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Type, Series, and Ware: Characterizing Variability in Fremont Ceramic Temper

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For thirty years, Fremont ceramic analysts have primarily relied on the ceramic typology proposed by R. Madsen in 1977. The intervening years of research have yielded a wealth of relevant data and refined analytical techniques. Contemporary analysts regularly identify variations in Fremont ceramic temper that exceed Madsen's descriptions. In addition, key observations from previous analyses were omitted from the Madsen typology. I review past and current conceptions of Fremont ceramic types as well as the literature pertaining to the treatment of ceramic variation, specifically temper. Building on this work and on recent developments in Hohokam ceramic studies, I suggest a method to identify and exploit temper variability in Fremont ceramics. I then propose a reclassification of Fremont pottery within a Type–Series–Ware hierarchy. Fremont pottery is subsumed under a single ware, with series defined by temper and types by surface treatment

The Fremont, associated with maize-consuming pithouse dwellers who also relied on some wild resources, occupied most of what is now Utah between ca. 200 and 1400 A.D. In his classic treatment of the Fremont, D. Madsen (1989:3) advised the public that if they "stumble on an archaeological site anywhere within the [the Fremont] region and find sherds of… distinctive gray pottery, [they] have found the remains of what we have come to call the Fremont." These distinctive vessels were constructed via coil and scrape, and fired gray in a reducing atmosphere. Aplastic inclusions varied, but most of the pots were tempered with crushed igneous rock or angular quartz. The most common surface treatment was simple smoothing, although painted, slipped, corrugated, appliquéd, and incised sherds are regularly recovered. A fugitive red hematite wash is also sometimes found on vessel exteriors. Fremont pottery was generally well-made and fired, and often highly polished. Archaeologists have divided Fremont pottery into a number of different types based primarily on tempering material and surface treatment.

Artifact typologies are imposed on material objects by archaeologists and represent arbitrary concepts rather than objective reality (Brew 1946). As such, they should not be considered closed sets, but should rather be treated as dynamic constructs characterizing useful variation in the archaeological record. With a few important exceptions (discussed below), conceptions of Fremont ceramic types have been more or less static since R. Madsen's (1977) typology was proposed, although both the painted and unpainted ceramics have a high potential for further useful subdivision. Recent developments in Hohokam ceramic classification serve as an example of the benefits of continuously re-evaluating types and categories, even in long established schemes. The intensive investigation and identification of plain, red, and buff ware in the Phoenix Basin (Abbott 2000; Abbott and Schaller 1994; Abbott and Walsh-Anduze 1995; Miksa et al. 2004; Wallace 2001, 2004) has facilitated analyses of prehistoric ceramic production and exchange at an unprecedented scale, and Fremont ceramics show a high potential for similar subdivision.

This paper addresses inconsistencies in the current widely accepted two-tiered (Type-Ware) Fremont ceramic typology (R. Madsen 1977). I argue that the three-tier Type–Series–Ware hierarchy outlined by Colton and Hargrave (1937) better describes Fremont pottery, and should be adopted in future analyses. After briefly outlining the history of Fremont ceramic typological analysis and identifying the relevant issues, I discuss the ways in which more recent ceramic analysts have treated Fremont ceramic temper variability.

Methods developed in the Hohokam area of the North American Southwest are then presented as a model for future investigations of Fremont ceramics. I next present methods designed to identify and characterize variation in Fremont ceramic temper incorporating elements of the Hohokam case study. I conclude with a proposed restructuring of Fremont ceramic classification, based on a concept initially developed in my master's thesis (Watkins 2006). The revised hierarchy contains three formal tiers, Type–Series–Ware, where the distinguishing characteristics for series and type differentiation are temper and surface treatment, respectively.

HISTORY OF FREMONT CERAMIC TYPES

Morss (1931) is usually credited with defining the Fremont as an archaeological culture. In his characterization of the material culture traits he identified along the northern Colorado Plateau's Fremont River, Morss described a set of gray ware ceramics tempered with igneous rock. Surface treatments included plain gray, corrugated, black-on-white, black-on-gray, and appliquéd. The sherds, as described, are consistent with the types now called Emery Gray and Ivie Creek Black-on-white. Morss recognized a relationship between the pottery he observed and the sherds that had been previously described by Judd (1926) in the eastern Great Basin, which were similar in surface treatment, but with significant variation in tempering material.

The archaeological differentiation between the "Fremont" of the northern Colorado Plateau and the contemporary residents of the eastern Great Basin (variously designated as Puebloan, Puebloid, Sevier, or Sevier Fremont) continued to varying extents until the 1970s, when (by consensus) all of the maize-exploiting users of gray ware pottery north of the Colorado River were designated as comprising the Fremont (see D. Madsen 1989; Janetski and Talbot 2000; and Watkins 2006:15–27 for discussions of the problems associated with defining the Fremont). Because of the longstanding dichotomy between the Formative inhabitants of the Northern Colorado Plateau (the eastern Fremont) and the Eastern Great Basin (the western Fremont), the ceramics of what we now call the Fremont were not discussed collectively prior to D. Madsen (1970), who was later followed by R. Madsen (1977). My summary of Fremont ceramic typologies reflects this historic partition, and is divided between western and eastern Fremont pottery.

Western Fremont Pottery

The first detailed investigation of western Fremont pottery was undertaken by Steward (1936:5–19), who described and named several ceramic types. The system Steward used to create his type names was not sufficiently described, and the typology was further muddled by the application of the term "ware" in three different contexts. All western Utah pottery was initially characterized as a single, unnamed "ware." The sherds were then further broken down into utility and painted "wares." Individual surface treatments were then also characterized as "wares." Despite the confusing terminology, Steward explained that his naming conventions were carefully selected, and were intended to distinguish regional and typological subdivisions without obscuring any chronological or genetic relationships.

Steward designated two groups of unpainted pottery, Great Salt Lake and Sevier, based on temper and geography. These groups were further subdivided into "types" on the basis of surface treatment. Great Salt Lake pottery was tempered with fine quartz, and included plain gray and punched "types," the latter designation being applied to all sherds with added plastic exterior decoration or incising. Sevier pottery was primarily tempered with basalt, and included plain gray and corrugated "types." Steward further noted that the corrugated pottery was more often tempered with quartz than basalt. Most of this corrugated pottery was certainly what is now called Snake Valley Corrugated, the major temper constituent of which is quartz. This likely reflects the attention Steward paid to the spatial context of recovery in addition to temper in creating his typology; i.e., the fact that the quartz-tempered corrugated pottery spatially co-occurred with the basalt tempered pottery was enough for Steward to place them into common categories. As discussed below, this discrepancy was later addressed and resolved by Rudy (1953).

The painted pottery was divided into two groups using perceived differences in design. Again, probably as an indication of Steward's attention to geographic distributions, the two "types" were designated Sevier

Black-on-gray and Great Salt Lake Black-on-gray. Steward also initially identified and briefly discussed "Uintah" Gray, discussed in greater detail below.

Rudy (1953) found support for much of Steward's original characterization of western Fremont pottery. Following Steward, but applying the schema suggested by Colton and Hargrave (1937), Rudy subsumed western Fremont pottery under a single ware, which he called Desert Gray Ware. Rudy further determined that most of the painted and corrugated sherds, and some of the undecorated sherds that Steward called "Sevier," contained a distinct, consistent temper. Rudy created a ceramic series defined by this new temper, which he designated Snake Valley. The new series contained three types, Snake Valley Gray, Snake Valley Black-on-gray, and Snake Valley Corrugated, which were differentiated by surface treatment. This marked the first application of the full Type–Series–Ware hierarchy to the Fremont ceramic typology. Rudy's application of the Colton and Hargrave typology, defining series by common tempers and types by surface treatment, is antecedent to the classification scheme I propose in this paper. Rudy found consistency in the temper of Great Salt Lake Gray and Sevier Gray ceramics, and retained them as ceramic types. With the three ceramic types in the Snake Valley Series, a total of five ceramic types were defined in the western portion of the Fremont area as of 1953.

Eastern Fremont Pottery

The two pottery types that dominate Fremont ceramic assemblages on the Northern Colorado Plateau were first systematically described by Wormington (1955:68–72). Turner Gray—Variety I was characterized as a plain gray ware tempered with angular calcite. Turner Gray—Variety II was described as a plain gray ware tempered with "angular fragments of light gray rock, in varying proportions of mica and shiny black material." Gunnerson (1969:143–145) revisited these type designations and suggested names indicative of the geographic areas in which the type dominated. After briefly being redesignated as "Turner Gray—Cisco Variety" by Lister (1960), Gunnerson christened Variety I as "Uinta," as it predominates in the Uinta Basin. This designation was considered particularly appropriate, as this pottery was originally called "Uintah Gray" by Steward (1936:18–19). Variety II was designated Emery Variety after Emery County, "which is within the area where it is most common" (see also Lister 1960:218).

Gunnerson further compartmentalized Uinta and Emery pottery by surface treatment. After stating that "Emery Variety" pottery was tempered with crushed igneous rock, he designated the undecorated pottery as Emery Gray, surface manipulated pottery as Emery Tooled, painted and slipped pottery as Emery Black-on-white, and painted and unslipped pottery as Emery Black-on-gray, "depending on the nature of the decoration." Uinta Variety was similarly subdivided into Uinta Gray and Uinta Tooled. Gunnerson seemed to be carefully avoiding referring to his ceramic designations as types, wares, etc. However, for the purposes of the typology I propose below, Gunnerson's Emery and Uinta "Varieties" are considered roughly equivalent to the proposed Emery and Uinta Series, and the designations based on surface treatment (e.g. Emery Gray and Uinta Gray for undecorated pottery) are synonymous with proposed types within these series.

Of all the current Fremont ceramic types, Ivie Creek Black-on-white may be the most problematic. Fremont black-on-white pottery has long been known to archaeologists, having been first observed by Morss (1931), and later Rudy (1953) and others. The type was first formally defined by Lister (1960), who observed a number of vessels of this type at the Coombs Site, an intrusive PII Pueblo site north of the Colorado River. As discussed below, this type has a history of chronic misidentification (D. Madsen 1970; Richens 2000a, 2000b).

The Madsen Typologies

Following D. Madsen (1970), R. Madsen synthesized the existing Fremont ceramic types in 1977 and proposed a classification of Fremont ceramics which has remained the standard since. D. Madsen's work was extremely significant in the development of the later typology of R. Madsen, and represents a substantial contribution to Fremont archaeology. Because R. Madsen is more often cited than D. Madsen in recent investigations, I have focused the remainder of this discussion on R. Madsen's work.

Based on color and general method of manufacture, R. Madsen recognized three ceramic traditions, or wares, in the Fremont area: Desert Gray Ware (after Rudy 1953), Promontory Gray Ware, and Ivie Creek Black-on-white Ware (after Lister 1960). Since Smith (2004) has presented a convincing argument that Promontory pottery is not affiliated with the Fremont (see also Janetski 1994; Janetski and Smith 2007;), it has been omitted from further consideration in this discussion. Although Lister, and subsequently R. Madsen, proposed Ivie Creek Black-on-white as a distinct ceramic ware, it was never accepted as such, and analysts now almost always include the type as part of Desert Gray Ware, which R. Madsen (1977:v–vi) loosely defined as coil and scraped pottery, tempered with a variety of igneous and sedimentary materials, manufactured by the Fremont. The three-tiered restructuring of Fremont pottery classification proposed below subsumes all Fremont pottery under this single ware.

R. Madsen's typology contained nine types, which he formally defined. The types included Great Salt Lake Gray, Uintah Gray, Sevier Gray, Emery Gray, Ivie Creek Black-on-white, Snake Valley Gray, Snake Valley Black-on-gray, Snake Valley Corrugated, and Paragonah Coiled. These types were defined on the basis of both temper and surface treatment (Table 1), although the primary characteristic by which these types were defined was temper. In so doing, R. Madsen departed from the precedent set by Rudy (1953), who explicitly incorporated temper (into the series level) and surface treatment (at the type level of the hierarchy), as well as from others (Gunnerson 1969; Steward 1936) who suggested a similar construct with different terminology. Surface treatments that are both commonly encountered and abundant were given type status (e.g., Snake Valley Corrugated), while rare surface treatments (e.g., corrugated pottery with Emery temper) were merely mentioned briefly as a known deviation. R. Madsen also produced maps identifying the maximum distributions of Fremont pottery types as then known, as well as "core areas" (Fig. 1) where a type dominated and was presumably produced (see also D. Madsen 1970).

Paragonah Coiled is a type first formally defined by R. Madsen (see also Madsen 1970, Meighan et al. 1956). Vessel forms are exclusively miniature, and this poorly

Table 1

FREMONT POTTERY TYPES AS PER R. MADSEN (1977)

Type Name	Temper Description	Surface Treatment	Additional References
Snake Valley Gray	Fine to medium angular particles of quartz (10 – 20%), feldspar (20% – 30%), and biotite mica (5% –10%)	Smoothed	Lyneis 1994; Reed 2005; Watkins 2006
Snake Valley Black-on-gray	Fine to medium angular particles of quartz (10 – 20%), feldspar (20% – 30%), and biotite mica (5% –10%)	Painted	Lyneis 1994; Reed 2005; Watkins 2006
Snake Valley Corrugated	Fine to medium angular particles of quartz (10 – 20%), feldspar (20% – 30%), and biotite mica (5% –10%)	Corrugated	Lyneis 1994; Reed 2005; Watkins 2006
Paragonah Coiled	No Temper	Unsmoothed	Meighan et al. 1956
Sevier Gray	Medium (0.3 – 0.6 mm) to extremely coarse (larger than 1 mm) angular pieces of dark or gray basalt (15 – 40%) and quartz (0 –15%) with occasional mica.	Smoothed	Richens 2000b; Madsen and Lindsey 1977; Spurr 1993
Great Salt Lake Gray	Mostly angular particles (0.1–1.0 mm) of quartz (10 – 30%), and mica – biotite and muscovite – (5%), with some rounded grains of sand	Smoothed	Richens 2003; Allison 2002
Unita Gray	Up to 40% angular crushed calcite [limestone] (white and light pink) with occasional presence of quartz or crushed igneous rock	Smoothed	Storm 2006; Johnson and Loosle 2002; Truesdale and Hill 1999
Emery Gray	Angular crushed fragments of gray basalt (20 – 40%) and quartz (10 – 25%) with occasional mica particle	Smoothed	Spurr 1993; Geib and Lyneis 1996
Ivie Creek Black-on-white	Ranges from angular crushed fragments of gray basalt (20 – 40%) and quartz (10 – 25%) to dark crushed basalt particles	Painted White Slip	Geib and Lyneis 1996; Lister 1961

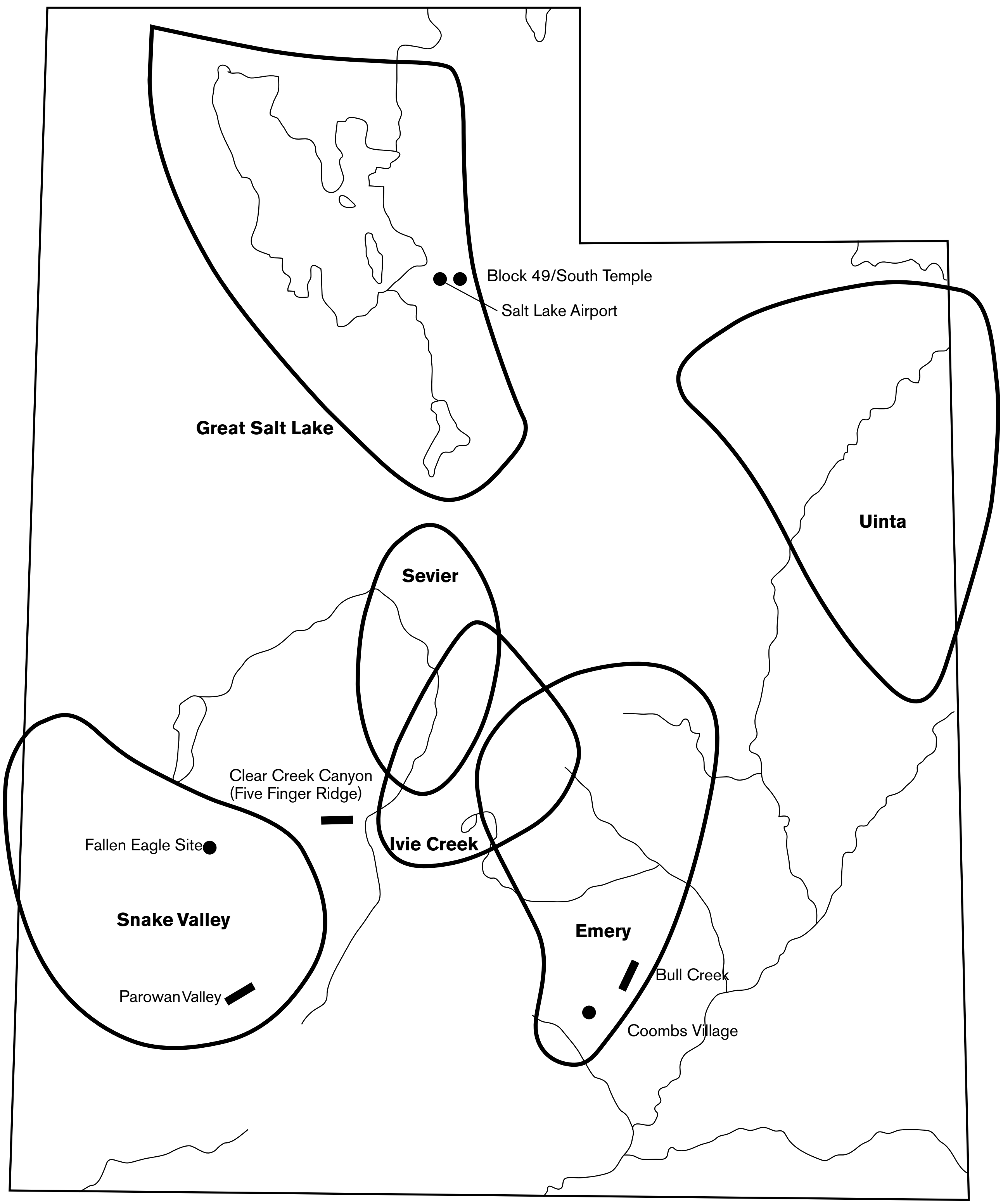

Figure 1. Hypothesized production zones of Fremont pottery as of 1977, along with sites mentioned in this discussion.

fired, temperless mud ware is rarely encountered except in the Parowan Valley. Paragonah Coiled pottery should probably not be considered a "type" in the same way as the others addressed below. I suspect the contexts of production and use of these vessels drastically differed from those of other Fremont ceramics, which (when combined with the relative rarity of the sherds outside of the Parowan Valley) prompts me to omit it from the typology proposed below. However, my intention in doing so is not to discourage research on these fascinating ceramics. When encountered, I suggest continuing to refer to these sherds as Paragonah Coiled, but intensive compositional, distributional, and other analyses are required to shed light on how these vessels fit in to the Parowan Valley and the greater Fremont ceramic toolkit.

FREMONT CERAMIC TEMPER VARIATION

Temper is the most important characteristic by which Fremont ceramic types are defined in the R. Madsen typology. Researchers have recognized variability in analyzed ceramic assemblages that exceeds the temper descriptions in the type definitions, specifically with regard to Emery Gray (Geib and Lyneis 1996; Spurr 1993; Yoke 2004), Sevier Gray (Richens 2000b), Great Salt Lake Gray (Allison 2002; Richens 2003), Uinta Gray (Johnson and Loosle 2002; Storm 2006), and the Snake Valley series (Lyneis 1994; Stokes et al. 2001). Three of these investigations are discussed in detail here to illustrate the problems Fremont ceramic analysts have encountered with regard to temper variability, as well as the solutions they have proposed. Recent developments in Hohokam ceramic temper analysis are also discussed as a model for future research on Fremont ceramics. I conclude this section with a proposed methodology that is designed to identify and exploit variation in Fremont ceramic temper.

Basalt Temper Varieties

In their re-analysis of basalt-tempered Fremont pottery from the Glen Canyon area, Geib and Lyneis (1996) discovered that the temper in some of the sherds recovered from that region was inconsistent with existing type descriptions. Specifically, most of the basalt in the sherds was black in color, which deviates from the temper definitions of both Emery Gray (gray basalt) and Sevier Gray (dark or gray basalt) (Table 1). In response, the investigators undertook a compositional analysis of the basalt-tempered pottery of the region to identify the range of variation in the basalt and to see whether this variability had useful implications for provenance.

Table 2

IGNEOUS TEMPER GROUPS IDENTIFIED BY GEIB AND LYNEIS (1996)

Temper Category	Groundmass	Phenocrysts
A	Black to dark gray	Clear and dark green to black
B	Gray, aphanitic, and mattelike	Sparse biotite and and abundant clear
C	Felsic microcrystalline with black flecks	Dark green to black
D	Whitish and finely granular	Well-defined black amphibole
E	Glassy, black, and microvesicular	Unreported

A sample of Emery Gray ceramics was analyzed under a binocular microscope, and was sorted into groups based on observed similarities in ground mass and phenocrysts (Table 2). Geological maps were then consulted in an effort to identify geological units that might be source areas. Geological samples were collected from the possible source areas, and then compared side-by-side under the microscope to the ceramics in the sample. Ceramic and geological samples were then thin-sectioned and analyzed petrographically to test correlations between temper categories and geological units, characterize the mineralogy of the temper categories, and check for variability within the proposed groups. Only Temper Varieties C and E were found to be consistent with the traditional definitions of Emery Gray and Sevier Gray, respectively. All the temper groups, with the exception of Temper Variety E, were found to be consistent with known geological units in the region. Some of these geological units are widely distributed, and some of the identified temper types co-occur in some sherds, limiting the extent to which tight provenance determinations can be made.

In addition to provenance, the results of this study have ramifications for the Fremont ceramic typology. The temper variability identified in the Emery Gray ceramics exceeds the traditional temper definition (Table 1), which is only consistent with Temper Variety C

(Table 2). Geib and Lyneis (1996:178–179) provide three possible solutions to this typological inconsistency. Their preferred, radical alternative is to "abandon Emery Gray and Sevier Gray as types and conceive of them as parts of a single igneous-tempered ceramic ware." Variability in temper and other technological characteristics within this ware would be monitored during ceramic analyses. A second choice would be to recognize sherds with Temper Variety C as Emery Gray, and with Temper Variety E as Sevier Gray, leaving large quantities of igneous-tempered sherds either unclassified or in new, yet to be defined types. The final presented option would be the inclusion of Temper Varieties A–D as varieties of Emery Gray, albeit with a modified type definition, with Sevier Gray distinguished as a separate type consistent with Temper Variety E. I return to these specific options, as well the Fremont "variant" scheme discussed below, in my discussion of the proposed re-classification of Fremont ceramic types.

Fremont Variants

Lyneis (1994) endorses a strict definition of Snake Valley Gray, and will only assign sherds to this ceramic series if the temper is consistent with the type definition. Some pottery recovered north of the Parowan Valley along the Kern River Pipeline corridor included temper that resembled that in what has been defined as Snake Valley pottery, but with significant mineralogical deviance, lacking the "classic" temper triad of quartz, feldspar, and biotite mica (Table 1). These sherds, which would also include the sherds tempered with only quartz recovered from Fallen Eagle, are often informally referred to "Non-classic Snake Valley Gray" by Fremont ceramic analysts. Lyneis hypothesizes that these sherds represent a localized application of Parowan Valley (i.e., Snake Valley) pottery manufacturing technology, with the utilization of volcanic tuffs as source material—volcanic tuffs that differed mineralogically from those utilized in the Parowan Valley.

The distinguishing characteristic of Snake Valley pottery as defined by R. Madsen is the distinctive temper combination of quartz, feldspar, and biotite. Because some of the pottery in question was inconsistent with the existing temper/type definition, Lyneis divided the sherds into numbered, project-specific "Fremont Variant" groups identified through binocular microscope and petrographic thin-section analysis. Sherds from the variant groups are thought to be uncommon and narrowly distributed and thus, Lyneis argues, do not warrant a new type designation. The sherds do, however, share characteristics of Snake Valley pottery as currently defined. Characterizing these sherds as "variants" of Snake Valley pottery avoids creating inconsistency with the type definition, describes important relationships, and provides a common language for scientific dialogue, including potential provenience studies.

The Fallen Eagle Site

The Fallen Eagle site (Stokes et al. 2001) is a small Fremont settlement located in southwestern Utah (Fig. 1). Some 6,721 sherds were recovered during excavations at the site; 6,523 of these were classified as Snake Valley Gray. The sherds were classified following "the guidelines presented by R. Madsen (1977)" by identifying consistencies in "temper material, temper size, wall thickness, and paste color" (Stokes et al. 2001:18).

The Fallen Eagle investigators observed a number of sherds that exceeded the type definitions provided by R. Madsen. Arguing that the standard Fremont typology is insufficient to distinguish locally-produced pottery, they re-categorized the sherds in a parallel investigation into more specific temper groups (see Table 3). In this second analysis, 6,207 out of 6,721 sherds were placed in a "quartz-only" temper group. Since their analyses were reported independently, it is impossible to determine from the published data how many of the sherds with quartz-only temper were classified as Snake Valley Gray. It is clear, however, that the vast majority of the

Table 3

TEMPER GROUPS IDENTIFIED AT THE FALLEN EAGLE SITE

Quartz Temper	Baked	Painted	Quartz Temper (lots of mica)	Black Temper	Feldspar Temper	Mixed Temper	Red Wash	Clay	Total
6,207	250	141	42	38	32	8	2	1	6,721

sherds ultimately classified as Snake Valley Gray at Fallen Eagle were tempered only with quartz. This is not consistent with the temper descriptions given by R. Madsen, who described a triad of quartz, feldspar, and biotite (Table 1).

In order to mitigate the discrepancy between what was observed in the sherds and the widely accepted type definitions, the Fallen Eagle analysts (Stokes et al. 2001:18) acknowledged that "[t]hese identifications placed sherds into an idealized type, and may or may not imply a link to the traditional home ranges of a particular type." Despite recognizing that the temper variability in the Fallen Eagle ceramic assemblage exceeded the known type definition, most of the sherds tempered with only quartz were classified as Snake Valley Gray. This stands in sharp contrast to Lyneis' investigation, discussed above. I do not cite this case study as an indictment of the Fallen Eagle investigators. They identified the variation in ceramic temper, but were unable to fit the deviance into the existing typology. The analysis was not deficient; the deficiency lies in the R. Madsen typology—there is no mechanism in place to describe and classify sherds with temper that falls outside of the existing definitions.

UNDECORATED HOHOKAM CERAMICS—THE TEMPER TYPE CONCEPT

The research described above attempted to capitalize on variability in prehistoric ceramics for provenance and typological purposes. Such capitalization is at the heart of the temper-type concept that Abbott (2000; Abbott and Schaller 1994) has developed as part of his treatment of Hohokam ceramics. As is the case in the Fremont area, the distinguishing characteristic in the traditional Hohokam undecorated pottery typology in the Phoenix and Gila basins is temper. The relevant traditional ceramic types in the Gila-Tonto Series are Gila Plain and Red, Salt and Gila varieties (Schroeder 1940; Weaver 1973), Wingfield Plain and Red (Abbott and Gregory 1988), and Squaw Peak Plain and Red (Lane 1989), tempered with sand, micaceous schist, phyllite, and Squaw Peak schist respectively (Table 4).

Abbott, after observing temper variability that was not adequately characterized under the existing type definitions in a ceramic assemblage from the site of Pueblo Grande, initiated a regional investigation in collaboration with geologist David Schaller aimed at correlating specific temper types with production source areas (Abbott 2000; Abbott and Schaller 1994; Schaller 1994). Four data sets were analyzed: bedrock geology, petrographic thin-sections (ceramic temper), clay chemistry, and information from an analysis of sherds under low magnification in the binocular microscope. The goal of Abbott's study was to use bedrock geology, temper, and clay chemistry to discern discrete groups representing ceramic production sources that could be consistently identified by an analyst with the binocular microscope.

Table 4

TRADITIONAL HOHOKAM PLAIN WARE CERAMIC TYPES

Ceramic Type	Temper	Reference
Gila Plain, Salt Variety	Sand	Schroeder 1940; Weaver 1973
Gila Plain, Gila Variety	Micaceous Schist	Schroeder 1940; Weaver 1973
Wingfield Plain	Phyllite	Abbott and Gregory 1988
Squaw Peak Plain	Squaw Peak Schist	Lane 1989

The portion of the analysis focused on temper had three principal objectives: mapping the geographic distribution of specific rock and sand types, characterizing the range of variation in Hohokam ceramics, and recognizing the limitations of what can be observed in a binocular microscope. These objectives were closely integrated, and the analyses were therefore undertaken simultaneously, with each dataset recursively informing the analysis of the others.

The geographic range of specific rock and sand types in the region needed to be identified from the perspective of the ceramic analyst, rather than from that of a geologist or petrographer. Schaller, in consultation with Abbott and other analysts on the project, undertook the Herculean task of synthesizing the existing geological literature, supplemented and complemented by his own field sampling program, in order to establish the distribution of rock and sand types thought to represent temper groups on the landscape (which is quite different from a standard geological map). Creating this map required extensive give-and-take between Schaller and the ceramic analysts. A typical example of this process involved Schaller's lumping of several different contiguous schist units that had been distinguished and mapped geologically into a single group, because the units could not be distinguished from one another in the sherds with a binocular microscope.

The range of temper variation in the ceramics was established by analyzing petrographic thin-sections in a staged sampling program. Over the course of the investigation, the archaeological significance of the rock types identified by Schaller was continually refined. Additional questions arose in conjunction with the binocular analysis of ceramic temper. During this process, analysts sorted the sherds into groups that appeared similar under low magnification. These groups were tested by analyzing additional thin-sections, and the analysts informed their sorting of the assemblage by viewing the "remnant" fragments of sherds that had been thin-sectioned and confidently placed into groups.

This process resulted in six hypothetical temper types, identifiable with a binocular microscope, and correlated with known geographic areas. Three of the groups, phyllite, Squaw Peak schist, and micaceous schist, were consistent with existing ceramic types/varieties (Table 4). The remaining three temper categories, however, would have been previously lumped together as "sand" under the Gila Plain Salt Variety. It is noteworthy that at no time did Abbott suggest an abandonment of the traditional ceramic typology, nor did he suggest creating new ceramic types, avoiding the formation of vast quantities of legacy data. Thus the temper-type concept can layer additional levels of data onto an analysis without totally supplanting long-standing ceramic types. None of the old information need be lost, and new information is still made available.

The analysis described above is similar to Geib and Lyneis' (1996) investigation of Emery Gray pottery, which was successful in sourcing *ceramic temper*. Sourcing pots and conclusively identifying ceramic production zones requires additional analysis. Several of the Hohokam temper sources were located in near proximity to one another, and potters in a given location could have been exploiting multiple sources. This is of particular importance as it appears that some of the potters were traveling as far as 10 kilometers from their home settlement to exploit temper. In order to more closely correlate the hypothetical temper types with production sources, Abbott conducted a chemical assay of the clay fraction of a subset of sherds. If a correlation between temper type and discrete compositional groups based on clay chemistry could be established, then the temper types could be associated with production groups/sources. These groups could then be correlated with the bedrock geology to establish a point of origin for the ceramic vessels.

There are two common methods of chemical assay capable of targeting clay independent of temper in a potsherd. These methods contrast with bulk analyses which analyze clay and temper together. Abbott has utilized the Electron Microprobe with great success. Laser Ablation-Inductively Coupled Plasma-Mass Spectrometry (Speakman and Neff 2005), which has the advantage of assaying more elements than the probe, is another technique that has been applied in these types of analysis. Abbott's chemical assay confirmed an association between temper and clay types in his six hypothetical Hohokam temper types, demonstrating that while Hohokam potters were selecting platy rock and sand types as temper, they minimized their efforts by procuring the most readily available appropriate materials. Abbott's success in equating easily recognizable temper types with production sources has permitted the low-cost assessment of provenance in huge sherd samples, facilitating a wealth of new research.

Thus, with the use of the temper-type concept, sherds can be easily sorted into broadly defined yet meaningful ceramic types with the naked eye or at most a cursory examination with a binocular microscope or hand lens. A more detailed, time-intensive analysis can then be performed on a subset of the sherds in order to sort them into temper types that can be associated with specific production loci. This construct has the added benefit of avoiding the proliferation of vast quantities of legacy data that would result from a wide-scale restructuring of an entrenched ceramic typology.

ANALYSING VARIATION IN FREMONT CERAMICS

The work of Geib and Lyneis (1996) set a new precedent for the fine-grained analysis of temper in Fremont ceramics by identifying five igneous temper types. However, they were unable to associate these temper types with discrete production zones (e.g., Abbott 2000). They further demonstrated—with their re-analysis of the Bull Creek ceramic assemblage—that inferring trade from the traditional ceramic typology is not always accurate. Fremont ceramics were probably being circulated within the traditionally defined Emery Gray production zone, indicating that Emery-tempered ceramics recovered from within the Emery production zone cannot necessarily be assumed to have been "locally" produced, as they may have been manufactured at another site within the zone. Exchanges of Fremont ceramics based on the traditional ceramic typology can only be inferred at a very broad, amorphously defined, geographical scale (Madsen 1970).

I propose that a systematic, wide-spread analysis of temper variability within Fremont ceramics—including analyses of bedrock geology, temper, clay, and sherds (via binocular microscope)—be conducted to identify discrete geographic zones where particular pots were being produced. The unique geological circumstances in the Phoenix Basin provide an opportunity for the determination of provenience at an unprecedented scale, probably to within a few kilometers. Although this degree of precision is unlikely to be obtained in the Fremont area (as discovered by Geib and Lyneis), I am confident that specific ceramic production zones could still be identified at a meaningful scale. Work in central Arizona (Kelly et al. 2009), where the local geology is not as diverse as the Phoenix Basin, has shown the utility of this technique beyond Abbott's original study area. Abbott's success was due in no small part to his initial large-scale research efforts at Pueblo Grande. Fremont ceramic studies would also benefit from an initial large project; however, smaller projects could also contribute significantly to the research described below by parsing out variations within each ceramic production zone.

As described in the case studies above, contemporary Fremont ceramic analysts typically divide Fremont pottery into project-specific temper varieties based on variation observed through a binocular microscope, the first step in the methodology described above. A sample of each temper group (Abbott typically begins with 20 sherds) is then subjected to both petrographic and clay chemistry analysis. These new data are then used to test the proposed temper group. If the sherds from each proposed temper type form discrete groups in the binocular scope, in thin-section, and in terms of clay chemistry, then a production source can be defined. If the samples from each proposed temper type do not form discrete groups based on all three kinds of data, then the temper groups should be revised based on the new data and re-sampled until a reference group of about 20 sherds has been obtained. Future analysts can learn to recognize these temper groups by looking at the "remnant" sherds from the reference groups. (A remnant sherd is the portion of the original sample left over after petrographic and chemical analysis.) Once a production source has been identified, it can be tied to specific geographic locations in the landscape based on an investigation of bedrock geology and sand sampling from drainages.

Chemical analysis will be particularly important in the Fremont area, not only to avoid making potentially disastrous assumptions, but because at least some bedrock temper sources are widely dispersed, so that more than one production source may be associated with a single temper type (see Geib and Lyneis 1996). Although some success has been achieved in the realm of bulk chemical analysis (C. Cole, personal communication 2006; Reed 2005; Reed and Speakman 2005; Watkins 2006), for provenience determinations chemical assays need to be able to pinpoint paste independently from temper in order to capitalize on Fremont ceramic variability at the scale of the binocular microscope. Bulk analyses can be (and are in many cases) very effective, but in the case of extreme temper variation, such as in Fremont ceramics, I prefer to assay clay independently of temper. Either the Electron Microprobe or Laser Ablation-Inductively Coupled Plasma-Mass Spectrometry could be utilized. For comparative purposes, it would be ideal if one technique could be agreed upon by consensus. Because of my familiarity with the technique, and the ease of accessibility, I would prefer to utilize the Electron Microprobe if discrete groups could be formed with the more limited elemental assay.

TYPES, SERIES, AND WARES

A three-tier pottery classification system for the American Southwest consisting of ware, series, and type was introduced by Colton and Hargrave in 1937. The basic unit of the scheme, the *type*, is defined as "a group of pottery vessels which are alike in every important characteristic except (possibly) form" (Colton and Hargrave 1937:2). General characteristics include surface color, method of clay handling, composition of temper,

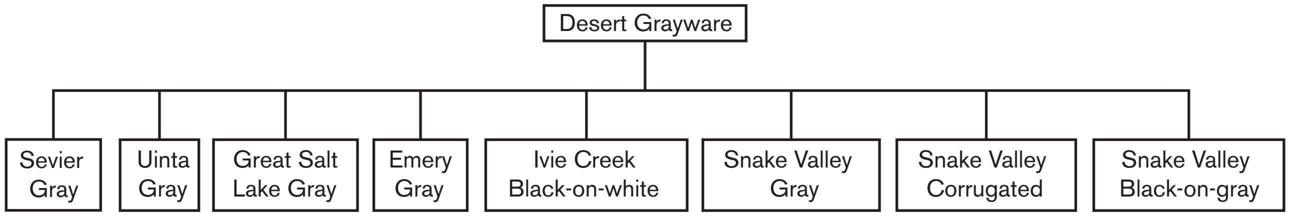

Figure 2. Relationships between Fremont pottery types under the current accepted typology.

composition of paint, and styles of design. A *series* consists of types bearing a "genetic" relationship to one another. In the case of the Fremont, the genetic relationships are "collateral developments or variations from any type" (Colton and Hargrave 1937:3). The best example of this from the Fremont area is Snake Valley pottery, in which the later painted and corrugated varieties grew out of an existing gray ware tradition (R. Madsen 1977). Finally, a *ware* "is a group of pottery types which has a majority of (the above) characteristics in common but that differ in others" (Colton and Hargrave 1937:2).

The two-tiered Fremont pottery classification system proposed by R. Madsen is inconsistent, masks important relationships between types, and makes discussion and classification of uncommon surface treatments and ceramic tempers difficult. Some researchers (Allison 2002; Lyneis 1994; Richens 1999, 2000a, 2000b, 2003) are already using *de facto* versions of the Type–Series–Ware system, and references to the Snake Valley types as a "series" have been common in the literature for some time (see Rudy 1953). In this section, I discuss common analytical misconceptions resulting from the existing typology, and—following Colton and Hargrave (1937)—propose a three-tier classification system of Fremont pottery.

Analytical Misconceptions

Most Fremont pottery is undecorated gray ware, and (as discussed above) temper is the primary characteristic by which types have been determined. Common exceptions to the standard surface treatment are painted and corrugated vessels with Snake Valley temper (Snake Valley Black-on-gray and Snake Valley Corrugated), and slipped and painted pots with Emery temper (Ivie Creek Black-on-white). Early analysts assigned these regularly-encountered surface treatments the status of "type." As explained above, R. Madsen classified Fremont pottery using a two-tiered system of ware and type (Fig. 2), with the primary defining characteristic being temper and the secondary defining characteristic being surface treatment. This system has helped perpetuate three significant misconceptions among Fremont researchers.

First, painted and corrugated vessels of other Fremont pottery types are occasionally encountered. Some researchers type all Fremont corrugated pottery, regardless of temper, as Snake Valley Corrugated, arguing that no other Fremont corrugated type has been formally defined (D. Hardy, personal communication 2004). The same problem occurs when painted, unslipped pottery tempered with materials other than quartz, biotite, and feldspar is encountered. Since no formal Sevier, Salt Lake, or Uinta Black-on-gray types have been defined, analysts may be tempted to classify these sherds as Snake Valley Black-on-gray. Both Richens (2000a, 2000b) and D. Madsen (1970) have identified instances where unslipped, painted pottery with basalt temper has been called Ivie Creek Black-on-white, since technically there is no Emery Black-on-gray category in the R. Madsen typology.

Second, a system limited to only two tiers masks the relationship between types in the second tier. A researcher unfamiliar with Fremont ceramics might look at Figure 2 and conclude that Snake Valley Gray and Sevier Gray are as different as Snake Valley Gray and Snake Valley Corrugated. This is far from accurate, as the Snake Valley types differ only in surface treatment, and Snake Valley Corrugated and Sevier Gray differ in both temper and surface treatment.

Finally, the existing classification and analytical scheme provides no consistent method for dealing with variation in surface treatment that is not provided for in the type definitions. This includes appliquéd, tooled, and various other surface manipulations occurring on Fremont pottery. As argued in the previous section,

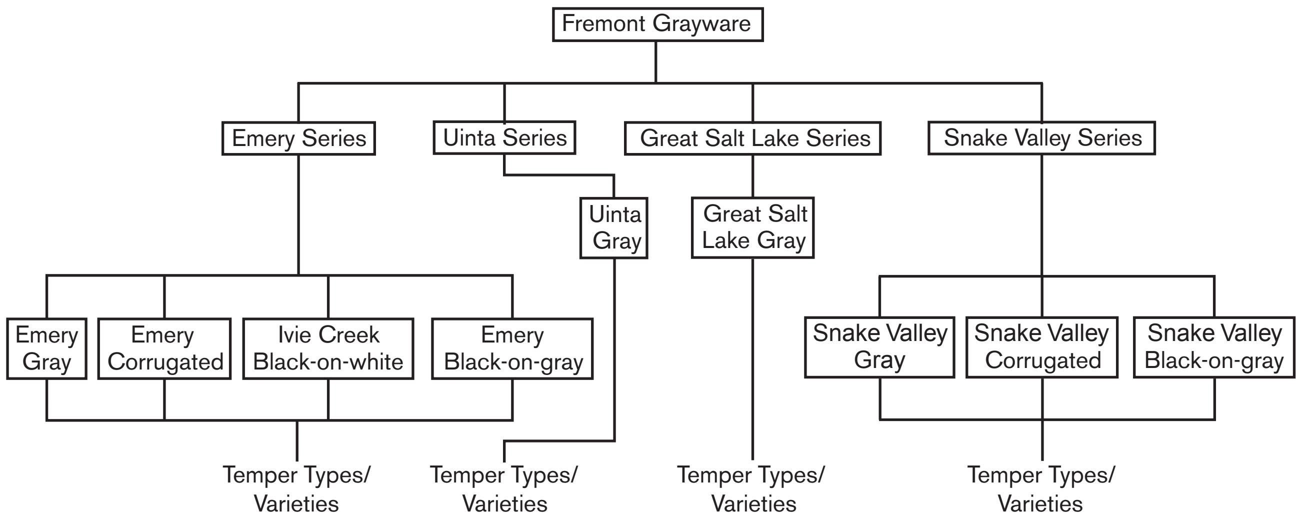

Figure 3. Proposed hierarchical reclassification of Fremont pottery, rare types omitted.

a mechanism for dealing with variability in ceramic temper is not included in the existing ceramic typology. In the classification system I propose below, any sherd can be assigned to a series, type, and temper type after a detailed analysis of temper and surface treatment.

A Three-Tiered Classification of Fremont Ceramics

Ware. Fremont pottery, all of which consists of well-formed, highly polished gray-fired vessels (with one white-slipped variation) is well categorized as a single ware. The white slip on Fremont ceramics is better conceived of as a derivative surface treatment, rather than as a suitable criterion for the establishment of a new ware. As stated above, the idea of Ivie Creek Black-on-white as a separate ware never caught on, and most analysts already discuss this pottery under the rubric of Desert Gray Ware. The Desert Gray Ware designation is inadequate, and is typically only invoked in discussions of typology. I propose re-designating this level of the typology as Fremont Gray Ware (Fig. 3), a convention that is both descriptive and consistent with Ancestral Puebloan typologies in adjacent regions. Because the term is invoked so rarely, changing it will not introduce confusion into the typology.

Series. The key variable in the definition of each proposed series is temper. The major temper groups are allotted a series in the typology. I have revised some of the temper descriptions associated with each series to include more of the temper variation, while still keeping them mutually exclusive (Table 5). I have made suggestions for future reconfigurations of other temper descriptions following additional research. I am not hoping that these temper descriptions will remain in place for the next 30 years, as did those presented by R. Madsen. Instead, I anticipate that future research will continually refine these descriptions without generating massive amounts of legacy data.

I have slightly modified the Uinta Gray temper definition given by R. Madsen (Table 1) for the *Uinta Series* to include all sherds containing some angular calcite

Table 5

TEMPER DESCRIPTIONS FOR THE FOUR NEWLY DEFINED FREMONT CERAMIC SERIES

Ceramic Series	Temper Definition	Inclusive types under the old typology
Uinta	Includes some angular calcite	Uinta Gray
Emery	Dominated by crushed, dull igneous rock (basalt and andesite)	Sevier Gray, Emery Gray, Ivie Creek Black-on-white
Snake Valley	Dominated by angular quartz, often including feldspar and biotite	Snake Valley Gray, Snake Valley Black-on-gray, Snake Valley Corrugated
Great Salt Lake	Other sand or crushed rock, typically derived from igneous sources	Great Salt Lake Gray

(Table 5). However, it appears that temper variability in ceramics thought to have been manufactured in the Uinta Basin is more extensive than previously thought. Sherds tempered with sandstone and volcanic tuff, and that are otherwise consistent with the calcite-tempered material, have been recovered (Johnson and Loosle 2002:276). The tuff and sandstone tempered sherds were recovered in small quantities, again raising the question originally posed by Lyneis (1994) as to how unique tempers recovered in small quantities should be classified. If the temper is too different to be included in the modified temper definition of an existing series, the sherds should be assigned to a new series, even though the known samples are few in number. This strategy may require a re-assessment if numerous examples of the poorly represented series are eventually found. For now, sherds with unusual temper constituents that are inconsistent with known descriptions should be classified as Great Salt Lake (see description below).

Following the more radical suggestion of Geib and Lyneis (1996), I have placed sherds that had been previously classified as Emery, Sevier, or Ivie Creek into a single group, the *Emery Series*, which will include all Fremont pottery with temper dominated by dull basalt or andesite (Table 5). Justification for this move is based on the difficulty encountered by Geib and Lyneis (1996) in sorting the traditional gray basalt associated with Sevier Gray from certain temper varieties in the traditional Emery production zone. Richens (personal communication 2005), who has probably seen more Sevier ceramics than any other analyst, is able to consistently make a distinction between these groups; however, other researchers would probably have more difficulty. However, I am not suggesting a total abandonment of the Sevier designation, and suggest that it be retained as a temper type (see below).

Ceramics in the *Snake Valley Series* have a temper that is dominated by angular quartz and feldspar (Table 5). Other minerals, particularly feldspar and biotite, may be present in varying quantities. This temper definition encompasses the "classic" Snake Valley pottery thought to have been manufactured in the Parowan Valley, as well as the "Fremont Variants" defined by Lyneis (1994) north of Parowan. The kind of temper variation described by Lyneis would be incorporated into the typology at the Temper Type level (see below).

Based primarily on the huge temper variety in northern Fremont ceramics (Allison 2002; Johnson and Loosle 2002; R. Madsen 1977; Richens 2003), I have defined the *Great Salt Lake Series* as pottery that is tempered with sand or crushed rock, often derived from igneous sources, that does not fit into any of the temper descriptions given above (Table 5). Various minerals, particularly mica, may also be included in Great Salt Lake pottery. Richens (2003) typed some of the pottery in his Block 49/South Temple sample that was tempered with quartz, feldspar, and biotite as a variety of Great Salt Lake Gray on the basis of surface treatment, as the sherds in question were rough and relatively unsmoothed when compared to the "classic" Snake Valley pottery commonly recovered in the Parowan Valley. Under the proposed typology, these sherds and any others dominated by quartz temper would be placed in the Snake Valley Series on the basis of temper.

Type. Types in a temper series are determined on the basis of surface treatment, the most common being plain (not manipulated beyond smoothing and polishing), corrugated, painted (black-on-gray), and slipped and painted (black-on-white). After a cursory review of the literature, I suggest at least two additional type categories for ceramics exhibiting clay body manipulation other then corrugation—appliquéd and incised. These type designations refer respectively to ceramics that clay has been added to or removed from (via punctation, tooling, or incising). The appliquéd and incised types seem to persist in each series to some degree, but I have omitted them from Figure 3 due to space constraints. If warranted by further analysis, additional type designations should be allotted to sherds exhibiting alternative clay body manipulation or variable paint types (such as the "Great Salt Lake Red-on-gray" proposed by Allison [2002] at the Salt Lake Airport). Sherds exhibiting more than one surface treatment are somewhat problematic. Such sherds are rare, however, and I suggest keeping type conventions as simple as possible. For example, a sherd tempered with quartz, biotite, and feldspar and with black paint and corrugation should be designated Snake Valley Black-on-gray and Corrugated.

Temper Type, or "Variety." I have heretofore referred to my proposed restructuring of the Fremont ceramic typology as being three-tiered. However, here I propose a fourth quasi-tier to characterize temper

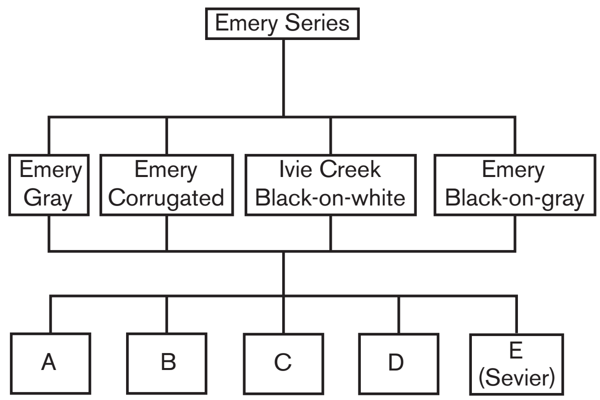

Figure 4. Selected temper types/varieties in the Emery Series.

variation within the broadly-defined series. In Abbott's lab, these well-defined categories are referred to as temper types, a categorization that is not determined for every sherd in over-large assemblages due to the amount of time the analyst must spend viewing sherds under the binocular microscope. Resource constraints may similarly prohibit the assignment of every sherd in an assemblage to this level, and temper type data for the sampled portion of the assemblage should be presented in separate tables in technical reports, such as in the Fallen Eagle case discussed above (Stokes et al. 2001). Because of my personal experience as an analyst in Abbott's lab, I prefer referring to this level of the typology as "temper type." An undecorated sherd tempered with Geib and Lyneis' (1996) igneous Temper Variety E would have formerly been referred to as Sevier Gray, but under the proposed typology would be designated Emery Gray, Sevier Temper.

However, I understand that other analysts may be more comfortable talking about "varieties." In its modern usage, the variety concept is quite flexible, and it is particularly applicable to temper types in this context. The participants in the 1995 Chambers-Sanders Trust Lands Ceramic Conference (Hays-Gilpin and van Hartesveldt 1998:53) defined variety as allowing "minor variations, *such as those due to available materials…to be encoded without losing one's definition of a type. Varieties become a means to split out material that might be relevant to discussion of production localities*, or to mark other characteristics as potentially important for answering specific research questions" (emphasis added). The hypothetical sherd referred to in the previous paragraph therefore might be categorized as Emery Gray, Sevier Variety.

Temper types, or varieties, occupy the bottom position in the ceramic hierarchy (Fig. 3). Temper varieties cross-cut the ceramic types defined by surface treatment, as they are presumably related to production locations. A specific example in the Emery Series is given in Fig. 4, where Geib and Lyneis (1996) have already defined several temper types. Future temper types, as well as those already documented to varying extents (such as Lyneis' "Fremont Variants" in the Snake Valley Series), would take similar positions in their respective ceramic series in the typology.

SUMMARY AND SUGGESTIONS FOR FURTHER RESEARCH

In addition to applying the method proposed above to Fremont ceramics, I suggest a further subdivision of the Fremont painted types (Snake Valley Black-on-gray, Ivie Creek Black-on-white, and Emery Black-on-gray) into chronologically sensitive categories based on variation in painted designs. This has never been seriously attempted. Fremont painted pottery was produced for several hundred years, and the identification of chronologically sensitive ceramics would be an enormous boon to Fremont chronological studies, which rely primarily on radiocarbon dates. Wallace's (2001, 2004) recent reassessment of Hohokam Red-on-buff pottery has not only made the identification of the types more objective, it has substantially refined the Hohokam chronology. His basic approach to typological and chronological refinement involved (1) the application of a numerical time seriation to ceramic attribute data from "unmixed" deposits; (2) a test of the seriation with independent sequencing and dating techniques; (3) the selection of groups of contexts from a seriation timeline; and (4) the use of these groups to calculate attribute percentages and define ceramic types. The Parowan Valley ceramic collection from the UCLA excavations in the 1950s and 1960s (currently on loan to Brigham Young University) is an ideal assemblage to which Wallace's method could be applied. The identification of even a few diagnostic design elements associated with assemblages prior to and after the introduction of corrugated ceramics would be of great benefit to Fremont chronological analyses.

Additional work is required in assessing the distribution of Fremont ceramic types and series. The distributions reported by D. Madsen (1970) and R. Madsen (1977; see also Fig. 1) were based on a thirty-year-old dataset, and should be recalculated. Research on the distribution of pots exhibiting variable surface treatments in addition to temper would also be fruitful. My own distributional analysis of the Snake Valley Series (Watkins 2006), calculated using the expanded dataset available in 2005, is not entirely consistent with the older results. Snake Valley Gray, for example, has a wider distribution than Snake Valley Black-on-gray, and the distribution of Snake Valley Corrugated is even more restricted than the painted and undecorated types in the series.

The most recent synthesis of the Fremont ceramic typology was undertaken in 1977 by Rex Madsen. His contribution was significant, but he omitted useful portions of previous typologies, and significant variation not characterized in his typology has been observed during the 30-year interim. In the present paper, I propose methods to identify and characterize variability in Fremont ceramic temper, and suggest a restructuring of the Fremont ceramic typology based upon Colton and Hargrave's (1937) three-tiered Ware–Series–Type hierarchy. Following developments in the Hohokam area, and the work of Geib and Lyneis (1996), I also suggest a fourth quasi-tier, involving temper type or variety, in order to more fully characterize Fremont temper variability. Instead of viewing this variability as a typological hindrance, we should capitalize on the variety for provenance and other purposes. Despite the potential problems that may arise in comparing new analyses to legacy data, I urge a constant review and re-assessment of the Fremont ceramic typology to better characterize the material and meet continually expanding research needs.

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