *P.Ross.Georg.* V 73
[217] *SPP* X 247, *P.Ross.Georg.* V 73
[218] *SPP* X 247, *P.Ross.Georg.* V 73
[219] *SPP* X 247, *SB* VI 9583
[220] *SB* VI 9583, *P.Ross.Georg.* V 73
[221] Banaji (2001), 247-8.
[222] *Topographie*, 167

The village does not occur more than twice with any other locale, appearing twice with Stratonos,[223] Severou,[224] Perkethaut,[225] Aphaniou,[226] Alabantis,[227] Elia,[228] and Melitonos.[229] *SPP* X 147 may be the best evidence for Psenyris' surrounding topography. The two-column village list contains generally eastern villages in the left column[230] while the right column lists villages to the west and southwest.[231]

Pseonnophris/Sanūfar صنوفر 29° 15' 44.79" N 30° 51' 57.92" E[232] (3rd BCE to 8th CE)
TMGeo locates the village in the *meris* of Herakleides. There are twenty-seven attestations of the village but only five from the late period. The village has been identified by linguistic affinity with an-Nābulsī's Sanūfar several kilometers south and east of Medīnet al-Fayyūm.[233] Only three late texts provide any topographical information. *SPP* X 150 and 54 are lists of Herakelides toponyms (including Alexandrou Nesos [T] in 150). *SPP* XX 239 is a list of villages, most of which are as-yet unlocated, but which includes Severou (H) and Psinteo (P).

Psimistous/Samastūs سمسطوس (7th to 8th/9th)
Not located in TMGeo but the village was at the far east of the nome in the Herakleides to the south of BAKCHIAS. It is attested in only six ancient texts and only one, *SPP* X 263 (7th) offers any helpful topography. Here, Psimistous is grouped with Syron, Piamouei, Kourabes, Pantikou, and Ammou. Syron, Piamouei and Pantikou are all Herakleides toponyms and all lay south of BAKCHIAS. The location of the village along the eastern margins of the nome is provided by an-Nābulsī, who places Arabic "Samastūs" in a list of deserted villages along the defunct Bahr Wardan, (*TF* 18). The list of villages given by an-Nābulsī may run from south following the line of the canal. If so, Samastūs occurs before Umm al-Atl (BAKCHIAS) and was to its south. This would be in keeping with the collection of villages grouped together in *SPP* X 263.

Psineuris/ Sanhūr سنهور (2nd BCE to 8th CE)
The identification with Sanhūr proposed by Banaji is accepted by TMGeo. The village is uncertainly read in *BGU* VI 1258 (132 BCE) as "Psinurios." Otherwise its earliest attestation is 4th/5th CE (*SB* XII 11039). It is located in the Arsinoite nome by *P.Lond.* I 113 5c (600) and *CPR* XXIV 32 (651).[234] Psineuris falls in the north-central cluster, appearing three times with Phanamet,[235] Phentemin,[236] and twice with Pisais.[237] It also occurs three times with Stratonos,[238]

[223] P.Mert. II 100, *SPP*X 147
[224] *SPP* X 147 and 245
[225] *SPP* X 162 and 147
[226] *SPP* XX 225 and X 147
[227] *SPP* XX 225 and X 147
[228] *SPP* XX 225 and X 158
[229] *SPP* X 145 and 162
[230] Syrou, Nestou, Anthou, Zinnis, Stratonos and Psenyris
[231] Beki, Eter, Theoxenis, Narmouthis, Perkethaut, Eustochiou, Pouet, Severou, Aphaniou, Kna, Aphrodites Berenikis Polis.
[232] The village apparently still exists but it is difficult to locate exactly. Multiple variant spellings all return results (Sanufar, Sinufar, Senofar, etc.). Google Maps returns results for "Senofar" placing it in more or less the same area as Shafei Bey and König. The coordinates are drawn from a travel website with an embedded Google map. The coordinates points to fields just to the east of a small village which is surely our Sanūfar.
[233] *TF* 126
[234] *tou Arsinoitou nomou* is also restored in *CPR* XXIV 28 (611)
[235] *SPP* X 254, 138 and 268

which may have been further to the east and/or north, and twice with Zinnis,[239] Akanthonos,[240] Phanesis,[241] Kaminoi,[242] Episkopou,[243] and Tristomon.[244] In the estate text *SPP* X 138 Psineuris is administered together with Kna, Phanamet and Akanthonos. *SPP* X 1 contains a list of villages contributing to the estate of the deceased Fl. Strategios Paneuphemos: Psineuris, Ampeliou, Berenikis (Aigialou?: see below), Karpe, Phentemin and Psinol. This collection of villages falls in the W/NW of the Fayyūm.

Psophthis (3rd BCE? to 8th CE)
Not located in TMGeo. Only one text of the late period attests Psophthis, *SPP* X 14 (7th-8th). Here it appears in a list of villages entirely of the Herakleides: Psophthis, Pantikou, Tenteel, Onniton, Tzaali, and Zinnis. Pantikou and Onniton were in the E/NE of the *meris* while I suspect Zinnis to have been closer to the center of the nome. Psophthis may have been in the east of the *meris* as well but there is little more that can be said.

WEST-NORTHWEST (FORMER THEMISTOU *MERIS*)

Davoli's archaeological survey discusses fewer unnamed sites in the former Themistos than for either the Herakleides or Polemon *merides*. According to Cornelia Römer the Themistou *meris* was largely abandoned in the fourth century; the only known Greco-Roman village to survive was Dionysias. Although there are 278 surviving attestations of the town from the 3rd century BCE to the 6th CE only one papyrus dates to our period, *P.Laur.* III 93 (6th CE); dated ceramics from Dionysias, however, attest to continued inhabitation. Two other ancient sites of Greco-Roman date, modern Kom Hamuli and Kom Aliun, also outlasted the supposed abandonment of the *meris*.[245] And yet a brief search of TMGeo reveals that, to the contrary, there were numerous active sites in the former Themistos well into our period. Still, to judge from the relatively fewer extant toponyms it may have been the least active region of the Arsinoite. Despite this, the former Temistos was certainly not yet—if ever—abandoned.

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Alexandrou Nesos (3rd BCE to 8th or 9th CE)
Not identified. Alexandrou Nesos has an article in FVP and has been tentatively placed on the project's map to the north of Pisais/Ibshāwaī approximately halfway between the latter village and the south shore of Birket Qarun. This placement reflects K. Mueller's MDS results in

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[236] *SPP* X 1, 268 and 145
[237] *SPP* X 254 and *CPR* XXII 49
[238] *SPP* X 151, *SB* XVIII 13264, *SPP* X 15
[239] *SPP* XX 154 and X 262
[240] *SPP* X 138 and 262
[241] *SB* XVI 12480
[242] *SPP* X 151 and 262
[243] *SPP* X 151, *CPR* XXII 49
[244] *SPP* X 262 and XX 225
[245] Cornelia Römer, personal correspondence Sept. 26, 2010. I am unclear as to the extent of the desertion of the *meris* to which Römer refers. The results of her extensive survey work are in preparation and will likely not be published until the following year, sadly too late to integrate into this project.

Mueller (2003), 122, rather than the papyrological evidence *per se*,[246] although Banaji very tentatively identifies the village with Babīg Anšū, a medieval village near modern Abū Ginšū just south of Pisais. This is not entirely unreasonable since as the *nesos*-name indicates we are looking for a village resting on some sort of outcropping and at one point probably surrounded by the lake. FVP notes only that the village often occurs in the earlier period with BERENIKIS AIGIALOU and PTOLEMAIS DRYMOU, both attested until the 4th century. PTOLEMAIS DRYMOU occurs near THEADELPHIA, another Themistos locale, as well as the Polemon village of Kerkeesis; BERENIKIS is noted to be near EUHEMERIA, another fixed location (TMGeo). My instinct is thus to place Alexandrou Nesos rather more to the west than allowed by Mueller, which accords well with its location in the map of Appianus estate locales in Rathbone (1991) xix .
In late texts Alexandrou occurs with Mouchis, Pseonnophris and Pseou (*SPP* X 150), with Berenikis Thesmophorou, Belou, Karpe, Pisais, Sintoou, Tassat and Ampeliou (*SPP* X 78), and Tetrathyron, Melitonos *epoikion*, Tebetny, and Suron *kome* (P.Flor. I 11).[247]

*Angkonos/Ankonos Chorion/*Coptic *Pkalankeh* (5th to 8th)
The village is unknown before the 5th century and TMGeo guesses at a location somewhere in the Themistos. *BGU* II 370 (638) places Ankonos in the Arsinoite. Unfortunately, Ankonos occurs most frequently in alphabetical village lists or lists that appear to have some matter of alphabetizing principal interposed with non-alphabetical elements, which makes placing it difficult. [248] TMGeo provides no justification for a Themistos location although the appearance of the village once with Lenou, near EUHEMERIA,[249] and with Phentemin and Patres[250] presumably inform the decision. The latter text is the best of a bad batch of evidence for Ankonos' location. It is a short list of villages and amounts in *nomismatia* broken at the top and followed by what appears to be a personal name Paesis. In the subsequent line the name Georgios appears followed by *apo komes*, after which the text breaks. It is possible that one of the individuals named, more likely the former, had some manner of fiscal responsibility for the villages mentioned.[251] Since Phentemin and Patres are firmly located it is tempting to place Ankonos somewhere in their vicinity. The toponym seems to appear three times in Coptic texts (*CPR* IV 81, 86 and 127) as *Pkalankeh*, twice with *Tbōnalaali* ("the vine") which has been identified with Greeek *chorion* Ampeliou. There is no independent, bilingual evidence for the identification of the two place names; the unique names alone guide the interpretation (ἀγκών: "elbow" or "bend", *e.g.* in a canal) and kel Nkeà: "bend of arm"). The identification of Pkalankeh with Ankonos and its possible proximity to Ampeliou create a problem for the location of the latter village, on which see the pertinent entry.

*Ampeliou epoikion/*Coptic *Tbōnalaali*? (2nd or 6th to 8th)

[246] http://www.trismegistos.org/fayum/fayum2/105.php?geo_id=105
[247] The text also preserves reference to a γραμμ(α)τευς Κε[ ]κε[restored by the original editor as Kerkeosiris, though without much confidence. Since there are multiple possible restorations I have eliminated this village from consideration with Ankonos.
[248] See for instance *SPP* X 87, which lists six *choria*, some fragmentary, in *alpha*, followed by Syron, Skellos and Bousiris. *SPP* X 265 has the series Akanthonos, Ammou, Aphaniou, Alexandrou, Ankonos, Eulogiou, Distichia, Tassat, Sebennytos.
[249] *SPP* X 288
[250] *SPP* X 104
[251] Patres, Phentemin, Ankonos, Hagiou Victoros Episkopou *epoikion*

TMGeo hesitantly places the village in Polemon though Grenfell and Hunt already convinced of a location in the S/SW of the Fayyūm based upon the appearance of an *epoikion* Ampeliou in a list of Polemon taxpayers, appearing closest to XULITIDOS EPOIKION in a senond century CE text[252] The Coptic letter *CPR* IV 86 muddies the waters. The sender is from the Coptic toponym *Tbōnalaali* ("the vine") and the recipient from *Pkelankeh*/Ankonos, more securely tied to the region of the Themistos. At the end of the letter the scribe and witness, a deacon Menas, writes in Greek (in a Coptic script) that he is ἀπὸ χ(ωρίον) Ἀμπελίου. Banaji uses the Coptic documents and *SPP* X 1 to conjecture a location in the former Themistos. *SPP* X 1 is a list of villages in the estate of the late Fl. Strategios Paneuphemos: Psineuris, Ampeliou, Berenikis, Karpe, Phentemin, Kainos and [Psi]nol. Banaji's idenification of Berenikis as BERENIKIS AIGIALOU rather than Berenikis Thesmophorou is problematic since the former village is otherwise last securely attested in 351.[253] The identification may be correct, however, as noted above in the pertinent entry. The other villages may have been relatively close together in the W/NW Fayyūm (Psinol is a difficult case, on which see below); Banaji proposes a location near ancient Pisais.[254] He notes that Pkalankeh has been identified with "Qalamsha near or possibly identical with Abū Ginshū (med. Babīg Anshū), just south of Ibshawai (ancient Pisai)," i.e. in the former Themistos.[255] This is based upon Kosack's historical maps, which identify an Arabic village Qalamshā (قلمشاة) with the Coptic *Pkalankeh*.[256] Linguistic affinity between the two is possible, though Kosack was more hesitant than Banaji.[257] Indeed, the association between the villages Banaji references is somewhat tenuous. The Coptic papyri provide no topographical information for the two locales beyond placing Pkalankeh "*he ptash piam*" (in the nome of Fayyūm). In the Greek papyri Ankonos and Ampeliou apppear together only once in *SPP* X 284 in a list of three *choria*—Mena,[258] Ampeliou and Ankonos--headed by the personal name Senouthios.

As already noted by Grenfell and Hunt, Ampeliou appears in the texts with villages scattered across the whole of the Fayyūm and pinning down firm connections is difficult.[259] Ampeliou occurs three times with Sele, medieval and modern Saila (سيلا/سيلة) in what was the SE Herakleides[260] and Theogonis in Polemon.[261] In *SPP* X 266 and 274 payments are made from Ampeliou and Theogonis (Pol.) without any other accompanying villages. In *SPP* X 193, however, the same individual makes payments on behalf of Ampeliou and Alexandrou Nesos (Them.). On the strength of the connection to Ankonos and the village cluster in *SPP* X 1 Ampeliou should be placed somewhere in the W/NW Fayyūm. Considering the possible connection to Theogonis I am inclined to place Ampeliou further towards the south/former Polemon than the other villages in *SPP* X 1.

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[252] *P.Tebt.* II p. 359 and 367; *BGU* IV 1046 (166/7 CE)
[253] *P.Abinn.* 55
[254] *CPR* IV 81 and 86
[255] Banaji (2001) 246, citing the historical maps of Kosack. Abū Ginšū: 29° 21' 10 N, 30° 40' 2 E.
[256] This sould not be confused with modern Qalamšāh, medieval Qambašā, in the south of the Fayyūm. I am unable to trace Kosack's sources for the location/existence of the more mortherly Qalamšā.
[257] "[A]ußer einem entfernten Zusammenhang zwischen kalankeà und Qalamša ist nichts bewei*SB*ar," *Kartenwerk*, 64.
[258] Mena *chorion* is attested only three times in the papyri but was possibly Themistos. See below, "Mena."
[259] As already noted in *P.Tebt.* II, p. 382
[260] *SPP* X 152, 278 and 54
[261] *SPP* X 266, 278 and 274

Andreou (6th to 8th)
Not located in TMGeo.[262] The village appears three times with Patres[263] twice with Theoxenis,[264] Phanamet,[265] Magais,[266] Sebennytos[267] and Eter.[268] The first three are of the former Themistos while Sebennytos was more centrally located in the former Herakleides. Andreou appears in the estate text *SPP* X 138 administered together with Magais by the same *comes*. *SPP* X 247 contains a short list of villages which may have been in the same general area (Andreou, Anthou, Phthrys, Belou, Patres, Sebennytos, Skollidos, Phanou, Chalothis). In *SB* VI 9583 Menas from Beki (northern Polemon) makes a payment on behalf of the villages of Beki, Okeos, Theoxenis, Eter and Andreou. *P.Prag*. II 136 contains a list of individuals making payments from Perkethaut followed by another list of individuals from Andreou. In *SPP* X 80 a section of the document groups the villages Patres, Embolou and Andreou under the Arabic name Sa'īd Suleiman. The grouping seems to place Andreou towards the western portion of the nome in the former Themistos.

Areou (Areiou) epoikion (2nd BCE to 8th CE)
Based upon linguistic affinity the earlier village of Areiou is considered identical with the later village Areou. The former spelling is universal after *SB* I 5338 (4th-7th), which is the last text attesting the earlier form. Areiou is firmly located in the *meris* of Themistos near Herakleia in *P.Lond*. II no. 358.[269] Unfortunately all late attestations of Areou are in alphabetical lists and provide no topographical information.

Berenikis Aigialou? (3rd BCE to 4th or 7th?)
Lying somewhere near Euhemeria the village is massively attested in the Fayyūm papyri garnering 427 attestations in TMGeo from the 3rd BCE to the 4th CE. It is last attested securely in 351 in the Abinnaeus archive (*P.Abinn*. 55). Commonly written simply as Berenikis the village can be easily confused with Berenikis Thesmophorou in the Gharaq basin near Kerkeosiris, which is likewise often abbreviated. Although Berenikis Aigialou disappears from the documentation in the mid-4th CE Banaji asserts that several instances of a Berenikis in later texts must refer to Aigialou rather than its southern counterpart. *SPP* X 1 is a list of villages with some connection to the estate of the late Strategios Paneuphemos. The text is broken at the bottom but the initial portion is complete. The villages all cluster regionally in the NW Fayyūm except Berenikis at l. 5, if this is understood to be Thesmophorou. Banaji believes that Aigialou is more likely meant.[270] A Berenikis appears in *SPP* X 78, another group of western Fayyūm toponyms. Again, if Thesmophorou is to be understood the list presents a regionally unified cluster of villages with a single and significant outlier. Resolving the abbreviated village name

[262] In the text entry for *SB* VI 9583 under Andreou the list of villages in the entry concerning Andreou is preceded by 00b (Themistos) but nowhere else do TMGeo's compilers place the village in the Themistos
[263] *SB* I 5339, *SPP* X 80 and 247
[264] *SB* I 5339 and VI 9583
[265] *SB* I 5339 and *SPP* X 60
[266] *SB* I 5339 and *SPP* X 138
[267] *SB* I 5339 and *SPP* X 247
[268] *SB* I 5339 and VI 9583
[269] *P.Tebt*. II, p. 369. ll. 4-5 ἐν ἐπο[ι]κ[ί]ῳ [Ἀ]ρείου λεγομένῳ ὄντι περὶ κώμην Ἡρακλείαν τῆς Θεμίστου μερίδ[ο]ς
[270] It helps that the appendix itself concerns the alleged "relative cohesion" of estate holdings and it is thus in Banaji's interest to argue for Aigialou rather than Thesmophorou.

as Berenikis Aigialou is the most sensible choice. If this is correct there may be additional attestations of the village in the papyri that have been misattributed to Berenikis Thesmophorou.

Boukolon kome (3rd BCE to 8th CE)
TMGeo locates the village in the Themistos near Alexandrou Nesos, Berenikis Aigialou, Dionysias, PSINACHIS and THEADELPHIA based on earlier texts. Boukolon *kome* is unfortunately attested only twice in our period: *SPP* X 65 with Phentemin, Kalykonos and Ouo and *SPP* X 70. The latter is a *choria* list with an apparently alphabetical section with villages in *psi* followed by a fragmentary section that may include Arsinoe along with Boukolon and an unnamed monastery (the text is heavily restored). All locales appear in both Greek and Coptic, Boukolon as *Petboukolou*.

*Dionysias/*Qasr Qārūnقصر قارون 29° 25' 0" N, 30° 25' 0" E (3rd BCE to 6th CE?)
The location of Dionysias is well known. As mentioned above the town is attested 278 times in the papyri. It disappears from the record in the latter half of the fourth century, the final dated text being *SB* XXII 15286 (362). The only late attestation of the village is P.Laur. III 93 (probably 6th), the upper portion of a letter from an *archisymmachos* to the *grammateus* of a Herakleion and the *meizones* of Dionysias and Apolytas. The latter, which certainly appears to be a toponym occurs only here and its location, other than perhaps a proximity to Dionysias, cannot be guessed.[271]

Hermopolis (3rd BCE to 8th CE)
Earlier texts locate Hermopolis with some precision. The village lay near the southern border of the Themistos; along with ANDROMACHIS and Theoxenis the village was part of the fourth toparchy, centering around Perkethaut (at that time still Philagris). P.Abinn. 57 (342-51) contains a report of a landowner of Theoxenis attacked while walking in his fields on the outskirts of Hermopolis. Narmouthis, Hermopolis, and Theoxenis are all said to be stealing the water of THEADELPHIA to the north in P.Sakaon. 35 and 42 (323).[272] In the later period Hermopolis is mentioned almost entirely with villages of the former Polemon and Themistos.[273] The closest connection that emerges is with Magais. *SPP* VIII 1040 (6th) and P.Prag. I 68 (7th-8th) both refer to a single *hypodektes* ("receiver" of taxes) of both Magais and Hermopolis. *SPP* X 153 (6th) contains a list of workmen and their villages, the latter all clustering in the north of the former Polemon and the central region of the former Themistos. The list includes Tebetny, which recurs with Hermopolis in *SPP* X 162. THe village is also mentioned twice with Perkethaut.[274]

Herakleiaια (3rd BCE to 7th CE)
Unlocated; FVP guesses at a location north of Pisais/Ibshāwaī, stating that "it is almost certain that Herakleia was somewhere near the southern border of Lake Moeris," also noting that Pisais was at one point an *epoikion* in the territory of Herakleia.[275] Mentioned with Kerkesoucha Orous (H or P), Ouraniou, Pisais (T), Distichia (H?) in *SPP* X 156, Ampeliou (P?), Tebetny (P),

[271] l. 2 το(ῖς) μείζο(σιν) Ἀπολυτᾶς
[272] FVP: Hermou Polis (Meris of Themistos)" B. Van Beek and W. Clarysse
[273] Single mentions with Pantikou, Zinnis, Stratonos and Sele being the exceptions
[274] *SPP* X 162 and 106
[275] B. Van Beek, http://www.trismegistos.org/fayum/fayum2/772.php?geo_id=772

Hermopolis (T) in *SPP* X 153; Letous/Letopolis (H), and Tristomon (P), Alabantis (H), Kourabes, Skandips, and Aphaniou chorion in *SPP* XX 225.

Theoxenis (3rd BCE to 8th CE)
Not identified. Described as "village (*kome*) of the Themistou *meris*" in P.Flor. I 9 (255). Theoxenis is frequently mentioned in earlier texts with Theadelphia. Rathbone (1991) places the village roughly halfway between Theadelphia and Arsinoe, while the evidence presented by Van Beek in FVP more convincingly locates it somewhat farther to the west. It was possible to drive off sheep south from Theoxenis to Narmouthis in Polemon; Along with ANDROMACHIS and Hermopolis it was somewhere in the vicinity of Perkethaut, itself near modern Kom Hamūli.[276] In our period the large fragmentary tax list *SB* VI 9583 includes Theoxenis in a list of amounts paid "through Menas from Bekio( ).[277]" The pertinent section of the document is complete and shows the payer responsible for the villages of Bekio( ), Okeos chorion, Theoxenis, Eter, Theoxenidos *ousia*, and Andreou.[278] A similar grouping is attested in the account of camel saddles in *SPP* X 147. After a break in the text ll. 1-5 of fragment two have the villages Beki, Eter, Theoxenis[279], Narmouthis, and Perketheaut.[280] Theoxenis was thus surely located towards the southern and western portion of the Themistos.

Kieratou (3rd or 4th to 8th)
Not located in TMGeo. Following Banaji, the village may be identical with medieval and modern Garādū 12.67 km W of Medīnet al-Fayyūm and 7.3 km SE of Ibshāwaī/Pisais (29° 17' 57 N, 30° 42' 35 E).[281] *SB* I 4498 (mid-6th) and *BGU* II 365 (603) place the village in the Arsinoite. A list of sales in P.Abinn. 80 (mid-4th) groups Kieratou with several Polemon and Themistos villages.[282] *SB* I 5339 col. 2 (4th-7th) contains a list of generally southern villages with a single outlier in Boubastos at the end of the list. The only village with which Kieratou appears more than once is Kyras Marias, which is as yet unlocated.[283]

Kna/ Aqnā اقنى (4th? to 8th)
Not securely identified. TMGeo tentatively places it in the Themistos, which I regard as firm. An-Nābulsī presents a series of twenty one deserted villages starting "from the south" lying along or in the general region of the ruined canal Bahr Tanbatwiyeh. Among them are the Greco-Roman locales Sayla (?), Psenhyris, Perkethaut, Patres, Kna, and Dionysias.[284] The Bahr Tanbatwiyeh, which had silted over by the 13th century, ran along the western edge of the

[276] idem. http://www.trismegistos.org/fayum/fayum2/2386.php?geo_id=2386
[277] papyri.info prints the reading Βεκι from the original edition. I follow the updated reading Βεκιο( ) in TMGeo. See on Bekio( ) below.
[278] The section begins with δ(ιὰ) Μην(ᾶ) ἀπὸ Βέκιο( ) and terminates with (γίνεται) ϛ δ´ indicating a full accounting.
[279] As Theaxenis, a common variant spelling.
[280] As Perkeeaut, a common variant spelling.
[281] Banaji (2001), 244 n. 10
[282] Syrou, ANDROMACHIS, Ibion, Kieratou, Theoxenis
[283] *SB* I 5339, *SPP* XX 239
[284] *TF* 17 بلاده من الجهة القبلية (its villages from the south); in Arabic as Shelā, Sinhūris, Barajtaut, Badrīs, Aqnā and Qasr Qārūn.

Fayyum terminating at the lake near Qasr Qarūn (Dionysias).[285] Psenyris is identified with an-Nabulsī's Sinnūris (mod. Sanarū, south of Sanhūr and Fidīmin), Patres is medieval Badrīs (see below), Dionysias' location is secure, and Kna has been identified with Aqnā on the western edge of the Fayyum near the lake.[286] With Banaji I follow an-Nābulsī and the map Shafei Bey for the location of Kna at the western extremity of the Fayyūm near the lake.

Kos[287](3rd BCE to 8th CE)

There are three Demotic references to a village called Qos ranging in date from the 3rd BCE to the 2nd CE. The demotic papyrus P.Lille Dem. 29 (223 BCE) locates the village with some precision as "the town of Sobek, Qos, in the Meris of Themistes, on the southern edge of the canal (*henet)* of Moeris (Baḥr Yusuf), in the Nome of Arsinoe."[288] The canal is not to my knowledge identified. The papyri are silent thereafter until the 7th CE when a Kos appears in ten Greek documents. The indentity of Qos and Kos is accepted by TMGeo, presumably based upon linguistic affinity. *SB* I 4832 lists the *epoikion* of Kos in the Arsinoite as the origin of a bishop Apa Petros. The nine additional references to Kos are not entirely helpful. For instance, the list in *SPP* X 77 (7th/8th) contains contributions from various villages. with a heading referring to a *kephalaiotes* of fishermen. The villages listed, however, range from Zinnis in the NE of the Fayyūm, centrally loated Sebennytos, and Kerkeesis in the Gharaq basin. Kos is mentioned twice with Embolou *chorion*, Zinnis, Kerkesoucha Orous (P),[289] Sebennytos.[290] The texts may be helpful in plotting an early Arab administrative geography but less so in precisely locating Kos.

Lenou chorion (1st to 7th/8th)

Not securely identified. First century CE texts found at EUHEMERIA refer to Lenou as an *epoikion* of the larger neighboring *kome.*[291] After these references the toponym disappears until the 7th century where it is attested only six times. The extant references exclude villages from the S/SW and appear to concentrate in the N/NW. The only multiple references are two occurrences of Belou[292] and Phanou.[293] Several other N/NW/central villages occur giving a general impression of a location in this area but the firm connection with earlier EUHEMERIA is sufficient to place Lenou somewhere in the area of EUHEMERIA and THEADELPHIA.

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[285] Banaji (2001) 247; *TF* 17: وطرف تنبطويه ينتهى الى ماء البركة التي عند قصر قارون. For the location of the canal see G. Salmon, "Note sure la flore du Fayyoūm d'après an-Nāboulsī", *BIFAO* 1 (1901) at p. 31 and the map on 72. Reprinted in Sezgin (ed.).

[286] For the location see Banaji (2001) 247 and A. Shafei Bey, "Fayoum Irrigation as Described by Nabulsi in 1245 AD with a Description of the Present System of Irrigation and a Note on Lake Moeris", *Bulletin de la Société Royale de Géographie d'Égypte* 20 (1940) at 285. Reprinted in Sezgin (ed.) Islamic Geopgraphy 54.

[287] I discount *P.Prag*. I 30, included by TMGeo in the list of texts mentioning Kos. The papyrus lists laborors and mules sent to Memphis, Babylon/Fustat and *Kon*, which the editors guess may be Lycopolis based on the Kon/Lykon affinity. TMGeo apparently supposes the reference to men Kos. The main points to note are 1) Kos is nowhere else declined and 2) the small *chorion/epoikion* of Kos is not likely to be a destination for requisitioned labor in the manner of Memphis or the new Arab capital of Fustat.

[288] P. Gallo, "The Wandering Personnel of the Temple of Narmuthis in the Faiyum," *Life in a Multi-Cultural Society*, Chicago (1992), 124.

[289] All in *SPP* X 262 and 77

[290] *SPP* X 247 and 77

[291] *P.Ryl.* II 137 and 139 (34 CE).

[292] *SPP* X 247 and 288

[293] *SPP* X 247, *SB* VI 9583

Magais (3rd to 7th/8th)
Not identified. FVP notes multiple connections to THEADELPHIA, EUHEMERIA and Hermopolis (T), locating the village towards the north of the nome but south of Birket Qārūn. P.Stra*SB*.Gr. VI 538 (281) places Magais near a canal connecting the towns of Narmouthis, Perkethaut, Theoxenis, Magais and ANDROMACHIS. Van Beek not unreasonably suggests that the order of the villages might represent their geographic distribution (south to north), with Magais south of ANDROMACHIS and thus south of the known locations EUHEMERIA and THEADELPHIA, and north of Perkethaut, one of the most southerly villages in the former Themsitos.[294] As noted above the village had its closest connections in the later period with Hermopolis, sharing the same *hypodektes* in 6th and 7th/8th century texts. Apart from Hermopolis, the only village Magais appears with more than once is Mouei.[295] Magais appears in the estate text *SPP* X 138 administered together with the as-yet unplaced Andreou. In *SB* VI 9583 Magias makes a payment through and intermediary with a short list of villages firmly connected to the the south of the nome/former Polemon.[296] As such we may suspect that Magais lay towards the southern portion of the territory comprising the former Themistos.

Mena Chorion (7th/8th)
Not located in TMGeo. Although the toponym appears only three times in the published papyri I believe it to have been located somewhere in the W/NW. *SPP* X 97 contains the village list Tassat, Patres, Phentemin, Mena, Zinnis and Karpe, all probably in the north central region of the Fayyūm on either side of the old Themistos-Herakleides divide. *SPP* X 284 groups three villages under the personal name Senouthios: Mena, Ampeliou and Ankonos. An outlier is Nestou (H), which appears alone with Mena in *SPP* X 41. The balance of what little evidence survives appears to anchor Mena in this area.

Pakei (2nd to 7th)
Not identified. In the 3rd century the locale was part of the Themistos section of the Appianus estate and Rathbone (1991) places it adjacent to Dionysias. The key text is P.Flor III 322 (248) concerning payment to wage laborers (*misthotai*) in Pakei of the village of Dionysias. TMGeo follows this lead, speculating that the place was a "farmstead" of the latter village (at least in the early period; it is clearly a separate entity by late antiquity). Pakei appears in *SB* VI 9583 included in a list of villages possibly paying taxes through one Anastasios from Phourtin:[297] Magdolon Palaali (P), Panthare, Pakei (T), Tristomon (P), Ptenne, and Pia Baliou. Magdolon Palaali is a problematic case (see more below) but is probably not to be identified with Magdola (P) in the Gharaq basin but rather with Nabulsi's Bilala, said to be an hour from the Medinet al-Fayyum on horseback, though no direction is given (*TF* 64)—i.e. too far north to be identical with Magdola.[298] Tristomon is even more uncertain, its speculative location in FVP taking up much of central Polemon. In our period Pakei appears in some sort of village tax list in *SB*

[294] B. Van Beek in FVP, "Magais (Meris of Themistos)"
[295] *SB* VI 9583, *SPP* VIII 846
[296] Mouei, Magais, Dikaiou, Tyis, Oxyrhyncha, Monachou, Koueisan, Berenikis Thesmophorou
[297] The beginning of the section lists Anasatasios as an intermediary, completes with a γίνεται and then resumes with village names and amounts without listing an intermediary before breaking off. It is possible that Anastasios is to be understood as intermediary for the following villages, the previous clause being merely a subtotal.
[298] Keenan (2004) 494

XVIII 13772 with the more southerly Polemon villages Mouchis, Narmouthis, Oxyrhyncha and Pansoue. I suspect, however, that the list is alphabetical and does not necessarily represent geographical proximity[299] Lacking better evidence I follow Rathbone's suggestion.

Patres chorion/Badrīs بدريس (6th? to 8th)
Not identified and only tentatively linked to the Themistos in TMGeo. The village occurs twenty one times in our period; it occurs three times each with Zinnis (H), Arabon kome (H), Tassat, and Phanamet (T) and twice each with Psineuris (T), Phentemin (T), Belou and Karpe (P?).[300] This proves troublesome; TMGeo tentatively places Zinnis near Kerkesoucha, a village near Karanis, north of the lake in northern Herakleidou *meris* while FVP speculatively places Arabon broadly in eastern Herakleides. Psineuris and Phentemin are more secure, identified respectively with the extant towns of Sanhūr and Fidīmīn and lying towards the eastern edge of the Themistos. The village is however surely identical with medieval Badrīs described by an-Nābulsī as one of deserted along or near the Bahr Tanbatwiyeh. (see Kna above).[301] I am confident of a Themistos location. If we follow an-Nābulsī, as does Banaji, Patres will have lain somewhere towards the east along the ruined canal, perhaps somewhat to the north of Psenyris but south of Kna and Dionysias.

Perkethaut (3rd BCE to 9th CE)
The village was known in Greek as Philagris from the 3rd cent. BCE until sometime in the mid-4th cent. CE at which point it disappears from the record only to reappear under its Egyptian name.[302] The location of Perkethaut is relatively secure; it was in the southwest of the Themistos and towards its southern extent, somewhere in the vicinity of the contemporary archaeological site of Kom Hamuli. The identification comes from the colophon of two 9th century Coptic documents from the site, which state that they were kept "in the library of the place of the archangel St. Michael in the *mone* of Alli at Perkethoout."[303] The village reappears in an-Nābulsī as Barajtaūt (برجتوت) with Patres, Kna and Dionysias; following an-Nābulsī's geography it will have been south of these villages on the Bahr Tanbatwiyeh, a good fit for a location near Kom Hamuli. Perkethaut occurs twice each with Alexandrou Nesos, Hermopolis, Zinnis, Psenyris, Aphaniou chorion, and Beki.

Pisais/*Ibshaway*ابشاوي 29° 21' 32 N, 30° 40' 42 E (3rd BCE to 10th CE)
Firm location. The Greco-Roman toponym is identified with the modern Arabic town of Ibshaway, Wessely having made the connection in his *Geographie*, 126 (FVP). The Coptic

[299] The abovementioned Polemon villages are followed by several entries modified by *pomariou* then Pakei, a break and finally Pansoue. The list would seem to be an alphabetical account of some sort.
[300] Zinnis: *SPP* X 138, *SPP* X 162, *SPP* X 97; Arabon: *SB* XVIII 13264, *SPP* X 180, *SPP* X 247; Tassat: *SPP* XVIII 13264, *SPP* X 90, *SPP* X 97; Phanamet: *SPP* X 180, *SPP* X 90, *SPP* X 93; Psineuris: *SB* XVIII 13264, *SPP* X 162; Phentemin: *SPP* X 104, *SPP* X 97; Belou: *SPP* X 247, *SPP* X 93; Karpe: *SPP* X 90, *SPP* X 97
[301] "Cette liste comprend non seulement les villages situés sur le parcours du Bahr Tanbatwayh, mais aussi tous les villages, bourgs et hameaux ruinés ou seulement abandonnés dans la région": G. Salmon "Répertoire géographique de la province du Fayyoūm d'après le Kitāb Tārīkh al-Fayyoūm d'an-Nāboulsī," *BIFAO* 1 (1901) at 31. Reprinted in Fuat Sezgin (ed.) Islamic Geography Vol. 54: Studies on the Faiyūm (1992), Frankfurt.
[302] W. Clarysse and B. Van Beek note that the double Greek-Egyptian name—the latter meaning "foundation of Thot"-- had existed since the 3rd cent. BCE but dissapeared in the Roman period. Why it should have reemerged under the Egyptian name in the 6th century CE is unclear.
[303] Clarysse and Van Beek (2002), 198. See Davoli (1998) at 330 for a brief survey of the site.

version *Pishaei* is close to the current place name as well as the medieval variant Abshayyat al-Rumān found in an-Nābulsī (*TF* 13,19). Pisais occurs most often with Belou (four occurrences),[304] three times with Mouchis[305] and twice each with Kna (T),[306] Psineuris[307], Phanamet[308], Zinnis (H)[309], Zizonos chorion,[310] Sintoou,[311] Tassat,[312] Arabon kome,[313] Distichia,[314] Pansoue,[315] Kerkesoucha Orous (H)[316], and Episkopou Epoikion.[317]

Sintoou (6th to 8th)
Not assigned to a *meris* in TMGeo in the main "Sintoou Chorion" entry although there are occasionally references to a location in the Herakleides. The village is unknown before the 6th CE and appears in only eleven papyri. The evidence for its location is slim; Sintoou appears twice with Alexandrou Nesos[318] and only once with nineteen other villages as far east as Pantikou. It does, however, appear in the village list *SPP* X 78, which contains only western and northwestern villages.[319]

Tassat/Tahsad al-Kubrā تحصاد الكبرى (6th to 8th)
Not located in TMGeo. Tassat does not appear in Coptic but its Arabic name Tahsad al-Kubrā (Greater Tassat) is included in the bilingual *P.Ross.Georg.* V 73. The village occurs only in the in the late period and Timm connects it with Patres and Karpe (VI, p. 2547). Since the former--as medieval Badrīs--lay along the defunct Bahr Tanbatwiyeh in the western Fayyūm Timm proposes a location somewhere in the region of Patres and Pisais. This is surely correct. Tassat's strongest connections are with this region of the Fayyūm. It occurs with Patres four times[320] and twice with Ampeliou,[321] Karpe[322] Pisais[323] and Phentemin.[324] Tassat also appears twice with Dikaiou Nesos,[325] Sebennytos,[326] Tourobestis,[327] Skollidos,[328] and Zizonos.[329] A location in the N/NW is highly likely.

[304] *SPP* X 247, *SPP* VIII 1304, *SPP* X 78, *SPP* X 13.
[305] *SPP* X 253, *SPP* VIII 1304, *SPP* X 74
[306] *SPP* X 253, *SPP* X 90
[307] *SPP* X 254, *CPR* XXII 49
[308] *SPP* X 254, *SPP* X 90
[309] *SPP* X 57, *SPP* X 13
[310] *SPP* X 57, *SPP* X 73
[311] P.Horak 65, *SPP* X 78
[312] *SPP* X 78, *SPP* X 90
[313] *SPP* X 13, *SPP* X 183
[314] *SPP* X 13, *SPP* X 156
[315] *SPP* X 13, *SPP* X 74,
[316] *SPP* X 156, *SPP* X 74
[317] *CPR* XXII 49, *SPP* X 74.
[318] *SPP* X 150 and 78
[319] See Banaji (2001), 246-7
[320] *SB* I 5338, *SB* XVIII 13264, *SPP* X 90, *SPP* X 97
[321] *SB* I 5338 and *SPP* X 78
[322] *SPP* X 90 and 97
[323] *SPP* X 78 and 90
[324] *SPP* X 73 and 97
[325] *SB* I 5338 and *SPP* X 260
[326] *SB* I 5338
[327] *SB* I 5338, *P.Ross.Georg.* V 73
[328] *SPP* X 98, *P.Ross.Georg.* V 73
[329] *P.Ross.Georg.* V 73, *SPP* X 73

Tetrakomia (4th to 7th)
Not located in TMGeo. There are only two attestations of the village: *CPR* VI 82 (4th; a letter with no topographical information) and *SPP* X 138 (600-25), the account of lands belonging to the late Fl. Strategios Paneuphemos. The latter is sufficient to place the village towards the center of the Fayyūm if not securely in either the Themistos or western stretches of the Herakleides. In the text Tetrakomia is grouped with Zinnis (H) and Patres (T) all three administered by the *comes* Tzittas.[330] There is one additional if highly uncertain attestation of the village in *SB* XXII 16474 (8th) although it is alphabetical. The village list published here is broken at the right reading comprises Syr[, Skel[, Stra[, Sell[, Syr[and Te[. The two Syr[ ] entries might refer to the distinct villages of Syrou (P) and Syron (H) or they could be the same. Sell[ ] is likely Sele in the far east, Skel[ ] (To) Skelos, Stra[ ] Stratonos and Te[ ] Tetrathyron or Tetrakomia, the only options of which I am aware in Te[ ], barring misspellings, *e.g.* of Tassat though this is unlikely since most misspellings represent itacism. The alphabetical nature of the text alone renders this text next to useless while the breakages, although not critical for the *sigma* villages, render Te[ ] in l. 7 impossible to restore with confidence.

Phanamet/ Binhamat/*Biahmu* (6th to 8th)
Not identified. The village is attested only in our period, first appearing in the lengthy village list *SB* I 5339.[331] It appears nineteen times in the corpus most often in connection with north-/north western villages, which is why I have included it this section. Phanamet appears four times with Patres and Psineuris (both T), three times with Boubastos (H) and Kna (T) and twice with Andreou, Magais (T), Tebetny (P), Stratonos (H), Sebennytos (H), Kainou (P), Pisais (T), Belou, Akanthonos, Mouei, Magdolon Palaali (P), and Ptolemais Hormou (H). Wessely speculated that the village might be identical with the Arabic village name Binhamat found in a single ninth century *descriptum*.[332] TMGeo repeats this speculation and adds another from the following text, also published only as a *descriptum* and containing the Arabic village name Biahmu.[333]

Phentemin/*Fidīmīn* فديمين (3rd BCE to 8th CE)
Location secure. The town is known earlier as Psentymis and retains this name until approximately the first quarter of the fourth century; Phentemin is used exclusively in the twenty two attestations from the late period.[334] The identification of ancient Phentemin with medieval and modern Fidīmīn is generally accepted and is evident in the Greek-Arabic papyrus *P.Ross.Georg.* V 73 (8th c.). This list of persons and villages includes Arabic renderings of fourteen Fayyūm place names, among them χωρ/ Φεντε/ as "Fidmīn" (فدمين).[335] Phentemin is

[330] On the individual see Palme (1997), 109-112
[331] The text cannot be dated more securely at present than "late antique, 4th-7th CE."
[332] Papyrus Erzherzog Rainer. Führer durch die Ausstellung 681 descr.
[333] Papyrus Erzherzog Rainer. Führer durch die Ausstellung 682 descr., Vo
[334] The last appearance of the name Psentymis is *SB* XVI 13001 (300-25) after which Phentemin is universally used.
[335] Banaji (2001)246

mentioned three times with Psineuris[336] and twice with Melitonos, [337] Sebennytos,[338] Zizonos,[339] Patres,[340] Ptene,[341] Tassat,[342] Karpe,[343] Ptolemais Hormou[344] and Anthou.[345]

Chalothis (2nd to 8th)
Not identified. TMGeo tentatively places the village near Euhemeria (Qasr al-Banāt), which was extinct by our period. The location is based on one much earlier text, a letter of ca. 100 CE from the archive of the veteran and landowner L. Bellienus Gemellus, the 38 texts of which were excavated at Euhemeria by Grenfell and Hunt.[346] In the letter Gemellus instructs one Epagathos, his estate manager in Euhemeria, to deal with some business at Chalothis concerning a *mechane* (irragation water wheel). Clearly this locale was somewhere in the environs of Euhemeria. For our period the usable references are few. There are only eleven occurrences of the villages, in five of which the place name appears unaccompanied by other toponyms. In *SPP* X 138 Chalothis appears with Ampeliou and Monachou epoikion. In *SPP* X 247 and *SB* VI 9583 in occurs with multiple other toponyms, none of which are reflected in the both texts save Distichia. The latter village is tentatively assigned to the Herakleidou *meris* by TMGeo.

Psetera (3rd to 8th)
Not identified; tentatively liked to the Themistos in TMGeo. The locale is mentioned as an *epoikion* in an earlier text found at Theadelphia (P.Laur. I 11 [225-275]) and occurs in the marriage contract *P.Ross.Georg.* III 28 (mid 4th CE) with the earlier village of Taurinou *kome*, a locale known to have been in the Themistos.[347] References in our period are thin. Psetera occurs twice in the same context with Pantikou Allages, medieval Bandīq, but this village lay on the Bahr Sela in the eastern Fayyūm--quite distant from Theadelphia.[348] The only other village with which Psetera occurs more than once is Ouo in the former Polemon.[349] Lacking firmer evidence the village must be assigned to the region around Theadelphia.

SOUTH AND SOUTHWEST (FORMER *MERIS* OF POLEMON)

Aninou (5th to 8th)

[336] *SPP* X 145, *SPP* X 1, *SPP* X 268
[337] *SPP* X 145, *P.Ross.Georg.* V 64
[338] *P.Ross.Georg.* V 64 and 73
[339] *SPP* X 57, *P.Ross.Georg.* V 73
[340] *SPP* X 104, *SPP* X 97
[341] *SPP* X 145 and 193
[342] *P.Ross.Georg.* V 73, *SPP* X 97
[343] *SPP* X 1 and 97
[344] *SPP* X 57, *P.Ross.Georg.* V 73
[345] *SPP* X 193, *CPR* XXII 60
[346] *P.Fay*. 122. On the archive see the Trismegistos Archives article by Ruben Smolders under the TMArchives entry "Epagathos estate manager of Lucius Bellienus Gemellus."
[347] See the relevant article by H. Verreth at FVP.
[348] *SPP* XX 225 and *SPP* X 60
[349] *SPP* X 60 (as Ouo Borrine) and *SPP* X 168 (as Ouo Notine)

Not located in TMGeo. There are only four texts that provide useable information but they are sufficient to place it in the northern Polemon. In *SPP* X 174 (8th) Aninou appears with Bebychos and Nibilla both in the N Polemon (?). The most useful documents are *CPR* XXII 60 ($7^{th}/8^{th}$) and *SPP* X 83 (8^{th}). In the former Aninou appears with a selection of villages of the N Polemon and W Herakleides including Phourtin and Tetrythyron, which are directly preceded by Aninou. The same two villages recur in *SPP* X 83, in this instance followed by Aninou. The text also includes Tyis at the end of the list. I believe that all these villages can be securely tied to the N Polemon (see relevant entries). Aninou also appears in *SB* I 5339, this list of villages all broadly in the western half of the Fayyūm.

Areos kome/Areiūh اريوه (2^{nd} or 3^{rd} BCE to 8^{th} CE)
Not identified but possibly near Kerkeosiris and Tebtunis in the Gharaq basin (*P.Tebt.* I 61 and II 609 vo. descr.).[350] It was very near the Polemon village Kerkesoucha Orous as made clear in a Ptolemaic text, which refers to a *kleros* of 40 arouras near the two villages.[351] Kerkesoucha was at times administratively dependent upon Tebtunis and may have been somewhere between Tebtunis and Talei, on which see more below (FVP).[352] The late references to Areos are few and unhelpful. The village is mentioned several times in the context of numerous other widely scattered toponyms, none more than once. In *P.Ross.Georg.* V 73 the village name is rendered in Arabic, whence the above transcription. To judge from the earlier evidence, Areos *kome* must be placed towards the southern extent of the former Polemon somewhere in the vicinity of Tebtunis.

Armatoura (6^{th} or 7^{th} to 8^{th})
Not located in TMGeo. Grenfell and Hunt thought it likely that the village was in the south based on its appearance in *SPP* X 250.[353] The village appears with other toponyms from the south of the Fayyūm as well as the former Herakleides. No toponym appears more than twice save Syrou (three instances):[354] Magais,[355] Dikaiou,[356] Koueisan,[357] Aphrodites Berenikis Polis,[358] Ouo,[359] Patres,[360] Beki,[361] Elia,[362] Eter,[363] Areiou,[364] Thambator,[365] Kouloupon,[366] Kynon,[367] Ibion.[368] Grenfell and Hunt were surely correct to associate the village with the south of the nome. Like *SPP* X 250, *SPP* X 275 places Armatoura with other southerly villages *SB* VI

[350] Grenfell and Hunt in *P.Tebt.* II Appendix II at 369
[351] *SB* XVI 12720 (142 BCE); S. Daris (1984), 116
[352] I. Uytterhoeven "Kerkesoucha Orous (Meris of Polemon)" in FVP
[353] *P.Tebt.* II, p. 369
[354] *SB* I 5338, *SPP* X 250 and XX 267
[355] *SB* I 5339 and VI 9583
[356] *SB* I 5338 and VI 9583
[357] *SB* I 5338, *SPP* X 27
[358] *SB* I 5338 and VI 9583
[359] *SPP* X 250, *SB* VI 9583
[360] *SB* I 5338 and 5339
[361] *SPP* X 275 and 27
[362] *SPP* X 250 and 27
[363] *SB* I 5339, *SPP* X 275
[364] *SB* I 5338, *SPP* X 275
[365] *SB* I 5339, *SPP* X 250
[366] *SB* I 5338, *SPP* X 250
[367] *SB* I 5338, *SPP* X 250
[368] *SB* I 5338, *SPP* X 250

9583 also groups Armatoura in a list of western and south-western villages making payments through a single individual.[369] Although some villages of the former Themistos and Herakleides appear with Armatoura (e.g. Magais, Patres, Sebennytos) villages of the far south (e.g. Kerkeosiris, Magdola, Talei, Tebtunis) do not; Armatoura was clearly towards the northern portion of the former Polemon. Unfortunately no close connections to any other villages emerge.

Aphaniou chorion (7th to 8th)
Aphaniou occurs only in our period. It is unplaced in TMGeo but Grenfell and Hunt were convinced of a Polemon location based upon the then-unpublished SPP XX 265. Aphaniou appears here with eight other villages, all Polemon.[370] Each village makes a payment of one (*nomismation*?) except Aphaniou which is paired with Beki, the two paying collectively. The same pairing may appear in SPP X 249 (estate locales), where Beki *kai* Aphaniou are grouped with Pantikou, Tanis and Hiera Nesos (the text is restored as [Βεκι κ]αὶ Ἀφανί(ου).[371] Here however we see villages of the Herakleides, Pantikou[372] and Tanis, which lay towards the eastern edge of the nome, while Hiera Nesos may refer either to a Polemon village near Tebtunis or a Herakleides village near BAKHIAS and Karanis. Beki appears an additional three times with Aphaniou, though not paired.[373] Aphaniou occurs with Eter three times[374] and twice with Pantikou,[375] Anthou,[376] Tristomon,[377] Narmouthis[378] and Perkethaut.[379] On the whole the villages with which Aphaniou appears are too widely scattered to for definite patterns to emerge. Its appearance with numerous villages of the S/SW and the southern reaches of the Themistos, as well as the likely not coincidental Polemon list *SPP* XX 265 seem to point to a Polemon location. The pairing with Beki is, however, the most useful item of evidence since the latter is more securely tied to the Polemon (see below, "Beki").

Bebrychos (3rd to 8th)
TMGeo locates the village in the Polemon; the village appears in P.Grenf. II 83 (5th), which concerns produce and rent revenues on several holdings: produce from the *kome* Tali, *epoikion* Eleusis, rent from an old house in the *amphodon* Alypiou (a quarter of the nome capital Arsinoe) and on a large house and farm building on the *epoikion* of Bebrychos, and finally the produce of fifteen arouras in Ptolemais Hormou and the rent on a house there. All these locales were in the south, save the reference to Arsinoe. All but Tali were more towards the north of the nome. It is perhaps more weight than the text can support but it is worth noting that rent on property in Bebrychos is mentioned in the same context as rent in Arsinoe. Eliminating Bebrychos, the locales mentioned move from the south to the north and then southeast to Ptolemais Hormou.

[369] Mouei, Magais, Dikaiou, Tyis, Oxyrhyncha, Monachou, Koueisan, Berenikis, 00a Aphrodites Berenikes Polis (?), Armatoura, Ouo, Boukolon Pedias, Episkopou, Arsinoe (Medīnet al-Fayyūm)
[370] *P.Tebt.* II, p. 371; Kerkethoeris, Beki, Kaminoi, Theogonis, Tali, Ibion Eikosipentarouron, Narmouthis, Oxyrhyncha
[371] TMGeo accepts the restoration without comment.
[372] May refer either to a Pantikou Nouki or Pantikou Allages, apparently distinct villages. See further below, "Pantikou" and, e.g., *SPP* XX 229 with Keenan (2007).
[373] *SPP* X 275, 260 and 147
[374] *SPP* X 275, 260 and 147
[375] *SPP* X 275 and 249
[376] *SPP* X 193 and 147
[377] *SPP* X 260, *SPP* XX 225
[378] *SPP* X 265 and 147
[379] *SPP* X 89 and 147

Bebrychos may have been quite far to the north, near the capital. In support of this is P.Rein. II 133 (267), which mentions Kaminoi, also in the far north of the *meris*.

The only village Bebrychos is mentioned with more than once is Aninou.[380] There are three occurances of Berenikis (probably Aigialou, see above) but two occur in alphabetical lists.[381]

Beki or *Bekio*(...) (2nd or 3rd to 8th)

The name of the village is uncertain. The village appears in one text of the 2nd-3rd CE but otherwise only in the late period. It is almost universally written as Beki although the authors of TMGeo believe this to be an abbreviation. P.Horak 64 appears to read Βεκιο( ), or rather Βεκι° with the *omicron* directly over the *iota*. I cannot verify this reading based upon the image in the published volume. The supposed superscript *omicron* looks rather more like a random ink dot than anything else. Grenfell and Hunt claim that a similar abbreviation is evident in *SPP* X 275; no image is available but Wessely printed Βεκι/ in the original edition. The village is attested fourteen times and one might expect to see it written in full at least once, especially considering its appearance in lists of villages none of which are abbreviated (e.g. *SPP* X 138). If it did have a more complete "proper" name perhaps a shortened form became regularized on the pattern of Ibion Eikosipentarouron (see below). Since I cannot resolve the possible abbreviation I leave the toponym as Beki.

Beki occurs in a 2nd-3rd century list with six other toponyms, all Polemon: APHRODITES POLIS, Eleusis, Mouchis, Dikaiou, LYSIMACHOS and Kynopolis.[382] In its thirteen additional attestations Beki appears four times with Aphaniou,[383] and Eter,[384] three times with Narmouthis,[385] and twice with Armatoura,[386] Tassat (possibly)[387] and Theoxenis.[388] As described above Beki and Aphaniou appear twice as a joint entity; in *SPP* XX 265 the two make a joint payment and in *SPP* X 249 they—probably--appear in a brief list of villages as a one-line entry [*Beki k*]*ai Aphaniou* (restored). Even if the second pairing is not accepted, the first clearly indicates that the villages had some manner of connection. *SPP* X 138 (lands of Strategios Paneuphemos) groups Beki with Karpe and Narmouthis under a *comes* Phoibammon.

Beki is not a commonly cited toponym and, being pairing with Aphaniou, was perhaps a minor locale. A grouping of villages does however emerge from its texts, often appearing in the same or close to the same order: Beki, Aphaniou, Eter, Narmouthis, Armatoura, and Theoxenis. Theoxenis was probably in the SW of what was once the Themistos; Narmouthis (Medinet Madi) is a known Gharaq basin location. We may perhaps consider these villages as roughly adjacent; if not all in the Gharaq itself at least in its vicinity.

Berenikis Thesmophorou (3rd BCE to 8th CE)

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[380] *SB* I 5339, *SPP* X 174

[381] *SPP* X 62 and 40 in both of which Bebrychos directly precedes Berenikis. *SB* I 5339 is the only non-alphabetical occurrence.

[382] *SPP* X 112

[383] *SPP* X 275, 265, 260 and 147, *SB* VI 9583

[384] *SPP* X 275, 260, *SB* VI 9583

[385] *SPP* X 138, 147 and *SPP* XX 265

[386] *SPP* X 275 and 27

[387] *SPP* X 260 and P.Horak 64. The former reads .ασσα in the published version. Tassat is the only possible restoration.

[388] *SB* VI 9583 and *SPP* X 147

TMGeo places the village in the far south of the *meris* of Polemon in the Gharaq basin. It was bordered on the north by Ibion, to the east by Theogonis and to the (south)west by Kerkeosiris. Land surveys from the archive of Menches show Berenikis to have been to the west or southwest of Kerkeosiris, the territories of the two villages being adjacent one another.[389] P.Tebt I 17 (114 BCE) reports a future visit to Kerkeosiris by an official on his way from Berenikis to Theogonis just to the east. Rathbone has identifed the site of Kom al-Khamsīn as Berenikis though this has yet to be proven; the general location is appropriate but there is no certain evidence.[390]

The toponym appears as Berenikis or *chorion* Bernikidos fifteen times in late antique papyri ascribed to the village by TMGeo. It is never in these texts, however, modified by "Thesmophorou." On several occasions TMGeo scholars note that the text might refer to Berenikis Aigialou. I am convinced that in every instance save *SB* I 5336 an argument can be made for assigning these references to Berenikis Aigialou.[391] Of the villages mentioned with Berenikis in these papyri (excluding *SB* I 5336) none is farther south than Narmouthis (*SB* I 5339) and Thesmophorou's nearest neighbors, Ibion appears only once and Kerkeosiris is entirely absent.[392] In and of itself this is not a problem; the villages that do appear with Berenikis, however, are of the N Polemon, Themistos and E Herakleides. This leads, on balance, to the impression that the Berenikis in question had a more northerly orientation. The alphabetical list *SB* I 5336 is noted by TMGeo to contain more villages of the Polemon than of the Themistos and as such ought to reference Thesmophorou; Ibion appears in l. 13, Kerkethoeris in the following line and Tebtunis (as Teptunos) in l. 26. All three were in the far south of the *meris*, the first two in the neighborhood of Thesmophorou and Tebtunis still farther south. It is quite possible that the Berenikis mentioned here is indeed Thesmophorou and not the more northerly Aigialou although I do not believe that the latter can be entirely excluded. *SB* I 5339 (300-699) is a list lacking an organizational structure that I can determine. It is composed entirely of villages of the central and western portion of the nome, Sebennytos and Stratonos probably being the farthest east.[393] Berenikis is mentioned twice in succession but this should not be taken as a reference to two villages; other villages are also mentioned twice, Sebennytos three times.

SPP X 1 (7th) has already occasioned comment. Banaji notes that the villages mentioned in this list of Fl. Strategios Paneuphemos' estate locales are all outside of the conjectured borders of the Theodosiopolite except Berenikis in the far south, if one chooses to interpret Βε̣ρ̣νικίδο(ς) as Thesmophorou.[394] All the villages in the list can be identified with known sites or assigned to a general area of the Fayyūm with some certainty; they all fall in the Themistos, the W extreme of the Herakleides and the very N of the Polemon (see relevant entries).[395] If the Berenikis mentioned is Thesmophorou it is an extreme outlier. It is more likely to be Aigialou.

SPP X 62 (7th) Bebrychos, Berenikis, Belou

[389] *P.Tebt.* I 84 and IV 1116
[390] FVP: B. Van Beek, "Berenikis Thesmophorou (meris of Polemon)"
[391] The texts in question are*SB* I 5336 and 5339, *P.Narm.* 2006 9, *SPP* VIII 810, *SPP* III 544, *SPP* XX 176, *SPP* X 1, 62, and 78, *CPR* XIV 55, *SPP* X 40, *P.Lond.* V 1763, *SB* VI 9583, *SPP* X 155
[392] Kerkeosiris appears in only one late text, P.Flor. 11
[393] Andreou, Bebrychos, Naleou, Theoxenis, Magais, Aninou, Tebetny; [----], Berenikis, Stratonos, Sebennytos, Karpe, Patres, Kainou, Embolou, Bathr[ ], Armatoura, Eter, Kyras Marias, Narmouthis, Kieratou, Phanamet, Thambator, Anthou, Boubastos
[394] Banaji (2001), 246-8
[395] Psineuris, Ampeliou, Berenikis, Karpe, Phentemin, Psineuris, Kainou, Psinol

SPP X 78 (7th), a list of payments of wine, bears similaries to *SPP* X 1. The villages are all broadly in the W and NW of the late antique Fayyūm (Themistos, and E Herakleides) save for Berenikis, if the latter is Thesmophorou.[396] Like *SPP* X 1 the village would be an extreme outlier.

CPR XIV 55 (7th) concerns a journey to "the Holy Cross" (Jerusalem). The writer just returned ἀπὸ τῆς [σ]ῆς μεγαλοπρεπίας and informs the recipient that he will be coming to Zinnis but will can be in Berenikis "tomorrow at the fourth hour, or maybe at the fifth, if you instruct me 'Go out tomorrow before daybreak with a courier.'" Neither of the two Berenikes can be excluded. For instance, according to al-Nābulusī, a traveler on horseback could make the journey from Medīnat al-Fayyūm to Talei (in the vicinity of Thesmophorou) in half a day

Berenikis appears in the tax document *SB* VI 9583 in a group of villages paying through a resident of Mouei.[397] Again, all the villages are well north of the notional Theodosiopolite and a Berenikis, if Thesmophorou, would be well apart from the rest of the group.

In these texts Berenikis appears three times with Karpe[398] and twice with Magais,[399] Kainou,[400] Ampeliou[401] and Belou.[402] If the above arguments are correct there is no firm attestation of Berenikis Thesmophorou later than P.Stras IV 192 (207). All instances of the village recorded in TMGeo should be assigned to the Themistos and Berenikis Aigialou. *SB* VI 9583, *SPP* X 1 and 78 are the best indications of the surrounding topography.

Dikaiou Nesos (3rd BCE to 8th CE)

According to FVP Dikaiou Nesos may have been to the north/north-west of the Polemon *meris*, somewhere close to the border with the Themistos.[403] It had close connections to the nearby village of ARISTARCHOU NESOS (last attested 318 CE), both villages occurring in a single entry in the second century CE list of persons and villages *P.Tebt.* II 609 descr. The village continues to appear regularly in the late antique texts, being attested 34 times in the published papyri, occasionally as *Tikaiou* or *Tikeou*. It is explicitly said to belong to the Theodosiopolite nome in *SPP* (2) III 32. Overall, Dikaiou occurs with fifty different Fayyūm place names, though none more than twice (these being Mouchis,[404] Ouo,[405] Beki,[406] Aphaniou *chorion*,[407] Theoxenis,[408] Tristomon,[409] Tyis,[410] Boubastos,[411] and Koueisan[412]). Seven of these villages—excluding Boubastos and Koueisan—occur in either or both *SPP* X 249 and 260. These two papyri may most clearly represent Dikaiou's surrounding topography, although the closest connections to be

[396] Berenikis, Karpe, Pisais, Belou, Sintoou, Tassat, Alexandrou, Ampeliou
[397] Mouei, Magais, Dikaiou Nesos, Tyis, Oxyrhyncha, Monachou, Koueisan, Berenikis
[398] *SB* I 5339, *SPP* X 1 and 78
[399] *SB* I 5339 and VI 9583
[400] *SB* I 5339, *SPP* X 1
[401] *SPP* X 1 and 78
[402] *SPP* X 62 and 78
[403] B. Van Beek, "Dikaiou Nesos (Meris of Polemon)" in FVP
[404] *SPP* VIII 811, *SPP* X 249
[405] *SPP* X 138 and 249
[406] *SPP* X 249 and 260
[407] *SPP* X 249 and 260
[408] *SPP* X 249 and 24 (alphabetical?)
[409] *SPP* X 249 and 260
[410] *SPP* X 249, *SB* VI 9583
[411] *SPP* X 24 (alphabetical), *SPP* X 245
[412] *SPP* X 24 (alphabetical?), *SB* VI 9583

gleaned from the evidence are those with Mouchis and Ouo. In *SPP* VIII 811 Dikaiou appears with Mouchis, both villages paying taxes in wheat through the same individual (whose village of origin beginning with Π is lost). It again appears with Mouchis in *SPP* X 249; the text refers to an "*ousia* Dikaiou" and lists the villages Gemellou, Georgion, Ouo, Melitonos *epoikion* and Mouchis. The village of Ouo again appears with Dikaiou in *SPP* X 138 in a section dealing with lands of Fl. Strategius Paneuphemos in five separate villages all administered by the same *comes*: Panse, Thambator, *epoikion* Ammo[ ], Ouo and Dikaiou. Ouo is not yet placed but if Mouchis (Coptic *Tmoushi*) is correctly identified with al-Nābulusī's Dumushīya near modern Deir al-'Azab[413] and the known site of Tebtny/Dafadnū I am inclined to locate Dikaiou rather more towards the eastern portion of the former Polemon (see further below, "Mouchis").[414]

Eleusis (3rd BCE to 8th CE)
Not identified. The village was on the road between Medinet al-Fayyūm and Oxyrhyncha not far from the nome capital. Nearby villages were Mouchis, APHRODITES POLIS, Kynon Polis, Oxyrhyncha, Theogonis and Tebetny (FVP).[415] In *SPP* III 32 (6th/7th) Eleusis in in the Theodosiopolite nome, while *SB* VI 9596 (579) and *BGU* II 366 (645 or 660) place it in the Arsinoite. FVP notes that its strongest connections are with Mouchis and as such should be located somewhere near modern Deir al-'Azab (see below, "Mouchis"). In the late documents Eleusis occurs twice with Mouchis. *SPP* X 250 contains a list of payments from villages through single individuals; Eleusis occurs after Mouchis, separated by Koulopon *chorion*. Mouchis recurs in the abovementioned *SPP* X 249 but not explicitly connected to Eleusis. Here Eleusis is grouped with Kerkesephis and Tristomon, from which villages a *dioiketes* is to make collections. Eleusis occurs with 46 additional villages, three times with Tyis[416] and twice with Ouo[417] and Melitonos *epoikion*.[418] Banaji has proposed an identification with modern Itsa, 9.46 km SE of the capital but provides no support for the assertion.[419] The two may or may not be identical but a location in the general area around Mouchis and Tebetny is certainly correct.

Eter (4th? to 8th CE)
Not located in TMGeo. Eter is attested only in the late period and appears in eight texts. Though the evidence is limited a general location emerges immediately from the texts. The villages with which Eter appears are generally located in the former Polemon or western Fayyūm,[420] while Eter itself occurs multiple times *only* with locales in the northern portion of the former Polemon and the Themistos. It appears four times with Beki,[421] three times with Aphaniou[422] and Theoxenis[423] and twice with Hermopolis,[424] Andreou[425] and Narmouthis.[426]

[413] Roughly 4 km south of Medinet al-Fayyum, 29° 15' 48 N, 30° 51' 7 E
[414] Deir al-'Azab: P.Mich XVIII, p. 96-7. Dumušīya and Dafadnū: Timm, 889-90 and Salmon, *Répetoire*, 64
[415] P.Erasm. I 2 (152 BCE); H. Proost, "Eleusis (Meris of Polemon)" at FVP.
[416] *SPP* X 250, 249 and 52
[417] *SPP* X 250 and 249
[418] *SPP* X 249 and 52
[419] Banaji (2001), 244. Itsa/اتسة: 29° 14' 14 N, 30° 47' 8 E. Banaji cies Rathbone, "Historical Topography" at 55-6 in this context but there is no discussion there of Itsa or Eleusis. Avoid travelling through Itsa in a Jeep Grand Cherokee on market day.
[420] e.g. *SPP* X 147, appearing in the section listing only western/Polemon toponyms.
[421] *SPP* X 275 and X 260, *SB* VI 9583, *SPP* X 147
[422] *SPP* X 275, 260 and 147
[423] *SB* I 5339, VI 9583, *SPP* X 147
[424] *SB* X 275. *P.Ross.Georg.* V 68

Menas from Beki pays makes a payment from a list of villages that fall in this region (Beki, Okeos, Theoxenis, Eter and Andreou). An outlying text is the four-line *SPP* X 293 (7th-8th) which names a *comes* Iohannes, a *dioiketes*, in the genitive and lists three villages: Tamauis, Attinou and *epoikion* Eter.[427] Both villages are in the former Herakleides. Attinou is not yet located, but Tamauis is modern Tāmiyya in the NE Fayyūm *ca.* 23 km from Medinet al-Fayyūm. Eter appears here as an *epoikion* and this may indicate that the location in question is a different place, an *epokion* of Attinou but this is only speculation.

Eustochiou (6th to 8th)
Tentatively located in the Polemon in TMGeo. Focusing on *SPP* X 154 (7th) Banaji has examined the pertinent documenation and the surrounding topography; there is no need to reiterate his findings in depth. In brief, it appears likely that Eustochiou can be placed somewhere in a cluster of villages to the north of the Gharaq basin perhaps not far from Narmouthis.[428] Eustochiou appears twice with the southern villages of Beki, Aphaniou, Theoxenis and Kalliphanous and twice with Severou and Pouet. The latter two villages were in the territory of the Herakleides *meris*, Severou probably somewhere near the nome capital. Pouet cannot be located precisely but it was probably somewhere near Severou.

Thambator(i) (5th to 8th)
Not identified. The village is not attested until the 5th century CE and there are only 11 extant references in the published papyri. Grenfell and Hunt guessed at a location in the southern Fayyūm (i.e. Polemon) based on the then-unpublished *SPP* X 250, where the village occurs with several other known Polemon toponyms.[429] The more recently published P.Prag. I 49 (628 or 643) places Thambator firmly in the Arsinoite rather than the Theodosiopolite. As noted above under "Dikaiou," in *SPP* X 138 one *comes* controls Fl. Strategius Paneuphemos' land in Thambator, Panse, *epoikion* Amm[ ], Ouo and Dikaiou Nesos; Ouo recurs with Thambator in *SPP* X 250. Thambator also occurs twice with Kainou and Armatoura.[430] Considering the close relationship between Dikaiou and Ouo and the apparent connections between the latter and Thambator I am inclined to place the current village somewhere in proximity to Dikaiou and Ouo.

Theogonis (3rd BCE to 10th CE)
While its precise location is unknown, Theogonis was in the southern portion of the *meris* of Polemon. FVP reports no less than 50 occurrences of the village with Tebtunis; the village also shared a *grapheion* with Talei for a period. In *P.Tebt.* I 17 an official spends the night in Berenikis Thesmophorou and continues to Theogonis on the following day, passing through Kerkeosiris.[431] Attested 236 times throughout the Greco-Roman period Theogonis appears in 16

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[425] *SB* I 5339 and VI 9583
[426] *SB* I 5339, *SPP* X 147
[427] The publication prints Eter as an unresolved abbreviation, Ἑτηρ( ). No image is available and I cannot verify the reading. However, there is not to my knowledge any village with a name resembling Eter which could be abbreviated in this way.
[428] Banaji (2001), 244
[429] *P.Tebt.* II, p. 363 and 368
[430] *SB* I 2339, *SPP* X 250
[431] B. Van Beek in FVP, "Theogonis (Meris of Polemon)"

late texts, now almost always as Theagenis. *BGU* I 311 (7th/8th?) places it in the Theodosiopolite.

*Ibion Eikosipentarouron/Tahanshute/*طهنشدى (3rd BCE to 8th CE)
Not firmly located. *SB* I 5139 (6th) places Ibion in the Theodosiopolite and it was certainly in the Gharaq basin. The toponym is frequently abbreviated as Ibion in earlier texts but as *chorion* Eikosi in the later papyri. The Greek toponym appears in *P.Ross.Georg.* V 73 paired with a Coptic name transliterated into Arabic (as above); the Coptic toponym itself does not appear in any extant text.[432] On Eikosi's location, Banaji notes that "it was clearly not far from Magdola…north-west of Kerkeosiris and sufficiently close to both Narmouthis and Tali for common administrative arrangements to prevail at various times."[433] In the late papyri Eikosi appears twice with Magdola.[434] In the second of these texts a lessee of land describes himself as "of the village of Ibion and Magdolon [*sic*] of the Theodosiopolite nome." Perhaps the villages were close enough to, at times, function as a single administrative entity. Eikosi appears twice with Kerkethoeris, Theogonis and Oxyrhyncha, all three in *SPP* X 143 and 265. Both are lists comprised entirely of southern/Polemon villages. Considering the closeness of the connection to Magdola I am inclined to place it very near the former village.

Kathieou/Qasīūh قسيوه (6th to 8th)
Not located in TMGeo. The toponym is rare, appearing three times in late antique papyri.[435] Grenfell and Hunt guessed at a location in the south based on its occurrence with other southern toponyms in the then-unpublished *SPP* X 250.[436] Kathieou does, however, appear in *SB* VI 9583 (650-99) in a list of villages making payments through an intermediary from Phourtin.[437] The villages are all in the N Polemon, Themistos or W extremity of the Herakleides. The toponyms in *P.Ross.Georg.* V 73 are too widely spread to be of help. Combining the evidence of *SB* VI 9583 and *SPP* X 250 one is left with the impression of a location in the N Polemon.

Kainou (4th or 7th to 8th)
Located in the Polemon by TMGeo. Kainou contains both northern (*borrinos*) and southern (*notinos*) areas which are not to be confused as separate villages. It appears in the list of southern villages *SPP* X 250 and can thus be reasonably placed in the south/Polemon. Of the five texts that provide topographical data none seems to indicate a deep south/Gharaq location. The brief and fragmentary list *CPR* XIV 38 (6th) mentions Kainou with Mouchis, which was in the NE of the former Polemon directly to the SE of Pseonnophris in the Herakleides. *SPP* X 1 (7th) lists estate locales of Fl. Strategios Paneuphemos all of which were to the north of the former Polemon border (if the Berenikis in the text is correctly identified with Berenikis Aigialou). The *choria* list in *SPP* X 292 (7th/8th) similarly collects villages in the northern Polemon, Themistos and western portion of the Herakleides.[438] Kainou occurs twice with

[432] On the etymology of the Coptic toponym, Timm at 903 remarks that "der verkürzte griechische Name des Ortes Eikosi(pentarouron) müßte im Koptischen mit dem Zahlwort für (fünfund)zwanzig: Djoute (èoyte) gebildet werden."
[433] Banaji (2001), 241. So also TMGeo.
[434] *SPP* X 111 and *SB* I 5139.
[435] *SPP* X 250, *SB* VI 9583, *P.Ross.Georg.* V 73
[436] *P.Tebt.* II, p. 381
[437] Phourtin, Alexandrou Nesos, Phanou, Beirach, Lenou, Tarchion, Nibilla, Tetrathyron, Kathieou
[438] Ouo, Hiera Nikolaou, Kainou *borrinou,* Pelkeesis, Stratonos, Phanamet, Lorou, Theogenis

Stratonos,[439] Armatoura,[440] Phanamet,[441] Ouo[442] and Berenikis (either Thesmophorou or Aigialou).[443]

Kalliphanous (3rd BCE to 8th CE)
Located by TMGeo in the *meris* of Polemon. The late antique documentation is then but lends the general impression of a location in the north of the *meris*. When combined with some of the earlier material this is reinforced. In PSI VIII 820 (314) a brother and sister own land in several villages almost, perhaps entirely, in the Polemon.[444] Kalliphanous appears in *SPP* X 249 (7th), presumably a private estate text, which record the names of *dioiketai* and villages for which they were responsible. Unfortunately the three-line section in which Kalliphanous appears is fragmentary, the line after the name Kolluthos *dioiketes* being unreadable. P.Brook. 25 (reedited in *JJP* 32 (2002), p. 79-81) places Kalliphanous in a short list of villages in the N Polemon and Themistos.[445] The ecclesiastical accounts in *CPR* XXII 60 (7th-8th) and the list of payments from individuals in *SPP* X 106 (8th) list toponyms of all three *merides*: N Polemon, Themistos and the W Herakleides (106 does contain Sele in the far E of the nome).[446]

Earlier papyri cement a location in the Polemon. P.Petrie III 43 (3rd BCE) lists numerous toponyms and groups Kalliphanous with villages in the north of the *meris*.[447] The same is observed in the village list *SB* XXIV 16175 (225-175 BCE) and the Schlußabrechnung in *CPR* XVIII 21 (206 BCE).[448] On balance a location in the north of the *meris* seems unavoidable.

Kaminoi (3rd BCE to 8th CE)
TMGeo and FVP locate the village securely in the northern portion of the Polemon near Kerkesephis and close to the border with the Themistos. *P.Tebt.* III 753 (197/173 BCE) records a journey south from Oxyrhyncha to Ibion, a return to Oxyrhyncha and a (possible?) trip up to Kaminoi.[449] Banaji has tentatively identified the village with medieval Qambašā but this is rather too far south.[450]

Koueisan (6th? to 8th)
Not located in a *meris* by TMGeo although it is assigned in the notes to the Theodosiopolite and therefore will have been in the SW of the nome; the loan in *P.Lond.* I 113 6c (620) calls the

[439] *SB* I 5339, *SPP* X 292
[440] *SB* I 5339, *SPP* X 250
[441] *SB* I 5339, *SPP* X 292
[442] *SPP* X 250 and 292
[443] *SB* I 5339 (cannot determine whether it is Aigialou or Thesmophorou), *SPP* X 1
[444] Boubastos, Kaminoi, Dikaiou Nesos, ARISTARCHOU NESOS, Kalliphanous, Psinteo. The village of Boubastos, noted in the TMGeo record for this text as a Herakleides toponym, may be a homonymous locale in the Polemon (N. Gonis, *JJP* 31 (2001), p. 22 n. 23).
[445] Kaminoi, Kalliphanous, Kna, Magdolon Palaali, Pia Siaei (Πιασιαει: possibly Pisais)
[446] *CPR* XXII 60: Kalliphanous, Alabanthis, Phentemin, Belou, Eustochiou, Aninou, Phourtin, Tetrathyron, Anthou, Elia. *SPP* X 106: Hermopolis, Penn[ ], Mouchis, Perkethaut, KtEsis, Gemin( ), Skandips, Ptenne, Kalliphanous, Kourabes, Dexe( ) / Texenne( ), Stratonos, Sele
[447] LYSIMACHIS, Kalliphanous, Tebetny, Kaminoi; Kynon
[448] *SB* XXIV 16175: PHYLAKTIKTE NESOS, PTEROPHOROU, Kalliphanous, Bousiris, ISIEION PAITOS, Mouchis, Aphrodites, Eleusis, Oxyryncha, Areos, PTOLEMAIS (MELLISOURGON?), Tebetny. *CPR* XVIII 21: Theogonis, SAMEREIA, Oxyryncha, Kalliphanous, Dikaiou Nesos
[449] FVP, B. Van Beek, "Kaminoi (meris of Polemon)"
[450] Banaji (2001), 245 citing Halm's Fayyūm map num. 20 (E. Fayyūm)

village an *epoikion* of the Theodosiopolite. Five additional texts offer topographical details. Koueisan appears in *SB* VI 9583 with a group of western and southern villages making a payment through an individual from Mouei.[451] *SPP* X 27 (7th-8th) lists three villages with Koueisan, two in the former Polemon and one which I have assigned to the Herakleides (Armatoura, Beki, Koueisan, Elia). *SPP* X 54 (8th), a list of payments, appears to represent a group of villages in the southern half of the nome.[452] The list may move from east to west; I have assigned Ampeliou to the southern Themistos or northern Polemon; Pseonnophris was just east of the Polemon-Herakleides border (mod. Sanufar). I have posited a central/Herakleides location for Touroubestis (see above); Herakleonos was somewhere near al-Lāhūn and Sele (mod. Saila) was at the eastern edge of the nome slightly to the north of the capital. If this supposition is correct, Koueisan should fall somewhere between Ampeliou and Pseonnophris. A location in the territory of the northern Polemon fits well. Koueisan is most frequently mentioned with Dikaiou Nesos (three instances).[453] It appears twice with Ampeliou,[454] Theoxenis,[455] Armatoura[456] and Touroubestis.[457]

Kouloupon (4th-7th to 8th)
Unplaced in TMGeo. Grenfell and Hunt place Kouloupon in the south of the nome based on its appearance in *SPP* X 250.[458] The evidence currently available has not improved much upon what was then available. Kouloupon appears only five times in the published papyri. *SPP* X 250 remains the most useful document, its list of southern toponyms almost entirely from the Polemon *meris* excluding Arabon. Column two of the verso of *SPP* X 74 also preserves a list of southern toponyms which includes Kouloupon.[459] SPP X 60 also contains a list of toponyms, a few from the former Polemon but also including the nearby Ptolemais Hormou and other Herakleides villages, possibly near the former Polemon's border. The village occurs three times with Kynon,[460] and twice with Metrodorou,[461] Hiera Nikolaou,[462] Ouo,[463] Mouchis,[464] Philoxenou,[465] and Armatoura.[466]

Kynon Polis (3rd BCE to 8th CE)
Called *chorion* Kynon or simply Kynon in late antique texts, Kynon Polis was located in the *meris* of Polemon and FVP places it in the northern of the *meris* near the border with the Themistos.[467] In the earlier period the village was most closely linked with LYSIMACHIS (first in

[451] Mouei, Magais, Dikaiou Nesos, Tyis, Oxyryncha, Monachou, Koueisan, Berenikis (Aigialou? Thesmophorou?)
[452] Ampeliou, Kouseian, Pseonnophris, Kainou, Tourobestis, Kainou, Herakleonos, Sele
[453] *SB* I 5338, *SPP* X 24, *SB* VI 9583
[454] *SB* I 5338, *SPP* X 54
[455] *SB* I 5338, *SPP* X 24
[456] *SB* I 5338, *SPP* X 27
[457] *SB* I 5338, *SPP* X 54
[458] *P.Tebt.* II, p. 386
[459] Kerkesoucha Orous, Magais, Narmouthis, Episkopou, Kouloupon, Mouchis, Kynon, Panse
[460] *SB* I 5338, *SPP* X 250 and 74 Vo. Col. 2
[461] *SB* I 5338, *SPP* X 60
[462] *SPP* X 159 and 60
[463] *SPP* X 250 and 60
[464] *SPP* X 250 and 74 Vo. Col. 2
[465] *SB* I 5338, *SPP* X 74 Vo. Col. 2
[466] *SB* I 5338, *SPP* X 250
[467] P.Rainer 'Rdg' ined. (1st) and P.Stra*SB*.Gr. IX 868 (2nd) place the village explicitly in the Polemon

the Themistos but later incorporated into the Polemon) and is also mentioned with Magais and other Themistos locales.[468] In the late period, Kynon is most often mentioned with villages with villages from the northern portion of the former Polemon and nearby areas of the the other *merides*. Only villages of the Polemon and western Herakleides occur more than once with Kynon. Kynon appears three times with Kouloupon,[469] Mouchis[470] and Melitonos,[471] all in the former Polemon; it appears twice with Ibion,[472] Armatoura,[473] Tyis,[474] Sebennytos[475] and Tourobestis,[476] the first three Polemon, the others Herakleides. *SPP* X 250, *SPP* X 105 and *SPP* X 74 Ro. Col. 2 may best represent the surrounding topography.

Kyras Marias (4th? to 7th)
Not located in TMGeo. The village is attested four times, once as an *epoikion* of the Arsinoite (P.Harrauer 55 [585]). Only two texts—*SB* I 5339 col. 2 (4th-7th?), *SPP* X X 239 (6th)—provide topographical details. The latter is comprised of villages towards the central and southern portion of the nome. The former places Kyras Marias between Eter and Narmouthis in the Gharaq basin. There is insufficient evidence to locate the village more securely but it was certainly in the south/Polemon.

Lorou (2nd or 3rd to 8th)
Not located in TMGeo. Lorou appears in eleven papyri, nine from the late period. There is little evidence to locate it precisely but it was clearly in the territory of the former Polemon. It appears twice with Stratonos[477] and Phanamet,[478] villages of the Herakleides and Themistos respectively, which probably lay towards their *merides*' borders with the Polemon. Lorou also appears twice with Oxyrhyncha.[479] On the whole Lorou appears in several lists of entirely or almost entirely Polemon villages. The earlier P.IFAO. III 42 (2nd or 3rd) is a list of sixteen toponyms including Lorou, all in the Polemon.[480] *SPP* X 292 lists Polemon locales, excluding Stratonos and Phanamet.[481] *SPP* X 165[482] and 273 also lend the impression of a Polemon location.[483] Whether it lay in the northern or southern extent of the *meris* is unclear but the occurrence of the village with multiple Themistos and Herakleides toponyms—as far north as

[468] B. Van Beek, "Kynon Polis (Meris of Polemon)"
[469] *SB* I 5338, *SPP* X 250 and 74
[470] *SPP* X 250, and 74 Ro. Col. 2 and Vo. Col. 2
[471] *SPP* X 145, 105, and 74 Ro. Col 2
[472] *SB* I 5338, *SPP* X 250
[473] *SB* I 5338, *SPP* X 250
[474] *SPP* X 250 and XX 225
[475] *SB* I 5338, *SPP* X 161
[476] *SB* I 5338, *SPP* X 74 Ro. Col. 2
[477] *SPP* X 292 and 165
[478] *SPP* X 292 and 245
[479] *SPP* X 165 and 245
[480] Theogonis, ARISTARCHOU NESOS, PHNEBIE, Kerkeosiris, Lorou, Hiera Nesos, Tebetny, PTOLEMAIS MELISSOURGON, Kaminoi, Kerkeesis, HERAKLEIDOU EPOIKION, SAMAREIA, Boukoliou (Tristomon), Talei, Tebtunis, Kynopolis
[481] Ouo, Hiera Nikolaou, Kainou, Pelkeesis, Stratonos, Phanamet, Lo[rou]
Theogenis
[482] Kerkesoucha Orous, Oxyryncha, Pae[.], Psinteo, Stratonos, Lorou
[483] Lorou, Ampeliou

Psenyris—and the absence of southern Gharaq and Tutūn Basin villages may indicate a more northerly location.[484]

Melitonos epoikion (5th or 6th to 8th)
Not located in TMGeo. Administratively located in the Arsinoite nome (*CPR* XIV 15 [after 641]). Melitonos is mentioned with villages as far south as Tali and as far north as Alexandrou Nesos. Its strongest connections, however, seem to be with villages of the northern portion of the former Polemon. It occurs three times with Tebetny[485] and Kynon[486] and twice with Ouo[487] and Mouchis.[488] The village also occurs with Ptolemais Hormou[489] and Syron[490] a little to the east near the entrance to the Fayyūm. It also occurs twice with Zinnis[491] and Stratonos[492] in the former Herakleides and twice with Alexandrou Nesos,[493] the latter being the most extreme outlier in the group. In *SPP* X 249 the village is grouped between Mouchis and Ouo, the three locales paying taxes in kind through a single individual. Its surroundings seem well-represented in *SPP* X 105 as well, where it is grouped with Tebetny, Philoxenou, Ouo, Ptolemais Hormou and Kynon. *SPP* X 52, another village list, is also representative of Melitonos' environs: Ptolemais Hormou, Neuei, Pelkeesis, Nibilla, Tyis and Eleusis. A location in the northern portion of the former Polemon, perhaps towards the border of the former Herakleides seems assured.

Mouchis (3rd BCE to 8th CE)
As briefly noted above, Mouchis has been identified with an-Nābulsī's Dumušīya. The linguistic affinity between the Arabic toponym and the Coptic *Tmoushi* is undeniable and the southern Fayyūmic location of the village fits neatly with the description of the medieval village. According to an-Nābulsī Dumušīya lay an hour south of the nome capital by horseback; the distance between the capital and modern Deir al-'Azab to the SE is 5.08 km.[494] The village received its water from a canal along with the neighboring villages of Abu Sīr, Itsā and Dafadnū (ancient Tebetny), all known locations[495]; Itsā is 7.06 km SW of Deir al-'Azab, Dafadnū (mod. Difinnū) 5.48 km SW while modern Abū Sīr Difinnū is 4.47 km W and S.[496] Mouchis occurs with 52 other Fayyūm villages in the late texts, most often with Ouo (four attestations).[497]

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[484] The southern villages of Tebtunis and Talei do appear in P.IFAO III 42 but southern villages are absent from the later papyri.
[485] P.Flor I 11, *SPP* X 105 and 162
[486] *SPP* X 145, 105 and 74
[487] *SPP* X 105 and 249
[488] *SB* VIII 9920 and *SPP* X 74
[489] *SPP* X 105 and 52
[490] P.Flor. I 11 and *SPP* X 256
[491] *SPP* X 256 and 162
[492] *SPP* X 256 and 74
[493] P.Flor. I 11 and *SPP* X 162.
[494] *TF* 94: وهي قبلي مدينة ال فيوم مسافة ساعة للركاب
[495] *TF* 96, discussing Dafadnū: ومطلق من الماء شركة ابي صير...من الخليج المشترك مع دموشية و من شركة اطسا
[496] For Itsa's location see above, n. XXX; Abū Sīr Difinnu, 29° 15' 21 N, 30° 48' 24 E; Dafadnū/Difinnū, see "Tebetny" below.
[497] *SPP* X 250, 249, 178 and 272. The latter reads *Oneiton*, "of those from Ouo," though the ethnic is more properly "*Ouonites*"

Mouchis appears three times with Pisais[498] and Kynopolis,[499] and twice with Dikaiou Nesos,[500] Arabon *kome*,[501] Eleusis,[502] Kainou,[503] Tyis,[504] Melitonos *epoikion*,[505] Kalliphanous[506] and Stratonos *kome*.[507] As noted above ("Dikaiou Nesos"), *SPP* X 249 places Mouchis and Ouo in an *ousia* Dikaiou along with Melitonos *epoikion*. Thus Mouchis was clearly somewhere in the vicinity of these villages.

Nibilla (5th? to 8th)
Tentatively assigned to the Polemon by TMGeo; this should be regarded as certain. Although only one village, Phourtin, appears with Nibilla more than once[508] three of the four texts in which it appears with multiple villages are sufficent to give a general impression of its location. *SPP* X 52 (7th-8th) groups Nibilla with a selection of southern villages, three? in the N Polemon.[509] *SB* VI 9583 (650-99) includes Nibilla in a list of villages making payments through an individual from Phourtin. The list includes villages of the N Polemon, Themistos and W end of the Herakleides, Phanou perhaps being the farthest east.[510] Lastly, *SPP* X 174 (8th) contains three *choria*, Bebrychos, Aninou and Nibilla. The former two have been located in the N Polemon. On balance this is where I would place Nibilla as well.

Ouo (6th to 8th)[511]
The village--divided into northern and southern halves (*borrine* and *notine*)--is not identified in TMGeo and does not appear until the late period, its earliest attestation being *SB* I 5336 (between the 4th and 7th). Ouo is not common in the papyri; although TMGeo lists 32 occurrences 16 of these are repeated occurrences of the village in the same text (e.g. the northern and the southern sections are often mentioned together). On Ouo's location, Grenfell and Hunt rightly noted that "the [village] lists suggest that it was in the south."[512] The short alphabetical list *SPP* X 282 for instance lists only villages known or strongly suspected to have been in the south/former Polemon.[513] As noted above, Ouo shows connections with several villages of the former Polemon: Dikaiou Nesos, Eleusis, Thambator, Melitonos *epoikion* and Mouchis.[514] In total Ouo appears with some 50 Fayyūm locales, mostly villages in the south. It occurs twice each with a

[498] *SPP* X 254, *SPP* VIII 1304 (alphabetical?), *SPP* X 74,
[499] *SPP* X 250 and twice in *SPP* X 74,
[500] *SPP* VIII 811, *SPP* X 249
[501] *SPP* X 250 and 272
[502] *SPP* X 250 and 249
[503] *SPP* X 250, *CPR* XIV 38
[504] *SPP* X 250 and 249
[505] *SPP* X 249 and 74
[506] *SPP* X 249 and 106
[507] *SPP* X 74 and 106
[508] *SB* I 5338, *SB* VI 9583
[509] Ptolemais Hormou, Melitonos, Neuei, Pelkeesis, Nibilla, Tyis, Eleusis
[510] Phourtin, Alexandrou Nesos, Phanou, Beirach, Lenou, Tarchion, Nibilla, Tetrathyron, Kathieou
[511] Possibly derived from Coptic *ouos* (edge, top of a mountain). Thanks to Maria Mavroudi for this etymology.
[512] *P.Tebt.* II, p. 392
[513] Kaminoi, Kerkesephis, Kimoitei, Kerkesoucha Orous, Kerkesis, Ouo borrine, Ouo notine, To Skelos
[514] See the relevant entries above for the texts.

selection of villages in the former *merides* of Polemon and Herakleides: Armatoura,[515] Kouloupon *chorion*,[516] Kainou *chorion*,[517] Kynopolis,[518] Elia,[519] Ptolemais Hormou,[520]Ammou,[521] Hieras Nikolaou,[522] Pelkeesis,[523] Stratonos,[524] To Skelos,[525] and Kaminoi.[526]

Paniskou (7th to 8th)
Tentatively located in the Polemon in TMGeo. Banaji has closely examined the village and its surrounding topography and there is no need to recapitulate his analysis at length.[527] Paniskou appears next to Oxyrhyncha in a list of generally southern toponyms in *SPP* X 281 (7th/8th). Here the two villages make a payment through the same individual. The village also appears in *SB* VI 9585 making payments with a different group of southern villages; the only additional overlap between the two texts is the occurrence in both of Kerkesephis. In the short list in *SPP* X 154 (7th) Paniskou appears with Eustochiou and Ibion. Banaji suggests a location somewhere in the central Tutūn basin perhaps nearest to Oxyrhyncha.

(To) Skelos (6th to 8th)
Not located in TMGeo. The village, often appearing with the defininite article as *To Skelos*, appears with villages of all three former *merides*. It was most likely, however, to have been located in the south of the nome. *SPP* X 282 (8th) is a list of villages entirely of this SW portion of the nome.[528] It is alphabetical (six villages in *kappa*, then Ouo and Skelos), but the geographical location of all is clearly southern. *SPP* X 73 (8th), however, lists payments from Zizonos, Pisais, Skelos and Tassat. Pisais was a bit farther north towards the center of what was the Themistos; Tassat was in this region as well with Zizonos lying somewhere in the central region of the nome in the former Herakleides. Skelos appears in a section of *SB* VI 9583 (650-99) with a resident of the village, Marcus, making a payment for Monti, Herakleonos, Ouo, Anoges, Arotheou and Tmouei. Herakleonos was in the Herakleides, Ouo in the north of the Polemon and Anoges somewhere near al-Lāhūn/Ptolemais. Another Marcus from Skelos, possibly the same individual, is seen making payments for Tebetny, Palaali, Oxyrhyncha, Patres,

[515] *SPP* X 250, *SB* VI 9583
[516] *SPP* X 250 and 60
[517] *SPP* X 250 and 292
[518] *SPP* X 250 and 105
[519] *SPP* X 250 and 168
[520] *SPP* X 105 and 60
[521] *SPP* X 178 and 60
[522] *SPP* X 292 and 60
[523] *SPP* X 292 and 108
[524] *SPP* X 292 and 165
[525] *SB* VI 9583, *SPP* X 282
[526] *SPP* X 282 and 168
[527] Banaji (2001), 244-5
[528] Kaminoi, Kerkesephis, Kimoitei, Kerkeseos, Kerkesoucha Orous, Kerkeesis, Ouo, Skelos

Embolou and Andreou in *SPP* X 80.[529] The first three are Polemon toponyms while the second three are more northerly in the Herakleides and Themistos. Skelos occurs most often with Anoges (three instances),[530] and twice with Herakleonos,[531] Arotheou,[532] Ouo[533] and possibly with Palaali.[534] The closest connection that emerges from the documentation *may* be with Herakleonos. *SPP* X 149 (6th) preserves a list of *choria* that may refer to estate locales.[535] Herakleonos appears as *chorion* Herakleonos *komes* in l. 7 while l. 9 preserves the text χωρ(ίον) Σκέλους (καὶ) Ἡρακλέωνος μικρ[ᾶς] οὐ[σίας]. L. 10 then reads χωρ(ίον) Σκέλους δ(ιὰ) Ἐλευθερίου. If, as appears likely, both attestations of Herakleonos refer to the same location we must consider this village and Skelos as roughly proximate. The area of the N/NE Polemon and the area of al-Lāhūn are so close that Skelos could lie in the former area and maintain strong connections with the latter with ease.

Strategiou (6th to 7th)
Not located in TMGeo. *CPR* X 127 (584) calls it an *epoikion* of the Theodosiopolite nome.[536] If the theory of the extent of the Theodosiopolite is correct this would place the village squarely in the SW Fayyūm. In truth, this village could be either P or H. The only other attestations are *SPP* XX 229 (alphabetical) and *possibly* in the very fragmentary *SB* XXVI 16474 (alph.), which was published as a "Liste von χωρία im südöstlichen Arsinoites." The village list—Syr[on/ou?], Skel[os], Stra[ ], Sell[e], Syr[on/ou?], Te [ ]—is broken on the right. Stra[ ] in l. 4 might be read as either Strategiou or Stratonos and Te [ ] as Tetrathyron or Tetrakomia.

Syrou (4th/7th to 8th)
Not located in TMGeo. There are two similar toponyms in the late period, Syrou Chorion (P) and Syron Kome (H) on which see above, "Syron." The villages that appear with Syrou give the general impression of a southern location. Its appearance in the almost entirely southern/Polemon village list *SPP* X 250 (6th) is useful. P.Horak 64 (8th) however securely places the village in the northern portion of the *meris*. The text preserves a list of prisoners, their villages of origin and their crimes. Leontios son of Senouthios and Senouthios' wife Anastasia are imprisoned for stealing a bull from the village of Eleusis. Eleusis was somewhere in the vicinity of Mouchis in the northern Polemon and considering the nature of the crime must have been relatively near Syrou. Syrou also appears twice with Tetrathyron. P.Münch. III.1 116 (6th-7th) records the payment of wheat from Syrou on behalf of bakers from Tetrathyron, possibly an indication of proximity. Tetrathyron also directly follows Syrou in the list of prisoners in

[529] Marcus' name is followed by the Arab name Salaei Abdullah and then the first three villages. The name Sa`īd Suleiman then follows, with the second set of villages. The pattern seems then to repeat with a Senouthios from Kerkethoeris but the text is hereafter fragmentary.
[530] *SPP* X 149, *P.Vind.Tand.* 17, *SB* VI 9583
[531] *SPP* X 149, *SB* VI 9583
[532] *SB* VI 9583, *SPP* X 87
[533] *SB* VI 9583, *SPP* X 282
[534] *SPP* X 80 and possibly also 285. The latter's toponyms are all abbreviated and Pali( ) in l. 4 may be an abbreviation for Palaali since there is no other attested toponym with an appropriate spelling.
[535] The first line is fragmentary and unreadable while the second preserves the names Iohannes and Abraamios in the genitive followed by οὗ(τως) and the list of *choria*. Following an initial lacuna in the final line οὐσί(ας) Τιμοθέου is clearly read. The first section *may* be referring to estate locales of the initial individuals but this is far from certain.
[536] There is no mention of the Arsinoite nome.

P.Horak 64 although this may be a coincedence.[537] Syrou appears twice with Ibion,[538] Kynon,[539] Theoxenis,[540] Beki,[541] Ouo,[542] Armatoura,[543] Aphrodites Berenikis Polis,[544] Sebennytos[545] and Nestou;[546] the first six were southern/Polemon toponyms while the final three were in the east/Herakleides.

Talei/Talīt 29° 6' N, 30° 48' E (3rd BCE to 8th CE)
The village was named Talithis in the early 3rd century BCE but by the final quarter of the center had become Talei. It keeps the latter name throughout the rest of antiquity, often rendered as Tali. Talei is securely located at the site of Kom Talīt in the far south of the Fayyūm, now outside the cultivated area. The village was still active in an-Nābulsī's day but with a small population (*TF* 128: قليلة السكان). The maps of Shafei and König represent medieval Talīt as one of the two most southerly villages in an-Nābulsī's era. Greco-Roman Talei was near Ibion Eikosipentarouron, Kaminoi, Kerkeosiris, Kerkesephis, Kerkethoeris, Mouchis, Narmouthis, and Tebtunis. Talei was occasionally connected administratively to Tebtunis and Ibion, which suggests proximity to the latter villages.[547] In the late period there are only twelve occurrences of Talei in nine texts, none of which provide information of note. *SPP* X 265 (*pittakion*) contains a selection of villages in the surrounding area without outliers.[548]

*Tebetny/*Dafadnū or Difinnu دفدنو/دفنّو): 29° 14' 8 N 30° 48' 19 E (3rd BCE to 8th CE)
Said to be in the Arsinoite nome Tebetny has long been identified by linguistic affinity with an-Nābulsī's Dafadnū (*TF* 96). The identification is widely accepted; *contra* TMGeo however the modern pronunciation is Difinnu and it is rendered as such in contemporary Arabic.
Tebetny occurs in the oft-cited *SPP* X 138 though it appears in a more difficult context. It is grouped with Nestou *epoikion*, Pelkeesis, Hiera Nesos, Ptolemais Hormou, Oxyrhyncha and Tebtunis. The final two villages are known to be in the former Polemon while Ptolemais Hormou is al-Lahūn at the entrance to the Fayyūm, not far away. Nestou, however, seems to be towards the northeast in the former Herakleides. There are two villages named Hiera Nesos, one in Polemon, one in Herakleides although the former village is perhaps a more likely candidate.[549] Pelkeesis is not yet identified (possibly Herakleides).[550] In additional papyri Tebetny is

[537] The villages are placed seemingly at random; following the entry for Tetrathyron is an entry for a prisoner from Boursiris, which was to the east of the Fayyūm proper and closer to the Nile.
[538] *SB* I 5338, *SPP* X 250
[539] *SB* I 5338, *SPP* X 250
[540] *SB* I 5338, *SPP* X 147
[541] *SPP* X 147, P.Horak 64
[542] *SPP* X 250 and 108
[543] *SB* I 5338, *SPP* X 250
[544] *SB* I 5338, *SPP* X 147
[545] *SB* I 5338, P.Horak 64
[546] *SPP* X 147, P.Horak 64
[547] FVP, I. Uytterhoeven, "Talei/Talithis (Meris of Polemon)"
[548] Kerkethoeris, Beki, Aphaniou, Kaminoi, Theogonis, Talei, Ibion Eikosipentarouron, Narmouthis, Oxyryncha
[549] So TMGeo. Polemon's Hiera Nesos was near Tebtunis and it is probably for this reason that TMGeo's compilers cite *SPP* X 138 as an attestation of this village, rather than the homonymous northern village.
[550] This first set of entries in the text is more difficult than the others. It does not list a *comes* and the villages for which he is responsible, but rather presents an "account of the villages of the *megalopre*(*pestatou*), after which the text breaks off. Palme speculates that the person in question was an additional *comes*, higher and rank and with greater responsibility than the others listed, possibly a *vice dominus*/*antigeouchos*.

mentioned three times with Melitonos *epoikion*,[551] and twice with Alexandrou Nesos,[552] Hermopolis,[553] Ptolemais Hormou,[554] Oxyrhyncha,[555] Tebtunis[556] and Perkethaut.[557] Melitonos is as yet unlocated, Alexandrou (see above) was north of Pisais in the former Themistos while the last four were rather more towards the south, Tebtunis being one of the most southerly villages in the Fayyūm.

Tetrathyron (6th to 8th)
Not located in TMGeo.[558] The village appears three times with Phourtin also probably in the W/SW Fayyūm, and twice with Alexandrou Nesos and Syron. I am suspicious of both occurences of Syron. The first in *P.Flor.* I 11 has been discussed above (see "Syron"). The second in *SB* XXVI 16474 (8th) appears in the context of an uncertain reading of Tetrathyron. TMGeo notes that the village may in fact be Tetrakomia. The latter is more likely since the other villages attested in the same context—Syron, Strategiou and Sele—are eastern villages (the list is also maybe alphabetical). The connection or proximity to Phourtin is all that is readily apparent; in *SB* VI 9583 (650-99) one Anastasios from Phourtin acts as intermediary for a group of villages including Tetrathyron. In general if not exclusively Tetrathyron appears with western and southern villages. P.Münch III 116 (6th) records a papyment of wheat from Syrou on behalf of bakers at Tetrathyron. *SPP* X 281 (7th-8th),[559] *SB* VI 9583 (650-99),[560] *SPP* X 83[561] and 252 (8th)[562] and finally P.Horak 66 (8th)[563] all group Tetrathyron with W/SW villages.

Tyis (4th/7th-8th)
Not located in TMGeo. Tyis appears only in the late documentation with a total of seventeen attestations. The only three villages with which it occurs more than once are Eleusis,[564] Kynopolis[565] and Ibion, all of the former Polemon.[566] In general the lists in which Tyis appear reinforce the impression of the southerly/Polemon location. *SPP* X 250 is a list of villages in the south of the nome in the former Polemon (excluding Arabon); *SPP* X 52, 83 and *SPP* XX 225 may be entirely Polemon. In *SB* VI 9583 Tyis pays with other generally southern villages including Magais, which was probably towards the south of the former Themistos (see above,

[551] *P.Flor.* I 11, *SPP* X 105 and 162
[552] *P.Flor.* I 11, *SPP* X 162
[553] *SPP* X 153 and 162
[554] *SPP* X 138 and 105
[555] *SPP* X 138 and 80
[556] *SPP* X 138 and 80
[557] *SPP* X 163 and 286
[558] Tetrathyron appears in *P.Horak* 64 which is eliminated here from consideration
[559] Aithiopon, Kai[nos?/nou?], Tristomon, Hiera N(esos?/-ikolaou?), Oxyrhyncha, Paniskou, Kerkesephis, Narmouthis
[560] *dia Anastasiou apo Phourt(in)*: Phourtin, Alexandrou Nesos, Phanou, Beirach, Lenou, Tarchion, Nibilla, Tetrathyron, Kathieou
[561] Phourtin, Tetrathyron, Aninou, Tyis
[562] Tebetny, Kerkesouchis, Tetrathyron
[563] Kaminoi, Sintoou, Tetrathyron
[564] *SPP* X 250 and 52
[565] *SPP* X 250 and XX 225
[566] *SPP* X 250 and XX 225

"Magais"). In *SPP* X 249 the village appears with Kalliphanous under the name Kolluthos *dioiketes*. The latter village was already firmly connected to the south/Polemon by Grenfell and Hunt.[567] There are no occurrences of the most southerly villages, e.g. Magdola, Talei and Tebtunis; Tyis may thus have been towards the north of the former Polemon, although this could be specious reasoning.

Phourtin (3rd/7th to 8th)
Not located in TMGeo. Grenfell and Hunt note that the village appears in lists with toponyms chiefly of the south or west Fayyūm.[568] The evidence is limited—twelve attestations—but it is sufficient to locate Phourtin in the south of the Fayyūm/Polemon *meris*. The village may have been in the northern portion of the Polemon; in *SB* VI 9583 (650-99) Anastasios from Phourtin makes payments on behalf of villages located in the territory of the Themistos and the Polemon *merides*.[569] *CPR* XXII 60 ll. 52-8 (payments from persons and locales) places Phourtin with Tetrathyron, the *megale ekklesia* of the nome capital, a *kleros* (T)kankaei, and Belou, which was in the Herakleides probably near the nome capital. Phourtin appears three times with Tetrathyron,[570] and twice with Oxyrhyncha[571] and Elia[572] (both instances mentioning a monastery in the latter village). The connections with southern villages like Oxyrhyncha and Talei[573] but also the nome capital and villages in the Themistos and Herakleides make it tempting to place the village in the Polemon near the old border with the other *merides*.

[567] *P.Tebt.* II, p. 381-82
[568] *P.Tebt.* II, p. 408
[569] Phourtin, Alexandrou Nesos, Phanou, Beirach, Lenou, Tarchion, Nibilla, Tetrathyron, Kathieou
[570] *CPR* XXII 60, *SB* VI 9583, *SPP* X 83
[571] *SPP* XX 238, *SPP* X 56
[572] *SPP* XX 238, *SPP* VIII 1286
[573] *SPP* XX 238

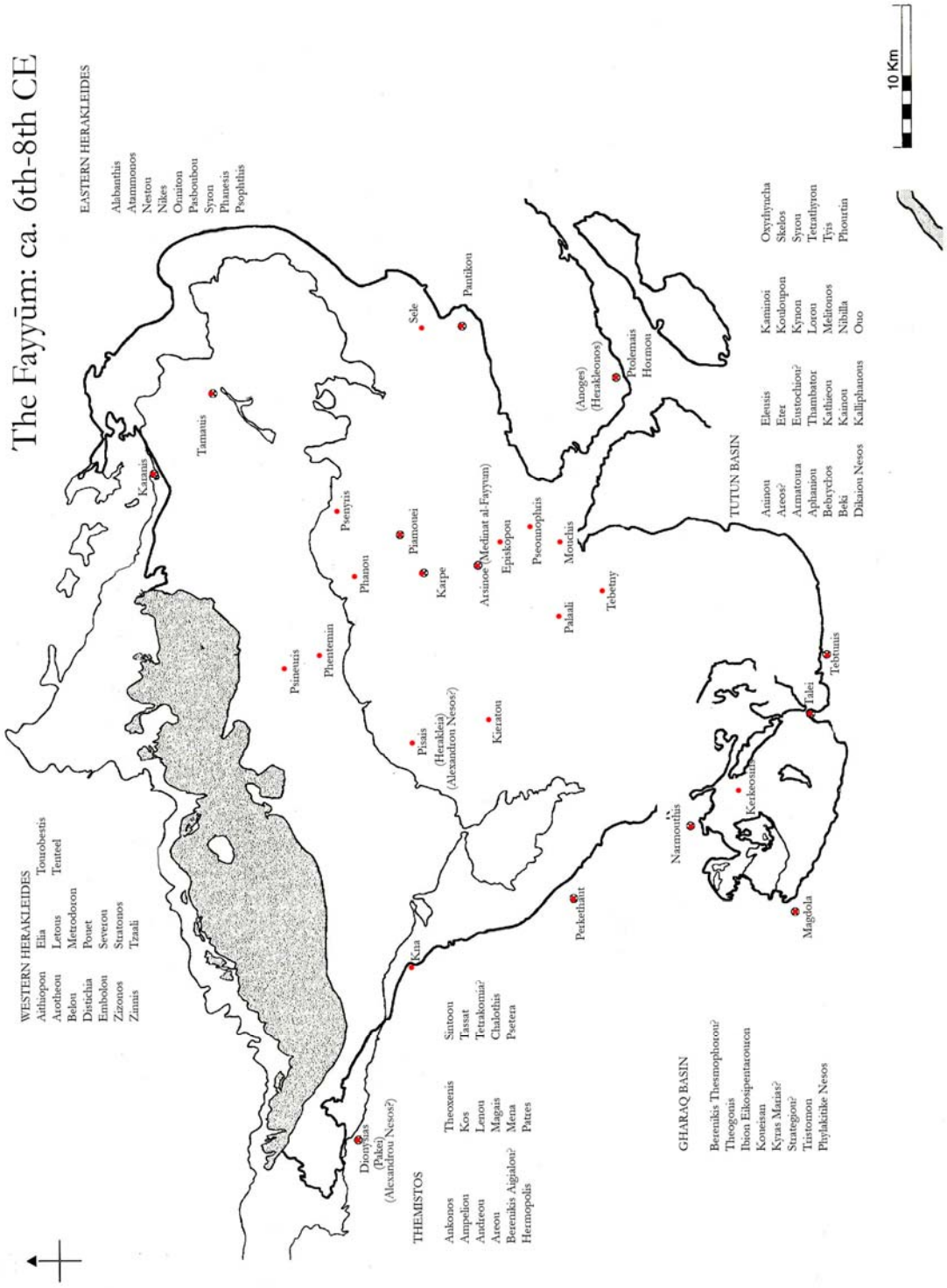

Fig. 23: A partial, relative topography of the late antique Fayyūm

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