LOOKING BACK FROM THE WORLD'S END: PALEOLITHIC SETTLEMENT AND MOBILITY AT GIBRALTAR

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Lying at the southwestern margin of the European subcontinent and separated from Africa by the narrow, but deep Straits of Gibraltar, the small Gibraltar peninsula (about 5 square km) marks the terminus of the hunter-gatherer settlement/subsistence systems that stretched across Eurasia during the Upper Pleistocene. Far from the Baltic and Alpine ice caps, and a modern sea level on a coastline with a narrow continental shelf, Gibraltar was a locale of comparative environmental stability during the Upper Pleistocene, in contrast with most of the rest of Eurasia. However, the Gibraltar ecosystem was not totally unaffected by the climatic changes of the last glaciation (see Barton 1988). As documented here, even the moderate environmental changes experiences by the peninsula had a marked effect on human settlement strategies.

BACKGROUND

The Gibraltar peninsula is the location of one of the first Neandertal specimens found (Garrod et al. 1928). However, little Paleolithic research has taken place there in the more than one and a half centuries since that discovery. For the early Upper Pleistocene, systematic archaeological research has been undertaken at only two localities: Devil's Tower Rockshelter, excavated by Dorothy Garrod in 1928, and Gorham's Cave, excavated by John Waechter from 1948 to 1954 (Barton 1988; Garrod et al. 1928; Waechter 1951, 1964; Zeuner 1953). Devil's Tower produced a few hundred artifacts, only a few of which were kept by Garrod, and a small but varied faunal collection (Garrod et al. 1928). On the other hand, the deeply stratified deposits at Gorham's Cave, excavated by John Waechter, produced thousands of artifacts and faunal remains (Waechter 1951, 1964). Detailed sedimentological studies by Zeuner (1953) provided a chronological and paleoenvironmental framework in which to interpret the cultural materials. Nevertheless, studies of neither site did little more than document a sporadic human presence on the peninsula throughout the Upper Pleistocene.

Over the past decade, better explanations of morphological variability in stone tools has led to the reinterpretation of the evidence from Paleolithic sites, such as those at Gibraltar, and better insight into the nature of changing human occupation for European foragers of the Upper Pleistocene. According to these explanatory models, retouched tools primarily represent flakes whose edges have been resharpened in order to extend their use-lives. Hence, variation in the frequency and morphology of retouched tools indicates differences in the extent to which lithic material was conserved through increased rejuvination of flake edges (and through the use of more carefully prepared cores), or expended through more flake production. This is tied, in turn, to aspects of raw material availability, settlement mobility and artifact portability, and the intensity (as much or more than the nature) of activities performed with stone artifacts (see Bamforth 1986; 1991; Barton 1988, 1990; 1991; Dibble 1987, 1995; Kuhn 1993; 1995; Nelson 1991; Rolland 1981; Rolland and Dibble 1990).

Of the two Gibraltar sites mentioned above, this paper focuses primarily on Gorham's Cave because of better quality of the available information—including complete collections, radiocarbon dates, sedimentary studies, and better stratigraphic control. It is unlikely that any of the cave's stratigraphic units and their assemblages represent distinct occupations by discrete forager bands, but rather are palimpsests of repeated occupations of the site (Barton and Clark 1993; Straus 1990). Nevertheless, when examined in the context of regional and local environmental variability, these assemblages indicate changes in the nature of human occupation and, more generally, provide a window on the dynamic character of Paleolithic settlement in southern Andalucía during the Upper Pleistocene.

LITHIC ASSEMBLAGES AND SETTLEMENT

The Gorham Cave assemblages encompass a variable continuum, from curated assemblages dominated by a few retouched pieces to expedient flake production, that extends over most of the Upper Pleistocene. At one extreme of this range of variation are assemblages characterized by low artifact density. Expended cores and flake tools with resharpened (i.e., retouched) edges comprise a significant proportion of the discarded artifacts. These highly curated assemblages suggest very brief occupations by residentially mobile forager bands discarding the residues of portable, maintainable, and generalized tool kits. The transport and use of prepared cores and the reuse of resharpened flakes is a way to reduce risk associated with lack of (or unknown) raw material availability during the course of settlement movement (Bamforth 1986, 1991; Barton 1988, 1990, 1991; Kelly 1988; Kuhn 1993, 1995; Nelson 1991; Parry and Kelly 1987). Given the abundance of raw material at Gorham's Cave, in the form of quartzite beach cobbles, these curated assemblages are most likely primarily comprised of cores and flakes expended enroute to the cave; the brevity of occupation left little discard from the opportunistic use (sensu Nelson 1991) of local quartzite beach cobbles and probably also includes limited residues (primarily a few cores expended in flake manufacture) from "gearing up" for the next residential move.

At the opposite extreme are assemblages characterized by high artifact densities, dominated by non-retouched flakes and minimally prepared cores. Resharpened flakes and prepared cores are rare—both relatively and absolutely. These expedient assemblages are characteristic of longer occupations, characteristic of base camps of logistically organized collectors, in contexts of locally abundant raw material.Such assemblages suggest a reduced need to conserve lithic resources by means of flake rejuvenation or core preparation, and a reduced need for portable and functionally generalized lithic tools. (*ibid*.).

This interpretation of the Gorham's Cave assemblages predicts a negative relationship between artifact density and retouched pieces. That is, shorter occupations and higher residential mobility resulted in the discard of fewer artifacts and more heavily maintained artifacts, whereas longer occupations and more logistical settlement produced assemblages of more artifacts but fewer rejuvenated tools. Figure 1 compares absolute artifact density with the relative frequency of retouched pieces for the Gorham's Cave assemblages. The very strong negative relationship ($r = -0.92$) matches the expectations outlined above. Highly curated assemblages occupy the upper left part of the graph. These include the earliest Middle Paleolithic occupations of the Cave, strata Q and R, and the earliest Upper Paleolithic units, E and F. Towards the lower right, the most expedient assemblage derives from the final Middle Paleolithic layer G.

Figure 2 shows variability over time in the Gorham's Cave assemblages. Absolute artifact density (in pieces per cubic meter of excavated sediment), and relative frequencies of retouched pieces and prepared (i.e., levallois/discoidal) cores are plotted against time. The differences between the highly curated assemblages of the early Middle Paleolithic (Q-U) and early Upper Paleolithic (E-F), and the expedient assemblage of the final Middle Paleolithic (G) are dramatically apparent.

As shown by Figures 1 and 2, the remaining assemblages display characteristics intermediate between those curated and expedient assemblages discussed above. These include materials from Middle Paleolithic layers P through K (and possible H) and from Upper Paleolithic layers B through D. They exhibit absolute artifact densities that, while variable, are generally intermediate between assemblages from layer G and from the early Middle and early Upper Paleolithic depositional units. While retouched artifact densities are low, as in the expedient assemblage from layer G, prepared core frequencies are more in line with assemblages interpreted as curated. The variability in absolute artifact density seen in assemblages from Middle Paleolithic units P-K may well be due to variation in sedimentation rate in the cave (see Barton and Clark 1993), given the stabile relative frequencies of cores and retouched artifacts in these assemblages.

The interpretation proposed here is that these assemblages represent palimpsests of brief, regular occupations by task groups from base camps at other localities. Prepared cores were transported to and discarded at the site, suggesting a need for portability and risk reduction associated with the traverse of some distance. On the other hand, the higher quantity of discard indicates longer occupations (though this is possibly an artifact of temporal compression from reduced sedimentation rates) and less need to curate used flakes. This, in turn, suggests that the groups visited the site regularly and were aware of the local availability of quartzite nodules—which were used and discarded in activities at the site. Following Nelson's (1991) terminology, curated assemblages (characterized by transportability and versatility) were used enroute to the cave, the residue being discarded primarily in the form of exhausted prepared cores, while local quartzite cobbles were used expediently, producing a residue of minimally used flakes and a few cores.

MOBILITY STRATEGIES AND UPPER PLEISTOCENE ENVIRONMENTS

The variability in lithic assemblages and associated settlement pattern inferred here, can be examined in the context Upper Pleistocene chronology and paleoenvironmental change (see Barton 1988). At the beginning of the Upper Pleistocene, the settlement system of foragers in the vicinity of the Gibraltar peninsula is characterized by residential mobility. Gorham's Cave was briefly visited in the course of such residential moves. This residence and economic pattern is associated with the mild climatic conditions of oxygen isotope stages 5e through 5c (layers U through R and possibly Q). Beginning in the cooler stage 5b (layers P-K), settlement seems to have shifted to more of a logistical pattern and Gorham's Cave was visited on forays from base camps located elsewhere. Such a logistical settlement system is more strongly evident during the stage 4 occupation, the initial cold interval of the pleniglacial. An interval of limited occupation (layer H) is followed by the intensive occupation of layer G that seems to represent use of the cave as a base camp for logistically organized collectors.

During somewhat more temperate, early pleniglacial conditions of isotope stage 3 (layers E and F), there seems to be a return to a residential mobility pattern by the Upper Paleolithic inhabitants. The later Upper Paleolithic occupations of the last glacial maximum (isotope stage 2; layers B and D), suggest a more logistic strategy. However, as in the late stage 5 Middle Paleolithic occupations, the cave was visited during forays from base camps located elsewhere.

On the basis of the long pollen core from Padul (Barton 1988:9-11; Florschütz, et al. 1971), south of Granada, isotope stages 5e, 5c, 5a, and 3 represent the least extreme environments of the Upper Pleistocene in the southern Iberian peninsula. At Gorham's Cave, they are associated with a pattern of residential mobility for both the Middle and Upper Paleolithic. Conversely, stages 5b, 4, and 2 represent cold intervals accompanied by marked changes in vegetation patterns. Assemblages from Gorham's Cave suggest more logistic settlement pattern for foragers during these climatic extremes.

Analogous, though not identical, variability in Upper Pleistocene settlement has been recognized in other parts of the Mediterranean basin, including eastern Spain (Barton 1988, 1991), Italy (Kuhn 1993), and Israel (Lieberman 1993; Marks and Freidel 1977). Mobility differences along the residential-logistical continuum, initially proposed by Binford, seem in part related to the abundance and distribution of primary subsistence resources (Binford 1979, 1980). Residential mobility is seen as an adaptation to relatively evenly distributed and/or scarcer resources. The longer-term occupations associated with logistic base camps cannot be supported under conditions of scarce resources, and even distribution favors moves of the entire social unit, rather than forays by subsets to bring back specific resources. Logistical mobility, on the other hand, often appears as an adaptation to resources with a more discontinuous (i.e., 'patchy') distribution but are sufficiently abundant locally to support extended stays in logistic base camps.

Unfortunately, there are not sufficiently detailed paleoenvironmental data to test this association directly in the Gibraltar peninsula. However, the altitudinal decline and latitudinal compression of life zones during the coldest intervals of the Upper Pleistocene likely increased biodiversity at lower elevations of the southern Mediterranean zone of Europe—for which Gibraltar is the most extreme case (see Badal, this volume; Cortéz et al. 1996:36-78). An interesting corollary is that the Gibraltar (and southern Andalucian) landscape may have supported denser populations during climatic extremes than at other times. This has been suggested for the Iberian peninsula in general during the late Upper Pleistocene on the basis of other lines of evidence (Barton, Clark, and Cohen 1994; Jochim 1987).

DISCUSSION

While this study is suggestive in many respects, additional data are needed to support the interpretations presented. A study of the debitage is clearly needed. Analyses focusing solely on the most exhausted, resharpened flakes (that is, retouched "tools") are not sufficient for understanding prehistoric lithic technology systems. The interpretations suggested here are based on a study of entire assemblages, and would be clarified by further study of variability in size, cortex, and the frequency of different raw materials among all stone artifacts at the site.

Related to this, the identification of raw material sources other than the beach cobbles at Gorham's Cave would permit reconstructions of the extent of paleolithic forager territories and aid in understanding mobility patterns (Féblot-Augustins 1993). Waechter (1964) suggests that, while there is poor quality flint on the Gibraltar peninsula, most of the flint used at Gorham's Cave comes from other sources. This fits well with the evidence presented here, but the identification of the sources would be helpful.

Equally valuable would be more detailed study of the Gibraltar Paleolithic fauna than is presented in either the Devil's Tower or Gorham's Cave reports. On the basis of recent work by Paul Goldberg (Goldberg and McPhail 1991) and comparable investigations at other sites, it is clear that non-human carnivores (especially hyena) played a significant role in the accumulation of faunal remains at Gorham's Cave. Analyses such as those of Villaverde (et al., in press), Pérez (in preparation), and others for Cova Negra and the Cueva de Nerja are needed in order to differentiate human and carnivore derived components in the faunal assemblage. Only after such studies have been done will it be possible to identify variability in patterns of faunal exploitation by the inhabitants of the cave.

As suggested above, the forager occupations at Gorham's Cave, and in the Gibraltar peninsula as a whole, were most likely only a small part of a much larger settlement system. Better information about the archaeological and paleoenvironmental context of the Gibraltar assemblages at a regional scale are essential for developing an accurate model of such systems. An understanding of cultural and environmental variability in both space and time is needed to understand the selective pressures which affected the lithic assemblages deposited at Gorham's Cave.

Finally, a better chronological framework, is needed for the site, for which only two radiocarbon dates are available. Given the existence at Gorham's Cave of stalagmitic layers, burned flint artifacts, animal dentition, and organic matter a variety of dating methods could be employed—including Uranium series dating, TL/ESR dates, and additional ^{14}C assessments (including AMS dating) are all possible. These would serve to better articulate the deposits and their assemblages with regional and local environmental changes. They would also help to calibrate variations in sedimentation rate, that can affect artifact density in deposits and the chance of reuse of artifacts by the cave's occupants (Barton and Clark 1993).

Recently (beginning in 1995), new excavations at Gorham's Cave have been undertaken by a team from Oxford Brooks University. Hopefully, this new work will begin to resolve some of the questions posed above. Nevertheless, even sites as rich as Gorham's Cave are but tiny windows permitting restricted views of the prehistoric landscape. As this study hopefully shows, a better understanding of the processes that result in archaeological sites and their assemblages, and better interpretive models to link archaeological data and human behavior are equally—and perhaps more—important than new excavations for reconstructing and explaining paleolithic culture.

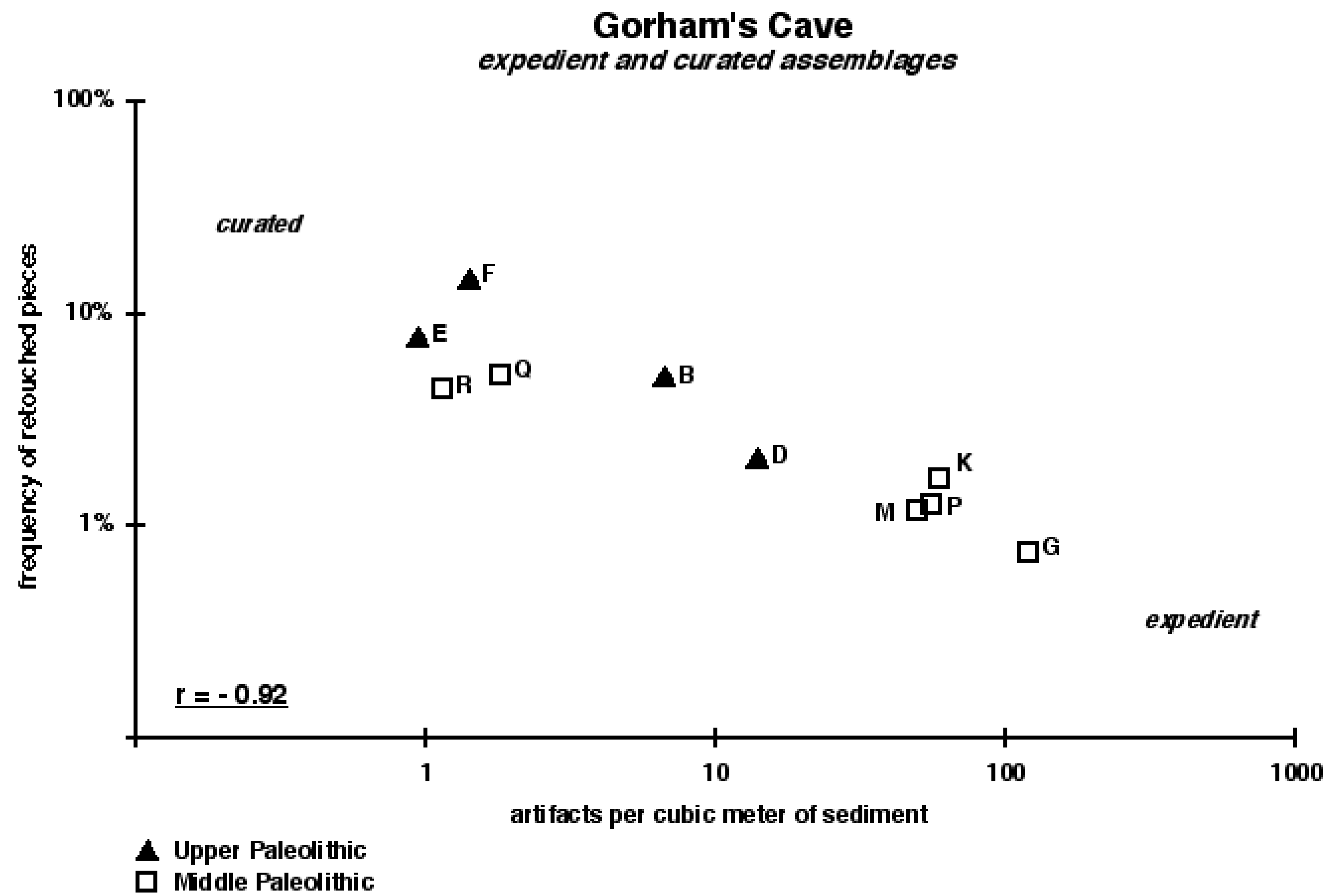

Figure 1- Total artifact density vs. relative frequency of retouched pieces for each level at Gorham's Cave, Gibraltar. Artifact density is measured in pieces per cubic meter of excavated sediment to control for variation in the area excavated in each level. A log10 scale is used. Expedient assemblages are found toward the lower-right part of the graph, curated assemblages toward the upper-left.

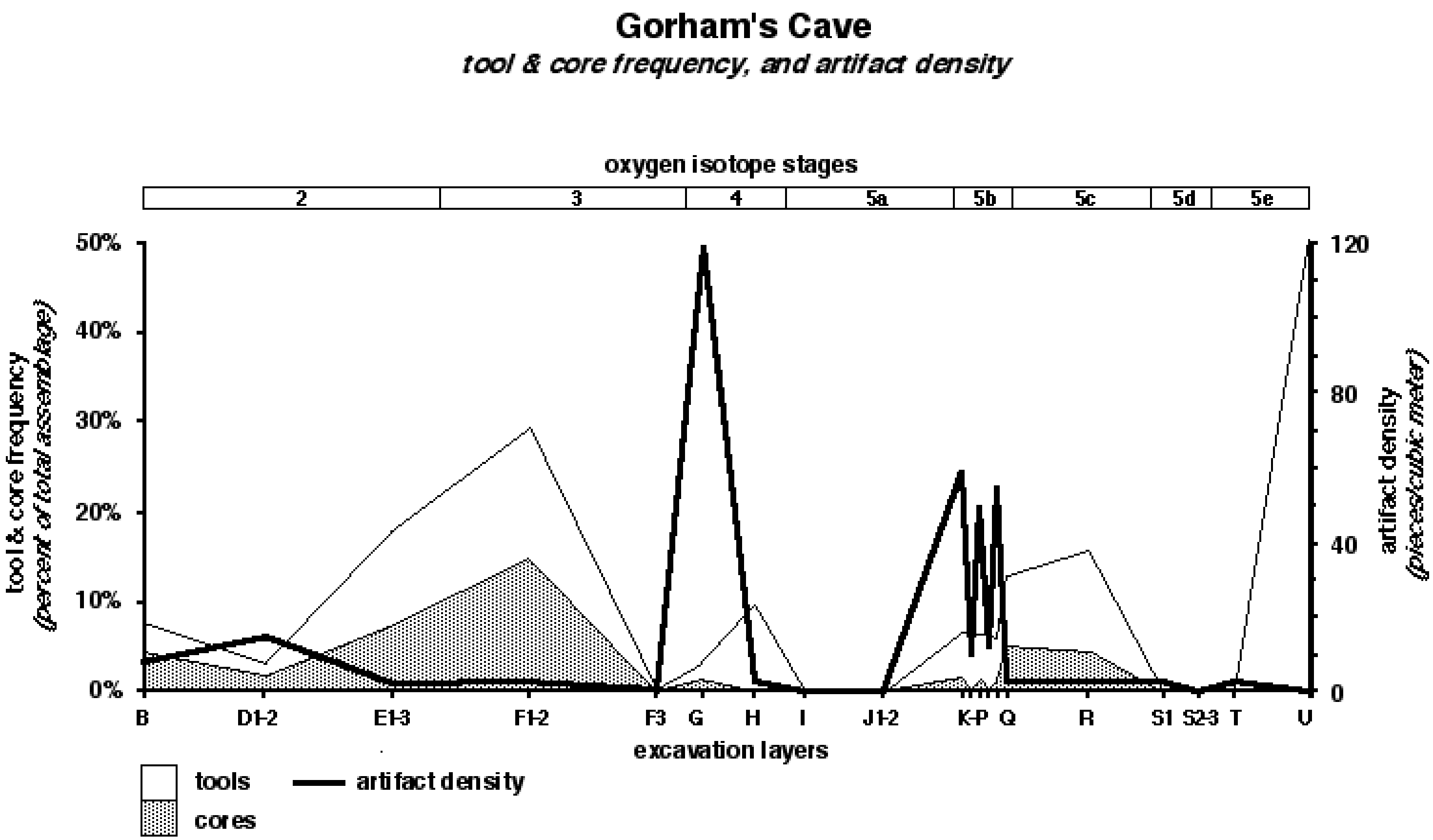

Figure 2- Variation in the relative frequencies of cores and retouched pieces within assemblages, and the total artifact density for Gorham's Cave, Gibraltar, during the Upper Pleistocene. The distance between levels has been roughly scaled to correspond with the duration of associated ^{18}O stages (indicated at the top of the graph). Correlations between excavation layers and ^{18}O chronology are based on Barton (1988).

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