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The Dilmun Bioarchaeology Project: a first look at the Peter B. Cornwall Collection at the Phoebe A. Hearst Museum of Anthropology

This article presents an overview of the Peter B. Cornwall collection in the Phoebe A. Hearst Museum of Anthropology at the University of California, Berkeley. Cornwall conducted an archaeological survey and excavation project in eastern Saudi Arabia and Bahrain in 1940 and 1941. At least twenty-four burial features were excavated in Bahrain from five different tumuli fields, and surface survey and artefact collection took place on at least sixteen sites in Saudi Arabia and Bahrain. The skeletal evidence, objects and faunal remains were subsequently accessioned by the Hearst Museum. The authors recently formed the Dilmun Bioarchaeology Project to investigate this collection. This article provides background information on Cornwall?s expedition and an overview of the collection. Additionally, skeletal evidence and associated objects from two tumuli in Bahrain, D1 and G20, are presented to illustrate the collection?s potential contribution. Although the tumuli?s precise locations cannot be determined, associated objects help assign relative dates to these interments at the beginning of the second millennium BCE, the Early Dilmun Period.

Keywords: Dilmun, Peter B. Cornwall, human osteology, Bahrain, Saudi Arabia

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Introduction

In late 1940 and early 1941, Peter B. Cornwall, then a graduate student at Harvard University, conducted an expedition to Bahrain and what is today Saudi Arabia?s Eastern Province. During his travels, he surveyed several sites and in some instances, excavated burials containing human remains and associated artefacts. In 1945, Cornwall deposited his collection in the Phoebe A. Hearst Museum of Anthropology at the University of California, Berkeley. While he published portions of these data in preliminary forms (e.g. Cornwall 1943; 1944; 1946a; 1946b), systematic study of the collection?s human remains, artefacts and excavation notes has been limited. The Dilmun Bioarchaeology Project (hereafter DBP) was formed in 2008 by the authors and their collaborators from the University of California, Berkeley and Sonoma State University to study the collection. The purpose of this article is to present the DBP?s research findings over the last three years. After a description of Cornwall?s expedition and the collection?s accession history, an overview of the collection?s contents is presented. Next, an in-depth study of burials D1 and G20?s human osteological, faunal and artefactual evidence is offered that showcases the collection?s potential. The burials are discussed in light of other archaeological and particularly mortuary data from Bahrain. The article concludes with a description of the DBP?s upcoming research plans.

Cornwall?s expedition

Sources for reconstructing Cornwall?s expedition include an accession file (no. 831) of correspondence, drawings, photographs and notes kept in the Hearst Museum?s archives, as well as Cornwall?s publications and publicly available documentation (e.g. ship manifests). Correspondence regarding Cornwall?s expedition began in March 1940 with a letter between Harvard University?s Carleton Coon, a professor of Middle Eastern anthropology, and

Theodore McCown, a physical anthropologist at the University of California, Berkeley. Coon wrote to introduce Cornwall, then a graduate student at Harvard, and described how Cornwall would soon write to McCown seeking funds for his expedition (Coon 1940). Harvard had considered his request, but was unwilling to support Cornwall because of his hearing impairment, a disability he acquired in childhood. Coon described Cornwall?s familial connections to the San Francisco Bay Area and the University of California, Berkeley, as his hope was that funding could be found in those places. McCown received Cornwall?s request, research design and a $1500 budget a few days later (Cornwall 1940). Cornwall and a colleague planned to arrive in Bahrain in October and travel to northern Saudi Arabia, specifically mentioning Jauf al-?Amr and the Wadi Sirhan, with an exploratory party working for California-Arabian Standard Oil of California (CASOC). According to this initial and ensuing correspondence with the Hearst Museum, Cornwall?s motives for undertaking the expedition included locating early human remains from the Palaeolithic Era, and finding evidence linking the region to ancient Dilmun. McCown informed Cornwall that the museum could sponsor his expedition in name only and could offer no initial financial backing (McCown 1940). Cornwall wrote back to say that he had raised the necessary funds from his father and his associates in California, and that Robert B. MacDonald, a scholar of pre-Islamic Arabia, would accompany him. Cornwall arrived in Bahrain on 25 October, travelling via Hawaii and other Pacific islands.

The state of Cornwall?s field notes in the Hearst accession file varies in quality, making the ability to reconstruct his research itinerary, describe tomb contexts or identify the precise location of a surveyed site challenging. Correspondence, field notes and photographs often supplement the information Cornwall supplied in his publications. From these various sources, it can be determined that he spent most of his first month in Bahrain, where he collected survey remains from an area labelled Z1 (Table 1/17), and excavated twenty-four undisturbed burial features in at least four separate areas, mainly on the north and west sides of the island (nos. 18?21). This included twenty-one tumuli, two features in a ?small cemetery locality? (Table 1/21) and one jar burial. He provided a partial key to the locations of his excavations, which included a vague description of the approximate area (Table 1). Collating this information with more recently published excavations and satellite images, the DBP has estimated the approximate location and its possible association with ? by now ? better studied cemeteries (e.g. Dar Kulayb, Aali). Unfortunately, Cornwall?s notes do not list which tumuli series were associated with which locations, and in only two of four instances (nos. 17 and 20; the G- and B-series, respectively) can tumuli be assigned to a particular cemetery. A number of uncertainties remain and it is hoped that this issue will be resolved as more information on Cornwall?s expedition is discovered.[1]

Cornwall organised his excavations according to the protocols typical of the time. The few images from the excavation indicate that he hired local workmen to assist him with excavations (Cornwall 1943: 230; 1946b: figs 1?2) (Figs 1 & 2). Excavation of tombs appears to have begun on the top and one side, moving downwards and inwards to identify the doorway (Cornwall 1943: 231). Very few images of excavated contexts have been published or are archived in the accession file, and hand drawings are absent. It is therefore not possible to reconstruct the design of burial chambers, the body?s position or the precise location of associated objects and faunal remains. Nor is it possible to determine if individual tumuli can be characterised as Early or Late Type, the characteristics of which were recently summarised by Laursen (2008: 158?160).

After completing his work in Bahrain, Cornwall worked in Saudi Arabia for two months as a guest of the California-Arabian Standard Oil Company. There he surveyed at least sixteen sites in the al-Hasa region in what is today the kingdom?s Eastern Province (Mintaqah al-Sharqiyah). Table 1 reports the names and descriptions of sites that Cornwall described in a handwritten catalogue he gave to the Hearst Museum, followed by the amount and types of materials recovered at each site. However, the best descriptions of each location remains his ?Ancient Arabia? publication (1946a), and the reader is advised to consult the narrative published there and Figure 3. Based

[1] The project continues to search for more evidence and documentation in archives associated with Cornwall?s expedition. By way of an example, one outstanding question is whether or not Cornwall excavated at Umm Jidr in the west central half of Bahrain. Frifelt claims that the excavated tumuli there are Cornwall?s work (1986: 25), and H½jlund agrees (2007: 199; fig. 256), stating that the tumuli illustrated in one of Cornwall?s publications is identifiable at Umm Jidr (Cornwall 1943: 232). In the descriptions of the areas he provided to the Hearst Museum, however, Cornwall seems to be describing the Dar Kulayb field east of Zallaq (no. 17). It is hoped that the discovery of additional documentation will confirm the location of Cornwall?s work.

Fig. 1.
Cornwall?s team excavating tumulus B3 in Bahrain. (Photo courtesy of the Phoebe A. Hearst Museum of Anthropology.)

Fig. 2.
Peter Cornwall and his hired labourers posing for a photograph in front of an unspecified tumulus in Bahrain. (Photo courtesy of the Phoebe A. Hearst Museum of Anthropology.)

on this publication, Cornwall began his journey in ?Uqair (no. 1) (which he identified as Hellenistic Gerrha) on the coast east of Hofuf. North-west of there he visited the Salt Mine Site (no. 2), for which later investigations have indicated a likely date from the late second to the first millennium BCE (Bibby 1973: 40, Potts 1990: 303, 331?332). He then travelled north up the coast to investigate the tumuli fields in the Damman Dome area in the vicinity of Dhahran, al-Khubar and Dammam. After performing surface collections at seven sites (nos. 3?9),[2] he continued north along the coast to al-Qatif, where he visited the oasis and Tarut Island (no. 10) before moving on again to al-Jubail (no. 11). From there, he turned west to al-Hinna (Cornwall?s ?Hinnat?), coming close to, but not visiting Thaj, whose significance Cornwall noted (1946a: 47). He studied at least three ?cliff castles? near Muraigha and Mulaija (nos. 12?14), small fortified settlements elevated on high plateaus whose date is uncertain. Afterwards, he turned east, passing by al-Rudaif (no. 15) and Jabal Hadrukh (no. 16) before arriving at the coast near Jinna Island. Cornwall gathered stone, ceramic, glass and metal objects from the surface of many sites he visited, at least 3739 of which were accessioned by the Hearst Museum.[3] Many of the sites Cornwall visited have been re-examined in recent decades, particularly Potts et al.?s 1977 survey and excavation, portions of which focused on the Damman Dome area (1978: 8?9, 15?23; see also Bibby 1973; Frohlich & Mughannum 1985; Zarins, Mughannum & Kamal 1983).

Before shipping artefacts, field notes and photographs to the United States, Cornwall coated human remains and some objects with a consolidating agent, probably Glyptal. According to correspondence, the Hearst Museum did ultimately pay for a portion of the materials to be shipped there. Returning in May 1941, he spent the next few years analysing and restoring the collection at his family?s house in Ross, California, a small town north of San Francisco. He published portions of his data in his 1944 Harvard dissertation, ?The history of Bahrein Island before Cyrus?, and a handful of journal articles that presented aspects of his research on the Bahrain tumuli (1943), the Eastern Province survey (1946a) and his interpretation of Dil-

[2] Cornwall assigns Site no. 9 the toponym Jabal Madhra? Shamali, noting it on his map north of Dhahran. This site is not to be confused with a similarly named site to the west near Thaj, investigated by Potts (Potts et al. 1978: 11; Potts 1984: 105, 107, map 7).

[3] There is reason to suspect that Cornwall in fact collected far more objects, as his correspondence suggests that he shipped 20,000 prehistoric stone tools to California (Cornwall 1941). For whatever reason, these objects were not given to the Hearst Museum and may be residing in another, yet to be identified location.

Table 1. Surveyed and excavated sites during Cornwall's expedition.

Site No.	Cornwall?s site name	Cornwall?s description	Number of accessioned objects	Material types	Comments
Saudi Arabia					
1	Oqair	Ruin-field just NW of modern Oqair, el Hasa province	0	none	Uqair; see Cornwall 1946a: 28?33; described as surveyed, but no objects in collection
2	X	Early site +/- 16 1/2 mi. NNW of Oqair	202	ceramic, stone (incl. steatite, pebble, chert, flint, quern), shell, copper	Salt Mine Site; See Cornwall 1946a: 33?34
3	1	Ruin-field +/- 4 1/2 miles N. of Ain es Siah, el Hasa	215	ceramic, glass, shell, pteris (plant?)	Ain al-Saih; See Cornwall 1946a: 34?38 (35: map and Plate 2)
4	2	+/- 1 mile SSW of Kholar refining drums, el Hasa	166	ceramic, porcelain, alabaster, glass, stone (incl. flint), shell, coral, copper	Probably referring to al-Khobar; see Cornwall 1946a: 34?38 (35: map)
5	M	Ruin-field centering around a point +/- 350 yards east of pole 33.4 kms. North of Dahran, on Dahran-Ras Tanura road, el Hasa	1959	glass, crockery, stone (incl. chert), ceramic, porcelain, metal (incl. copper, lead, iron, hematite, limonite, unspecified), shell, fish bone, coral, alabaster, fossil material, gypsum	Located north of Dhahran; See Cornwall 1946a: 34?38 (35: map)
6	N	Southern section of ruin-field M, el Hasa	83	ceramic, glass, stone (incl. chert), iron	Located north of Dhahran; See Cornwall 1946a: 34?38 (35: map)
7	12.1 kms	Ruin-field +/- 12: 10 kms. out on road from Dahran to Ras Tanura, el Hasa	284	ceramic, glass, shell, copper, flint	Located north of Dhahran; see Cornwall 1946a: 34?38 (35: map)
8	34 kms	Ruin-field +/- 34 kms. out, and on either side, on road N. from Dahran to Ras Tanura, el Hasa	191	ceramic, porcelain, glass, iron, shell, copper, flint, chert	Located north of Dhahran; see Cornwall 1946a: 34?38 (35: map)
9	SH	Jabal Midre Shemali, el Hasa	1049	ceramic, stone (incl. flint, steatite), clay, glass, copper, shell	Jabal Madhra? Shamali, located north of Dhahran; see Cornwall 1946a: 38?39 (35: map)
10	Tarut	Tarut Island, el Hasa	0	none	See Cornwall 1946a: 45?46; no objects in collection
11	Jubail	Coastal town	3	stone, glass	See Cornwall 1946a: 47
12	CH#1	Cliff House #1, +/- 10 kms W.S.W. of Muraigha	17	ceramic	See Cornwall 1946a: 48?49
13	CH#2	Cliff-castle a little over 4 miles S. of Mulaija, el Hasa	32	ceramic, glass, flint	See Cornwall 1946a: 48?49
14	CH#3	Cliff Castle, less than 2 miles E. of CH#2	37	ceramic, shell (fossil),	See Cornwall 1946a: 48?49
15	al-Rudaif	A hill +/- 110 miles NW of Dammam Dome, el Hasa	0	none	See Cornwall 1946a: 36; 49; no objects in collection
16	Jabal Hadrukh	A hill +/- 32 miles NW of Jubail	1	stone	See Cornwall 1946a: 49

Table 1. (*Continued*).

Site No.	Cornwall?s site name	Cornwall?s description	Number of accessioned objects	Material types	Comments
Bahrain					
17	Z1	Ruin-field +/- 5000 feet east of Zellaq, Bahrein Island	98	ceramic, stone, shell	G-series tumuli; likely Dar Kulayb mound cemetery
18	W of Sanad	Ruin-field w. of Sanad, Bahrein Island	?		likely eastern part of Aali cemetery; unable to determine which tumuli can be assigned to this location
19	Main Tumuli Field	Lies south of ?Ali, Bahrein	?		Aali mound cemetery; unable to determine which tumuli can be assigned to this location
20	Tumuli B Series	Tumuli along road from Manama to Budaiya. These tumuli are west of Marwazan, Bahrein Island	473		B-series tumuli; area approximately 3km south-east of Qala?at al-Bahrain
21	SK	(Small cemetery) locality +/- 4000 feet west of Farsiyah, Bahrein Island	?		possibly west of Farsiyah Bay; unsure which tumuli group can be assigned to this location

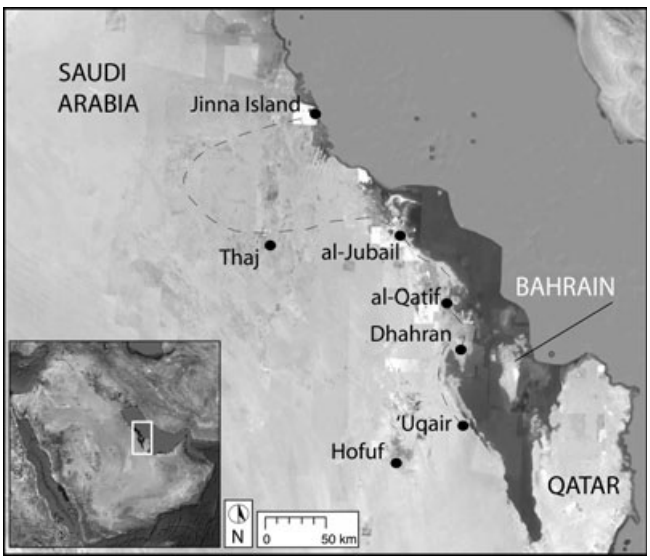

Fig. 3.
A map of Cornwall?s study area in eastern Saudi Arabia and Bahrain. The dotted line marks the path Cornwall followed in his survey, beginning in the south and moving north. (Image modified from Google Earth 2011; Image: US Geological Survey, 2011 GeoEye, 2011 Digital Globe; Data: SIO, NOAA, US Navy, NGA, GEBCO).

mun?s location (1946b). According to the Hearst Museum?s doorbook and accession sheet, the entire collection was deposited in the museum in December 1945, under the accession number 831. An inventory of its contents was completed in September 1949, according to a letter from the museum director, Edward Gifford, to Cornwall (Gifford 1949). Some correspondence between Gifford and Cornwall suggests that Cornwall was to help unpack and inventory the materials, but this did not happen despite repeated requests from the museum. Correspondence with Cornwall about the collection ends in 1952, when he reports in a letter that he is moving to Rome (Cornwall 1952). He died there in 1972 and his body was interred in Cypress Lawn Memorial Park in Colma, California.

A trial catalogue sheet dating to September 1965 indicates that Grover Krantz, a physical anthropologist then employed at the Hearst Museum, catalogued the skeletal materials. At the time of writing, there is no record that a similar process was carried out on the objects, although there is reason to suspect that it was. Given the museum protocol during the 1960s, it is likely that the catalogue number was written on each object and bone at or around the same time as Krantz?s work (Joan Knudsen, personal communication). The materials and the drawers in which they are housed also provide some information about their management by the museum staff since they were stored there in 1959, when the current museum facilities were built. For example, a sequential number was

written on each of the drawers; at some point after this, a fresh label was stapled to each drawer. The skeletal materials may have been inventoried during the museum?s broader efforts to comply with the United States Native American Graves Protection and Repatriation Act (Public Law 101?601).

Overview of the Cornwall Collection

The Cornwall collection is summarised below and divided between human remains, objects and faunal evidence.

The human remains

A preliminary study of skeletal remains was conducted during the spring of 2009 to evaluate the Cornwall collection?s research potential. This study permitted an estimation of the minimum number of individuals present (MNI = 35), provided a sense of the sample?s demography and health and suggested mortuary patterning and taphonomic conditions. Work continued throughout 2009 and 2010 to finalise the inventory of skeletal remains and collect morphological and metric data. Analysis and interpretation of these data, and their full integration with the results of research conducted by the rest of the DBP team, will be completed in the coming years.

Methodology

The collection of detailed morphological and metric data permits an analysis of the population and demographic attributes of the Cornwall collection (e.g. age, sex, health and nutritional status, activity patterns). Detailed skeletal and dental inventories, created by means of Buikstra and Ubelaker?s forms (1994: attachment 1?2) and completeness codes (1994: 7), have facilitated an estimate of MNI and each individual?s skeletal completeness. The skeletal elements used for assessing sex are, in order of reliability, the pelvic girdle, the skull and the size and robusticity of post-cranial bones. Standards derive from AscÃdi and NemeskÕri (1970), Buikstra and Ubelaker (1994), France (1998) and White (2000), as well as comparative post-cranial metric data from ancient Near Eastern populations compiled in Boutin (2008: 117?118 and ff.). The age of subadults is estimated through several methods, including dental development, bone size and length and the developmental morphology of ossification centres (Kœsa 1989; Liversidge et al. 2006; Scheuer & Black 2004; Ubelaker 1999). Methods for estimating the age of adults include the progressive union of cranial sutures and changes on the pubic symphysis and auricular surface (Brooks & Suchey 1990; Buckberry & Chamberlain 2002; Buikstra & Ubelaker 1994; Suchey & Katz 1998).

Patterns of health and nutrition are evaluated by means of Steckel, Sciulli and Rose?s (2002) health index for skeletal remains, whose attributes include stature and robusticity, linear enamel hypoplasia, cribra orbitalia and porotic hyperostosis, dental pathologies, degenerative joint disease, trauma and periosteal reactions. Supplemental standards for recording specific pathological conditions derive from Hillson (1996) for alveolar bone loss, Goodman and Rose (1991) for linear enamel hypoplasia,[4] Faccia and Williams (2008) for Schmorl?s nodes, Lovell (1997) for trauma and Stuart-Macadam (1985) for cribra orbitalia. The Arizona State University system (Scott & Turner 1997) is used for recording dental non-metric traits.

Preliminary results

Skeletal remains from approximately twenty-four burial features are represented: one jar burial, two features from a small cemetery and twenty-one tumuli. The only tumulus with individuals represented from multiple cists is tumulus B2 (from cists 4, 13 and 17). The majority of skeletons (20/35, 57%) seem to come from single interments, while ten were part of double burials (28.5%), and the remaining five from the lone multiple burial. Thirteen burial features included faunal remains (J. Piro, personal communication). As discussed further below, preliminary analysis of the associated grave-goods suggests that the skeletons derive from tumuli dating from as early as the Early Dilmun period to as late as the Tylos period.

Inventory data have been used to estimate the completeness of the thirty-five skeletons, which conveys the possibilities and limitations of the Cornwall sample based on preservation issues (Table 2). Skeletal completeness is based exclusively on the percentages of the cranial (22 bones, auditory ossicles excluded) and post-cranial skeleton (178 bones) that were extant, without special regard for the presence of diagnostic elements. Five categories of skeletal completeness, each reflecting the relative completeness of cranial and post-cranial elements,

[4] Ritzman, Baker and Schwartz (2008) demonstrate that the estimates of age-at-defect formation produced by Goodman and Rose?s (1991) regression-based method are significantly different from those produced by Reid and Dean?s (2000; 2006) histological method, which accounts better for the nonlinear process of crown growth. With these caveats in mind, the regression-based method has been used here, given the small size of the Cornwall collection and the macroscopic methods necessitated by non-destructive analysis.

Table 2. Skeletal completeness in the Cornwall collection.

	Cranial		Post-Cranial	
Completeness	%	n	%	n
None present	17.1	6	5.7	2
Fragmentary (<25%)	42.9	15	62.9	22
Partial (50-25%)	11.4	4	28.6	10
Fairly complete (75-50%)	25.7	9	2.9	1
Mostly complete (99-75%)	2.9	1	0	0
Total	100	35	100	35

respectively, have been employed (after Selinsky 2009). Dental completeness will be assessed in future studies.

The proportion of fairly and mostly complete post-cranial skeletons may be artificially low. Cornwall?s recovery strategies for skeletal remains are unknown, but he seems to have placed low priority on ribs or small bones of the hands and feet. However, of the major bones that were extant, many of them are well preserved and their diagnostic features are intact, which facilitates the collection of detailed data.

Sex was estimated for twenty-four adults, as well as two of the better-preserved adolescents (Table 3). Of those twenty-three individuals whose sex could be identified, seventeen individuals in the sample (73.9%) are possible or probable males, while six individuals are possible or probable females (26.1%). Therefore, based on preliminary analysis, males outnumber females by nearly three to one in the collection. For the purposes of palaeodemographic analysis, individuals have been assigned to one of five age classes: foetal = <birth; infants = birth?3 years; children = 3?12 years; adolescents = 12?20 years; adults = 20 + years (after Buikstra & Ubelaker 1994: 9) (Table 4). Further refinement of adult age class is in progress and will be presented in future publications. Of the individuals for whom an age category was estimated, the vast majority (68.6%) were adults. However, adolescents, children, infants and one foetus were also represented in smaller numbers. Preliminary analyses have demonstrated that numerous pathologies are present in the collection, including high frequencies of degenerative joint disease,

Table 3. Sex attribution of individuals in the Cornwall collection.

Sex	%	n
Female	19.2	5
Probable female	3.8	1
Male	42.3	11
Probable male	23.1	6
Unknown	11.5	3
Total	100	26

Table 4. Estimated age-at-death of individuals in the Cornwall collection.

Age Class	%	n
Foetal	2.9	1
Infant	8.6	3
Child	8.6	3
Adolescent	11.4	4
Adult	68.6	24
Total	100	35

ante-mortem tooth loss (AMTL) and Schmorl?s nodes. Other conditions have been noted, such as humerus varus deformity (Boutin & Porter 2011), skeletal fluorosis (cf. Littleton 1999) and bilateral parietal thinning, but these require further study and research using differential diagnosis.

Objects

The collection consists of approximately 3739 objects made from several different types of materials, including metal, bone, ivory, pearl, shell and alabaster, although stone and ceramic are the dominant material types. Dominant forms include vessels, jewellery and tools. Some of these objects were excavated in the Bahrain tumuli and were associated with human remains. Other objects are from surface collections in Bahrain or Saudi Arabia?s Eastern Province. Overall, objects are well preserved, ranging from complete to partially complete to broken. Cornwall conducted object restoration whenever possible using conventional supplies available during the 1940s. The DBP has collected descriptive meta-data (dimensions, colour, condition) from approximately 50% of the collection, concentrating on complete ceramic objects and all non-ceramic and non-stone objects. Many of these objects were photographed and several are now illustrated or will be illustrated soon.

Many of the objects published by Cornwall are present in the Hearst Museum (e.g. Cornwall 1943: 233; 1946b: fig. 3). Some noteworthy objects include metal weapons, an alabaster juglet, a ceramic vessel with an interior covered in bitumen and a worked ivory object. Comparing these objects to examples already published in the secondary literature from Qala?at al-Bahrain, the Barbar Temple and excavated cemeteries provides relative dates for the contexts from which they were collected. So far, the team has determined that the overall collection represents several different time periods from the region, the oldest being prehistoric Palaeolithic or Neolithic, and the youngest material dating to the tenth century CE. A

preliminary analysis of objects from tombs provides relative dates ranging from the late third millennium BCE to the end of the first millennium CE.

Faunal evidence[5]

Altogether, a total of eighty-five animal bone specimens were recovered from eleven of the twenty-four excavated burial mounds, mainly the C, D and G groups of tumuli. In his notes, Cornwall does not describe his collection methods, but it is assumed they were typical of the time and little regard was given to soil sifting. It is therefore likely that Cornwall and his hired labourers overlooked some evidence. Cornwall, in fact, seems to have mistaken some of the faunal evidence for human skeletal remains. The two groups were not accurately separated in his post-excavation analysis and were only identified during the DBP?s inventory of the human skeletal remains. All identified specimens were classified as sheep, goat or an unknown medium-sized mammal. The age at death spanned from very young to less than four years of age. The number of individual specimens present (NISP) in each burial varied from 0 to 13. Butchering marks and burning were limited. Their presence may suggest that animals were slaughtered and partially consumed during the interment ritual. However, there appears to be no priority in placing the choicest cuts of meat in the grave, as meat-bearing and non-meat-bearing parts are found in equal amounts.

Case studies: Bahrain tumuli D1 and G20

In order to illustrate the Cornwall collection?s interpretative potential, two case studies from the Bahrain tumuli collection are presented below.

Tumulus D1

The skeletal remains of two individuals were recovered from tumulus D1. They were given the accession number 12-10142 at the Hearst Museum. The suffixes ?a? and ?b? are used to distinguish the two individuals.

12-10142A

This individual consists of a fragmentary cranial and post-cranial skeleton (Fig. 4). The skull includes portions of the frontal, sphenoid and mandible. The extant axial skeleton includes four vertebrae and fragments of eleven ribs. From the appendicular skeleton, portions of the left scapula, left humerus and ulna, sacrum, right os coxa, right and left femurs, right tibia and left talus are extant, as well as the following complete elements: left clavicle, one metacarpal and one metatarsal. This individual is female, based on pelvic morphology and the maximum head diameter of the femur. She was a Young or Middle Adult (20?50 years) at the time of death, based on epiphyseal ossification and fusion, and degenerative joint disease.

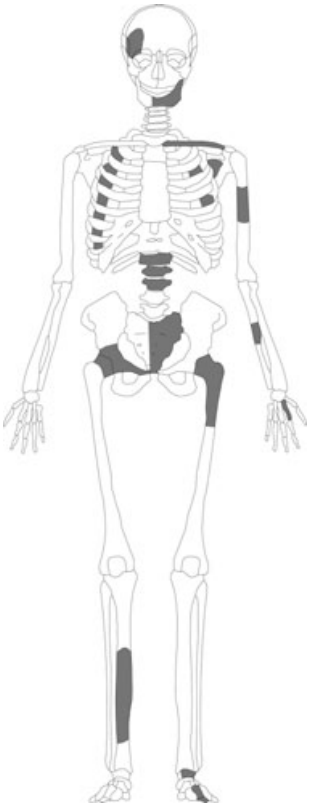

Fig. 4.
A diagram showing the skeletal completeness of individual 12-10142a (bones in grey are present).

The extant left mandible fragment is mostly edentulous (Fig. 5). The resorption of the alveoli for P_2, M_1, M_2 and M_3 is complete, and the resorption of the P_1 alveolus is in progress. No abscessing was observed. Too little cranial material is present to evaluate for pathologies. The post-cranial remains exhibit no evidence of infection/periosteal reaction or trauma. Two lumbar vertebrae do exhibit mild degenerative joint disease, and L2 has a Schmorl?s node on the superior surface of the vertebral body.

[5] This synopsis is based on research conducted by Jennifer Piro. A comprehensive analysis of faunal evidence will be presented by her in the DBP?s final publication.

Fig. 5.
Extensive ante-mortem loss of mandibular dentition in individual 12-10142a.

12-10142B

This individual also consists of a fragmentary cranial and post-cranial skeleton (Fig. 6). The skull includes portions of the frontal and right parietal. Fragments of two ribs are represented from the axial skeleton. The appendicular skeleton includes portions of the right scapula and radius, left femur, tibia and fibula, as well as the following complete elements: two carpals, five metacarpals, two phalanges and right pubis. This individual is male, based on pelvic morphology and the maximum head diameter of the femur. He was a Middle Adult (35?50 years) at the time of death, as indicated by pubic symphysis morphology. Too little cranial and dental material is present to evaluate for pathologies, although no infection/periosteal reaction, degenerative joint disease or trauma was observed in the post-cranial material. Two right metacarpals produced stature estimates of 173.27 +/- 5.15 cm (MC2) and 170.92 +/- 5.67 cm (MC5) (after Meadows & Jantz 1992). Most likely, this individual was relatively tall compared to other members of his society. In other Near Eastern skeletal series, estimates of stature from metacarpal length were *c.*3?8 cm shorter than those obtained from the long bones (Boutin 2008: 124). Accordingly, if 170.92?173.27 cm is considered this individual?s minimum stature, then he was taller than average ? possibly even by more than one standard deviation (s.d.) ? compared to males in a broader Near Eastern metric database (mean: 165.61 cm, s.d. 7.3; Boutin 2008: 489?495) as well as to those from the Early Dilmun period in Bahrain (Littleton 1998).

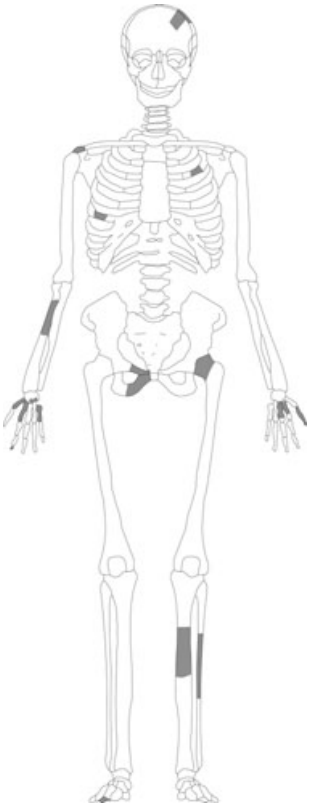

Fig. 6.
A diagram showing the skeletal completeness of individual 12-10142b (bones in grey are present).

One vessel was associated with these individuals, a 22 cm-high cylindrical jar (9-4704) with a round base, straight body and a sharp shoulder leading to a vertical neck, the upper part of which is incised with horizontal lines and thickened at the rim (Figs 7?8). The diameter of the vessel?s opening is 10.5 cm. The surface appears to have been smoothed, the fabric colour is light red (2.5YR7/8), and the clay is well levigated. This is a common vessel type in Bahrain and previous studies have classified this form as B73A in the Barbar tradition (e.g. H½jlund 1987: 32?33, fig. 68, Type 17; H½jlund & Andersen 1994: 96, fig. 217, Type B73; H½jlund 2007: 13, fig. 4, Type B73A). Although found in limited amounts in settlements, these vessels were commonly used in mortuary practices, as their repeated discovery in tombs indicates (e.g. During Caspers 1980: pls 14?15; H½jlund 2007: figs 136, 173, 197, 199, 238; Ibrahim 1982: 31, fig. 35, pls 41?43; Mughal 1983: 62, fig. 18, pl. 41). H½jlund observes this form in datable stratified contexts at Qala?at al-Bahrain IIb-c and Barbar Temple IIb, although the form first appears in Qala?at al-Bahrain

Fig. 7.
A cylindrical wheel-thrown ceramic jar (9-4704) associated with tumulus D1 and individuals 12-10142a and 12-10142b. The surface is untreated and the fabric colour is light red (2.5YR7/8). (Photo: C. Morgan.)

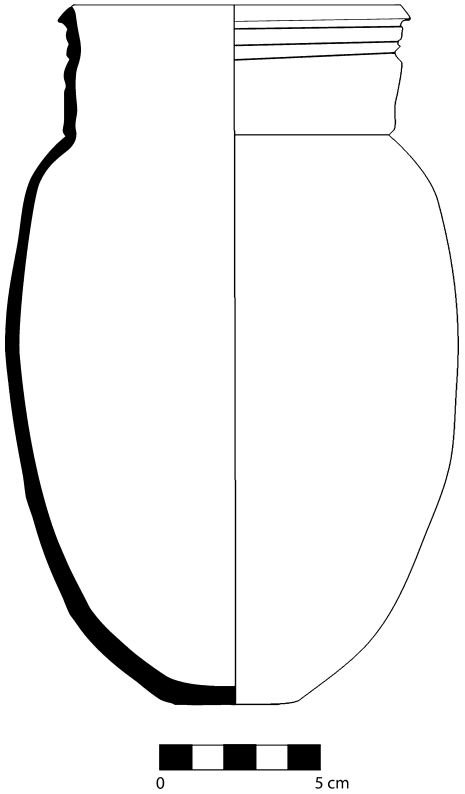

Fig. 8.
A drawing of ceramic jar (9-4707) associated with tumulus D1 and individuals 12-10142a and 12-10142b. (Drawing: K. Leu.)

IIa in limited amounts (H½jlund 2007: 13). Based on this link with a dated stratified context, a likely relative date can be assigned to the tumulus D1 individuals? interment at some point between 2000 and 1800 BCE, during the second phase of Early Dilmun?s second social formation (2007: 125?126). Additionally, a tooth from a goat was excavated in this tomb (J. Piro, personal communication), suggesting that at least one animal was interred with the individual, not an uncommon practice in burial practices during this time (e.g. Kveiborg in H½jlund 2007).

Tumulus G20

The skeletal remains of this individual derive from tumulus G20 and were assigned the number 12-10156 upon accession to the Hearst Museum. The skull is remarkably complete: the only bones missing in their entirety are the left zygomatic and the inferior nasal conchae. The right side of the skull is articulated, while portions of the left side have fragmented. The post-cranial skeleton is fairly complete, missing parts of ribs 3?10, one metacarpal, some hand and almost all foot phalanges and many tarsals (Fig. 9).

This individual was probably a male and an adolescent at the time of death (12?15 years). On the one hand, dental development suggests a minimum age of 12 years. On the other hand, ossification and epiphyseal fusion indicate a maximum age of 15 years (for a male) or 13 years (for a female). If this individual was female, it would be highly unusual that fusion of the proximal radius, acetabulum and sacral bodies (among other centres) had not yet commenced by the age of 12 years; accordingly, this individual was most likely male.

Skeletal age can be estimated from the maximum diaphyseal length of long bones. Choosing comparative standards appropriate for the known population affiliation greatly increases accuracy (Saunders 2008); unfortunately, sources of diaphyseal length data are limited. The best comparative sample for the Cornwall collection derives from Hummert and Van Gerven?s research on a medieval population from Sudanese Nubia (1983). The diaphyseal long bone lengths of 12-10156 (from both upper and lower limbs) are well within one standard deviation for the age range of 14?16 years. This is consistent with the age

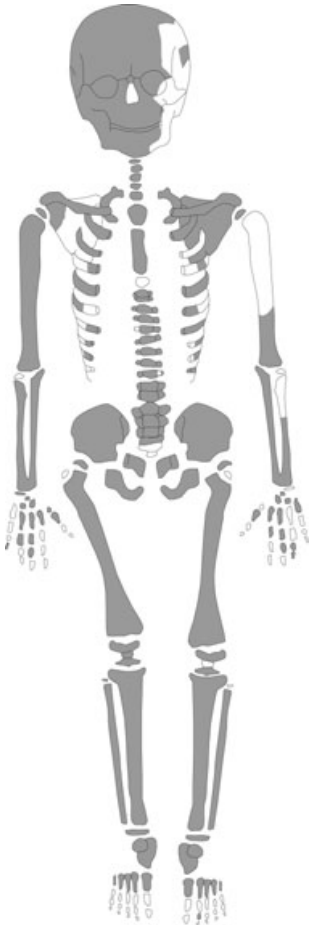

Fig. 9.
A diagram showing the skeletal completeness of individual 12-10156 (bones in grey are present).

Fig. 10.
Inferior view of 12-10156?s maxillary arcade. Note the extensive resorption of RM^1 alveolus and carious destruction of LM^2 crown and root.

estimate for males provided by epiphyseal ossification and fusion.

This individual?s dental health was poor, given his relative youth (Fig. 10). While attrition of the incisors, canines and premolars is light, maxillary molar attrition is moderate and mandibular molar attrition ranges from moderate to heavy. The right M^1 was lost ante-mortem and the alveolus has fully resorbed. All that remains of the left M^1 is a portion of the lingual root. The crown has been completely destroyed by caries, which are so extensive that a surface of origin cannot be identified. The teeth exhibit no calculus or evidence of abscesses or alveolar bone loss. Eight hypoplastic events were observed on five teeth (I^1, I_2, M^2, mandibular and maxillary canines). Their formation encompasses an age range of 3.0?5.5 years, although two clusters (between ages 3.5?4.0 and 4.5?5.0 years) may indicate peaks of physiological stress.

Littleton and Frohlich have observed high caries rates, as well as AMTL that was ?severe and early in onset?, for Bronze and Iron Age samples in Bahrain (1993: 445). They speculate that this pathological dental profile may be attributed to a non-abrasive diet with an emphasis on fermentable carbohydrates (i.e. date cultivation; cf. Maat, Lonnee & Noordhuizen 1990: 95; Nelson, Lukacs & Yule 1999). The frequency of AMTL may also be reflected in contemporary medical traditions, and H½jgaard (1986: 66) has proposed the intentional extraction of diseased teeth. High frequencies of linear enamel hypoplasia typified populations on Bahrain from the Bronze Age to the Islamic period (Littleton 2007).

No porotic hyperotosis, cribra orbitalia or trauma was observed in the skull, and neither was evidence of infection/periosteal reaction or trauma present in the post-cranial skeleton (Fig. 11). Both humeri have septal apertures (true perforations). No retardation of skeletal growth is apparent, despite the physiological stress that this individual seems to have suffered between the ages of 3.0?5.5 years; on the contrary, this individual may have been comparatively tall. Overall, his skeletal health appears to have been good.

A nearly complete ceramic jar (9-4048), 9.5 cm high, was associated with this individual (Figs 12?13). The base is 3.6 cm in diameter and the opening is 6 cm wide. The

Fig. 11.
Anterior view of 12-10156?s cranium. Note the differential preservation of right and left halves and linear enamel hypoplasias on LI^2.

Fig. 12.
A small nearly complete wheel-thrown ceramic vessel (9-4048) associated with tumulus G20 and individual 12-10156. The diameter is 6 cm. The vessel has a pink-coloured (2.5 YR 8/4) fabric and is partially covered with a white (7.5 YR 8/3) slip. (Photo: C. Morgan.)

vessel?s body is round with a flat base and a slightly inverted neck leading to a rounded rim. An easily visible line marking the place where the vessel?s body and neck meet indicate the two portions were constructed separately and brought together at some point in the production process. The vessel has a pink-coloured (2.5 YR 8/4) fabric and is covered with a white (7.5 YR 8/3) slip. This vessel is common in Early Dilmun mortuary assemblages (e.g. H½jlund 2007: figs 207, 217, 254; Ibrahim 1982: 32, figs 39?41, pls 45?48; Mughal 1983: fig. 21, pl. 43/2, 6). It is commonly described in the literature as a small pear-shaped jar. The vessel?s form appears in Qala?at al-Bahrain IIa, IIb and IIc, being most prevalent in IIa and IIb (H½jlund & Andersen 1994: 79, figs 119, Type B9). H½jlund suggests that the pear-shaped jar was most common in the IIa Phase, but was later eclipsed in popularity by the B73 jar (described earlier) during the IIb phase (2007: 21?22). Based on this suggestion, a likely relative date can be assigned to the individual?s interment at some point between 2050?1800 BCE, during the first or second phase of Early Dilmun?s second social formation (2007: 124?126). Tumulus G20 also revealed six animal-bone specimens belonging to one very young sheep or goat (J. Piro, personal communication). The presence of an unfused proximal radius indicates that the animal died before reaching six months of age.

Taphonomic and historical considerations

Many aspects of these two burials and their occupants are consistent with mortuary patterns observed previously in Bahrain and in the wider Gulf region. Like other prehistoric burials (Littleton 1995; Maat 1993), the negative impact of physical and biological taphonomic agents on skeletal preservation has been significant, although 12-10156?s relative completeness is a welcome exception. Nevertheless, as abundantly demonstrated by existing bioarchaeological research in Bahrain (Frohlich 1986; H½jgaard 1980; 1986; Littleton 1998; 2003; 2007; Littleton & Frohlich 1989; 1993), as well as in the United Arab Emirates (Alt et al. 1995; Blau 2001; 2007; Cope et al. 2005; Martin 2007), Kuwait (Maat 1993; Maat, Lonnee & Noordhuizen 1990), and Oman (Kunter 1981; 1999; 2001; Macchiarelli 1989; Nelson, Lukacs & Yule 1999), the knowledge gained by research on fragmentary human remains ? in terms of health and disease, nutrition and

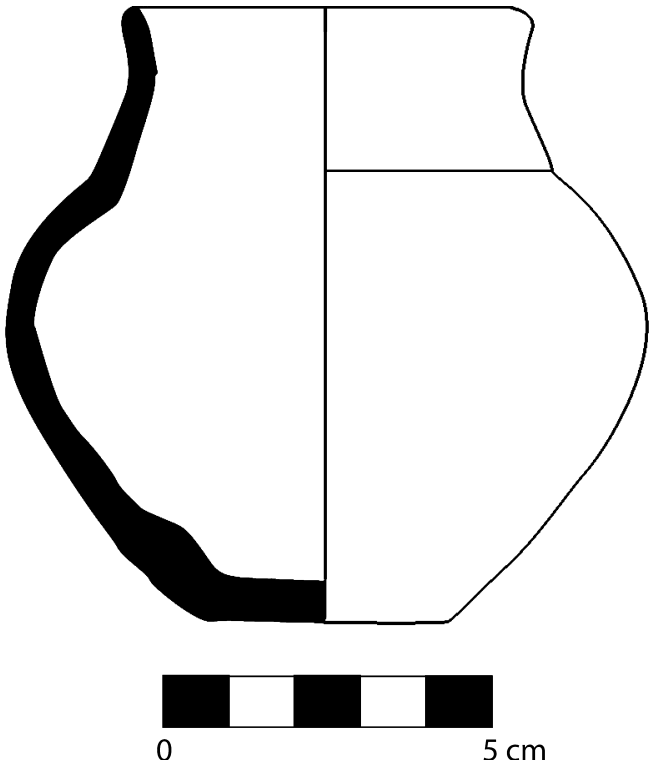

Fig. 13.
A drawing of ceramic vessel (9-4048) associated with tumulus G20 and individual 12-10156. (Drawing: K. Leu.)

subsistence practices, biodistance, activity patterns, gender and identity ? is well worth the challenges. These regional data will expand the database to which the DBP?s findings may be compared, both quantitatively (i.e. to strengthen the statistical robusticity of non-parametric tests) and qualitatively, thus providing the broader context necessary for interpreting the skeletal and dental remains in the Cornwall collection. Nevertheless, the broad temporal range encompassed by the skeletal remains will demand further refinements in the dating of the tumuli, as well as nuanced interpretations of the osteological data themselves.

These two tumuli are also typical of other interments dating to the Early Dilmun period. The presence of at least one ceramic vessel and a sheep/goat are common features in the mortuary assemblages from this time period. There are no explicit signs that these individuals were marked with a higher degree of prestige compared to their peers. Knowledge of the burial chambers? designs or the sizes of the tumuli would have been additional information to measure the relative wealth and prestige of the individuals. Unfortunately, this information is lacking in Cornwall?s descriptions. These two tumuli do make a small contribution to existing knowledge regarding emergent social complexity in Bahrain during the early second millennium BCE. A number of changes during this time signal centralised political and economic circumstances, including the fortification of Qala?at al-Bahrain, the construction of the Barbar temple, the appearance of stamp seals and commercial connections with Mesopotamia, South Asia and other Gulf settlements. Careful analysis of burial remains has also revealed a number of changes in mortuary architecture and assemblages that point to increased social differentiation within Dilmun society (Laursen 2008). The fact that certain individuals were interred in larger tumuli with more elaborate architectural designs and objects, suggests that their deaths motivated survivors to dedicate more wealth and labour to their commemoration (H½jlund 2007: 129?136). While the three individuals discussed above seem not to have received elaborate material commemoration like that of their elite counterparts, their interment does provide a window into the ordinary people who experienced and contributed to the emergent complexity of Early Dilmun society at the turn of the second millennium BCE.

Conclusion

This article serves as a first glance at the Cornwall collection and has demonstrated the materials? research potential to make a contribution to the archaeology and history of Bahrain and eastern Saudi Arabia. As the DBP?s work continues, several initiatives are planned. Most prominently, the authors are writing a monograph that will present the entire collection as well as a handful of specialist studies on particular aspects. Additionally, the authors are hoping to curate an exhibition of these materials at the Hearst Museum at some point in the future. The DBP is also conducting a facial reconstruction project on 12-10156, about which a manuscript is being prepared for publication. Given the relative lack of museum collections from the Gulf in the United States, this collection has the potential to raise awareness of the region?s past societies.

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