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## Bedrock features: An overview

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### ABSTRACT

A great deal of progress has been made by archaeologists in recognizing the importance of groundstone and bedrock features as well as in detailed descriptions of these features. We are now well positioned to undertake some of the more probing issues of what these features were used for and why they become common in some times and places but not others. In these endeavors, analysts should avail themselves of critical ethnographic observations and employ analytical frameworks like Design Theory. Of particular importance will be determining whether specific groundstone types were used primarily for processing high-effort feasting foods or whether they were used for processing daily subsistence foods.

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Nadel, Rosenberg, and colleagues should be congratulated for raising the archaeological profile of groundstone artifacts to some prominence after decades of neglect with the notable exceptions of a few specialists like Jenny Adams. This collection is another step in bringing studies of groundstone artifacts and features into the mainstream of archaeological analysis and theorizing.

The authors have generally taken a step-wise approach in dealing with groundstone assemblages, preferring to tackle issues of recording, establishing a reliable and useful data base, and general overviews of the full scope of groundstone phenomena. Steps dealing with the use of groundstone features or broader implications for causes of the appearance or changes in groundstone assemblages are largely deferred to the future. I would suggest that a more holistic approach that combined the establishment of accurate data together with more theoretical explorations at several levels would be more productive and generate more interesting questions than a stepwise approach, although the emphasis on data vs. theory would obviously shift as progress is made. Thus, the question of what foods were prepared and how, the labor involved, costs and benefits of making and using groundstone, who made and who used groundstone, ownership, value, why groundstone was minimally used at some times and heavily used at other times, sociopolitical or ritual contexts, and other such theoretical issues should all be “on the table” for examination in my opinion.

Despite this overall impression, there are some intriguing ideas about the uses of groundstone types in these papers, as well as a

cryptic and rather surprising note about use-wear and residue analyses being irrelevant for Rosenberg and Nadel's Natufian groundstone assemblages (this volume). A variety of residue techniques are now available involving lipid residues, the occurrence of oxalates and ergosterols from brewing (Isaksson et al., 2010; Dietrich et al., 2012), and potentially remnant DNA. The lack of ethnographic observations concerning the use of groundstone assemblages is also surprising, especially in papers dealing with California and Texas (e.g., Burton et al., this volume, and Gershtein et al., this volume). I would argue that even observations from far afield, such as the multiple cupules used to crack nuts in Vanuatu, are extremely valuable (Speiser, 1996, Plate 21:4,7,10–12). The attempts to develop a basic typology of bedrock features are certainly important contributions, although I think they could benefit from recourse to ethnographies in order to identify key attributes. For instance, mortars for pounding acorns in California were generally about 10 cm in diameter and less than 15 cm deep and often very shallow, whereas mortars for pounding small hard seeds were more than 25 cm deep (Dixon, 1905, pp. 135–6; Jackson, 2004, pp. 173–4). Thus, depths become important functional attributes in creating typologies. Typologies should also take into consideration the quantities of materials processed and developmental trajectories over the lifetime of the features.

Several authors in this volume draw attention to intriguing patterns in their assemblages. Most notable is the upsurge of groundstone features noted by Rosenberg and Nadel, (especially “mortars” and grinding stones) in the Near Eastern Epipaleolithic. The occurrence of these features is largely associated with burial areas, followed by the reduction of types and a shift to residential locations in the subsequent PPNA period. It is gratifying to see some

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initial interpretive balloons sent aloft relating the Natufian bedrock features to ritual activities. I would expect that burials + ritual + food = feasting, and surely, mortuary feasting can be inferred from these and other contexts as Yeshurun et al. (2013) have demonstrated at Raqefet (see also, Hayden, 2004, 2011). The Natufian mortuary contexts may signal an emphasis on early groundstone used to prepare labor-intensive foods by pounding/grinding in predominantly feasting frameworks. The range of bedrock features described by Rosenberg and Nadel (this volume) could have been used for preparing a number of different types of feasting foods including cereal breads, gruels, acorn soups or breads, and beer (smaller depressions for malting, coarse grinding or pounding, and larger features for brewing). Given the importance of bedrock mortars in California for making acorn meal especially for feasts (Dixon, 1905) and the Natufian use of acorns, it is surprising that Rosenberg and Nadel did not mention this as a possible use for Natufian mortars, and that Burton et al. (this volume) did not relate their features to the Near Eastern bedrock mortars. Interestingly, bedrock mortars in southern Californian archaeology appear to be largely associated with ritual and feasting sites (Robinson, 2010, pp. 99–100,103). In these cases, bedrock mortars were owned and inherited, and acorn resources were controlled by elites. Thus, it appears that groundstone products were prestige goods or even wealth.

These considerations bring up several interesting questions. To what degree can changes in bedrock features be related to possible changes in food types or preparations (for instance, a shift from the use of acorns to the use of cereals; or a shift from gruel preparations to breads or even brewing)? Another major topic that needs to be more closely examined involves the costs and benefits of using groundstone technologies to process foods. Is it really calorically worthwhile to spend three to five hours per day grinding grains when they could simply be boiled up like rice (see Hayden et al., 2017)? Was acorn meal cost effective to make for daily subsistence or was it a specialty food used primarily for feasts, as Dixon (1905, pp. 316–7,325,327) and Gayton (1945) observed among the Maidu and Yokuts of California?

If the use of early groundstone was predominantly associated with feasting, the initial upsurge in the use of groundstone may reflect the beginning of feasting systems. Similarly, the subsequent shift of groundstone contexts to houses, may reflect a change in social organization from the predominant role of corporate kinship group feasts (with main rituals focused on cemeteries) to more independent nuclear families (with major rituals occurring at their homes for marriages, burials, or house feasts—see Hayden, 2014). On the other hand, this shift and the later disappearance of bedrock mortars in the PPNB may be due to other factors such as increased reliance on grinding, more reliance on cereals and less use of acorns, or different food preparation techniques or technologies such as the use of wooden mortars and pestles. At least in some other areas, such as Göbekli Tepe, bedrock features continued to be strongly associated with ritual contexts in the PPNB and PPNB periods, to the tune of over 150 cubic meters (Hermann and Schmidt, 2012). Some of the larger features (similar to the large pit at Raqefet), including large limestone “barrels” or “troughs” (with capacities up to 160 L and containing oxalate residues—Dietrich et al., 2012, p. 687), may have served in brewing or as cisterns, but there were many smaller cups as well, together with numerous basalt and limestone mortars and grinding stones (Oliver Dietrich, Personal communication). In fact, the large bedrock features with these capacities at Göbekli are remarkably similar to similar bedrock features in Mexico used to ferment maguey hearts into alcoholic beverages (Fig. 1; Bruman, 2000:Fig. 10). Rosh Zin is also very likely to be a ritual site with its monolith housed in a small structure. One wonders if there were not bedrock mortars or features at the PPNB burial site of Kfar HaHoresh as well (Goring-Morris, 2005). Contra Rosenberg and Nadel, the very high labor inputs required to grind grains make me skeptical that any shift to grinding was the result of trying to increase the amount of food from a limited area or to increase the efficiency of food preparation (see Hayden et al., 2017). Although this has been a standard assumption, I would argue that grinding or pounding is *not* “a more suitable and efficient way of producing food.”



**Fig. 1.** Large pits hand hewn out of sandstone bedrock used to ferment pounded maguey hearts to make alcoholic beverages. Recorded by Henry Bruman in 1938 in Nayarit, Mexico (Bruman, 2000:Fig. 10).

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