Donald O. Henry
Department of Anthropology
University of Tulsa
Tulsa, Oklahoma 74104
U.S.A.

Harold J. Hietala
Department of Anthropology
Southern Methodist University
Dallas, Texas 75275
U.S.A.

Donald O. Henry and Harold J. Hietala

Spatial Patterns and Middle Paleolithic Behavioral Organization within the Ṭor Faraj Rockshelter

Introduction

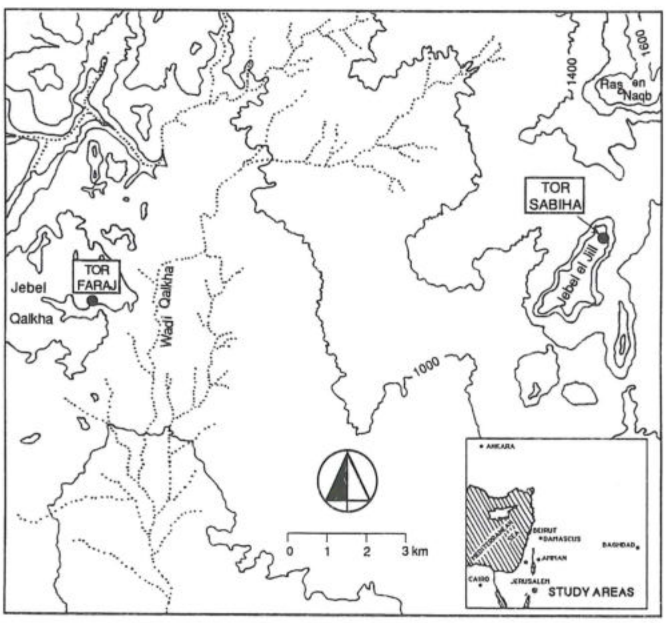
Previous results of field research at the Late Levantine Mousterian Rockshelter sites of Ṭor Faraj and Ṭor Ṣabīḥa in the mountains of southern Jordan have yielded evidence indicating the sites were inhabited during an annual cycle of transhumance (Henry 1994, 1995; FIG.1). Intersite data comparisons suggest that the occupants of these Middle Paleolithic sites adjusted their summer and winter behavior through differential opportunistic and logistical provisioning strategies. The summer camps, such as Ṭor Ṣabīḥa were at higher elevations, were associated with ephemeral occupations, and were provisioned *opportunistically* from resources within their catchment areas. In strong contrast, long-term winter camp occupations, such as Ṭor Faraj, were at lower elevations and were *logistically* maintained through acquisition of critical resources from outside their catchment areas. Thus, not only did the site occupants seasonally vary their adaptive strategies, but, in addition, they were fully capable of anticipating their resource needs. Since planning depth and behavioral flexibility are thought to characterize modern hunter-gatherers, this points to the existence of modern adaptive strategies approximately 70,000 years ago.

Both Ṭor Faraj and Ṭor Ṣabīḥa have amino acid racemization dates, on ostrich eggshell samples, of ca. 69,000 +/- 6,000 bp (Henry and Miller, 1992). The natural settings of the two sites, based on elevation and exposure, points toward differential seasonal occupations. Ṭor Ṣabīḥa is at a comfortable summer elevation of 1,300 m while Ṭor Faraj is significantly lower at 1,000 m. Also, Ṭor Ṣabīḥa has an eastern exposure and, therefore, would have made a poor winter camp while Ṭor Faraj, with its southwestern exposure, provides for a more comfortable winter setting. The results of phytolith analysis of sediment samples collected from Ṭor Faraj are also consistent with a winter occupation of the shelter.

Typologically, the artifacts from both sites resemble *Ṭābūn* B-type assemblages, especially as reflected in the presence of numerous broad based Levallois points. While this is compatible with the dating of other B-type assemblages (e.g., Kebara), the high blade and point frequencies of the Jordanian assemblages are more similar to *Ṭābūn* D-type configurations. This disparity may be tied to inherently higher blade and point representation in arid-zone Levantine Moustrian assemblages regardless of their temporal placement.

The tool-kits of the two sites display roughly similar configurations when classes are compared even though there are slightly higher relative frequencies of burins at Ṭor Faraj with a larger percentage of notches and denticulates at Ṭor Ṣabīḥa. Although all stages of lithic reduction are present at both sites, there seems to have been a greater emphasis on core shaping and blank production at Ṭor Faraj, consistent with occupations of longer duration. In addition, tool maintenance and rejuvenation seems to be more frequent at Ṭor Ṣabīḥa, a likely expression of ephemeral occupations. Detailed attribute studies also suggest longer occupations at Ṭor Faraj, relative to Ṭor Ṣabīḥa (Henry 1995)

In addition, micro-wear studies have identified Levallois points as the most utilized artifact category. Shea's (1991) analysis of a Ṭor Faraj sample suggests that butchery, light-duty woodworking and hunting were inferred activities with medium-resistant materials, such



1. Map of the western end of the Wādī Ḥisma showing the locations of the Levantine Mousterian sites of Ṭor Faraj and Ṭor Ṣabīḥa.

as wood, producing extensive wear. A wide range of functions, dominated by cutting activities but followed by scraping and piercing, were represented. Some hide-working and soft-plant processing were also noted. In contrast, Lee's (1987) comparative study , on Levallois points from both sites, found the wear patterns at Ṭor Ṣabīḥa to be more represented by work on soft materials, such as animal, while Ṭor Faraj, was more represented by woodworking. Cutting activities were more frequent at Ṭor Faraj. Altogether, a more complex picture of activities seems to emerge for Ṭor Faraj; consistent with complex long-term seasonal occupations.

Spatial Patterning

While differences in inferred occupational modes between Ṭor Faraj and Ṭor Ṣabīḥa are based on comparisons of the inventories and contexts of the artifacts recovered from the two sites (Henry 1992, 1995), the transhumancy model should be tested through comparisons of intrasite structure.

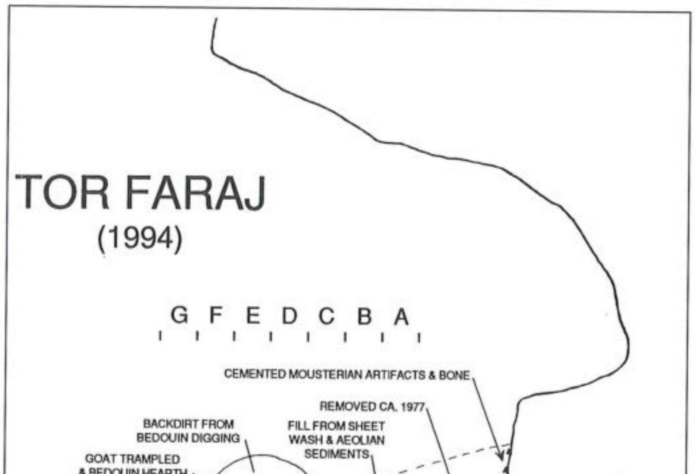
Studies of modern hunter-gatherers have demonstrated that long-term campsites exhibit more complex patterning, with discrete activity areas, resulting from a greater emphasis on the spatial separation or segregation of activities (Binford 1983:191; O'Connell 1987:104). A similar variation in site structure has previously been recognized in Levantine Paleolithic studies. Basecamps, sites with long-term occupations, associated with "radiating" settlement patterns seem to possess "specialized" or segregated activity areas, while ephemeral occupations associated with "circulating" settlement patterns seem to possess activity areas which are "generalized" (Marks and Freidel 1977). Specialized activity areas have been reported for early Levantine Mousterian sites, such as Rosh Ein Mor (Hietala 1977), as well as Late Levantine Mousterian, such as Far'ah II (Gilead and Grigson 1984) and Quneitra (Goren-Inbar 1990). Kebara (Bar-Yosef *et al.* 1992) certainly seems to possess specialized activity areas. The Middle to Upper Paleolithic transition site of Boker Tachtit seems to possess evidence of "specialized" and "generalized" activity areas, although in different levels (Hietala and Marks 1981; Hietala 1984). Interestingly, Kent (1991) has noted that anticipated length of residence is a stronger predictor of site size than is actual camp population. In general, though, the consensus is that long-term sites generally exhibit more complex structural patterns.

If the occupants of Ṭor Faraj organized their behavior in a manner similar to those of modern humans, then Ṭor Faraj would be expected to exhibit a more complex site structure than exhibited by the material remains of the occupants of Ṭor Ṣabīḥa. In fact, Ṭor Ṣabīḥa does show a relatively simple site structure with a lack of features and no evidence for activity segregation (Henry 1995). Thus, Ṭor Faraj is fully expected to exhibit complex site structure with definitive evidence for the spatial segregation of activities. A carefully designed two-year excavation program at Ṭor Faraj was initiated in 1993, in order to address questions about the behavioral organization of it's inhabitants.

Excavation Plans and Rockshelter Deposits

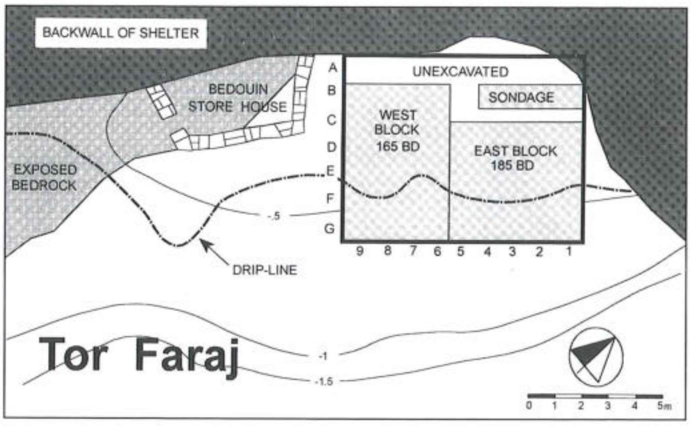
Information retrieved from an initial exploratory sondage in 1983 suggested relatively level-bedded Late Levantine Mousterian deposits over 1.5 m in thickness, suitable for intensive spatial analyses (Henry 1986). The first excavation season called for systematic removal of Bedouin backdirt piles associated with their construction of a stone-walled store house (*"ghurfa"*), the initiation of a large block excavation on the terrace of the rockshelter, and an extension of the 1983-1984 sondage (Henry *et al* . 1996). Sediments, below the Bedouin deposits, accumulated from aeolian silts primarily introduced from the plain forming the western end of the Wādī Ḥisma. Sand and sandstone rubble were also introduced from exfoliation of the shelter's ceiling and backwall, sometimes accompanied by massive roof-collapse of the shelter's brow. Major differences in the color and texture of the sandstone beds served as an excellent vehicle for tracing the depositional history of the shelter's formation.

The interior shelter's deposit is primarily composed of a thick 75 cm stratum (Layer C) consisting of a fine reddish yellow silty sand. This unit includes numerous hearths and ash lenses (FIG. 2). It is underlain by a more compact light red silty sand with a moderate amount of sandstone detritus (Layer D). This layer has a heavy component of rooffall in the southwestern corner of the block excavation. Artifacts associated with the layer D sediments frequently evidenced post depositional surface modification. The depositional history of the deposits is



2. Schematic plan of the stratrigraphy for the Ṭor Faraj deposits.

detailed in Henry *et al.* (1996). Preliminary results from the first season (summarized below) suggested an expansion of the of the initial block excavation to include the area between the block and the backwall of the rockshelter (FIG. 3). This was undertaken in the second season.



3.Topographic map and excavation plan of Ṭor Faraj.

CURRENT RESEARCH

Data Collection and Analytical Methodologies

Spatial analyses of artifacts and related evidence, from any rockshelter, requires an accurate and precise collection of all information in three dimensions. To accomplish this by traditional archaeological field methods requires collection in thin, as well as small, excavation units and mapping in place, by hand, for all artifacts, features, and ancillary materials. This is not only exceptionally time consuming but, in general, does not have sufficient built-in redundancy, or self-referential capacity, for correction if recording errors occur at the site or in the field laboratory. Fortunately, modern technology, with the development of the total station, assists in this regard. All artifacts, exceeding 30 mm in maximum diameter, bone, ostrich eggshell fragments, hammerstones, and features were plotted in a referential three-dimensional coordinate system using a Set-6 Sokkia laser theodolyte with an electronic data collection unit (SDR). It was easy, using a benchmark datum established in the backwall of the shelter, to reestablish an identical three-dimensional coordinate system in the second season. Artifact type, unit and quadrant, layer and specimen number (labeled on the artifact in the field) were also recorded on the SDR, in addition to the three dimensional coordinate pin-pointing the location of the artifact. In addition, any unusual field observations were recorded into the SDR, as notes. Screening the excavated material through 2 mm sieves allowed the recovery of artifacts smaller than 30 mm in maximum dimension which were identified by one quarter meter units within 5 cm levels. All data recorded by the laser theodolyte were, in addition, sketched onto unit record forms, giving a backup, in case damage occurred to the electronic equipment. Since individual artifacts were numbered sequentially in each meter square unit, an artifact or sequence of artifacts that either lost their numbers through over-zealous washing in the laboratory or labeled incorrectly in the field had both the computerized data and the sketch forms to unravel the error(s). In addition, features and rock accumulations were also sketched onto the unit record forms. This not only gave tight control over the feature information, but allowed for the later develoment of visual templates incorporating other artifactual and contextual information.

The data recorded by the laser theodolyte into the SDR were downloaded daily to a PC; two PC 's were available although only one was ever required. These data were first checked for internal integrity. For example, any artifact within a given unit, specified by a known given 5 cm level, is constrained by definition to have only a specific set of possibilities for recorded three dimensional coordinates. Any discrepancy was immediately noted with subsequent rectification of the recording error. In a few cases the operator of the theodolyte made a small error in "setting up", but these too were capable of correction. The data on the computer were then cross-checked with the artifacts in the laboratory to ensure that all pin-pointed artifacts could be "tracked" when they were later processed or analyzed by other members of the scientific team. The data were then downloaded, in "ascii" format, as files for input into other quantitative software packages, such as *Surfer* and *SPSS*. This procedure allows for a rapid check of provenience data against the sketch plans and they are then ready for spatial descriptions. Hard copies of the spatial data, in site plan, can be produced to assist in tracking overall field impressions and in ensuring effectiveness of the excavations as they are proceeding. This is particularly useful in the complex three-dimensional environment of a rockshelter excavation.

As a final step, in the oftentimes rarefied environment of computer systems terminology, the data are incorporated into a data management system which allows the development of a powerful "relational" data base. Specifically, the initial SDR spatial data, are meshed with over 50 other observations made on each artifact specimen. These observations not only involve conventional typological and technological measurements, but raw material varieties, refit constellations, blood residue analyses, wear pattern analyses, etc. These all then form part of one data base that becomes relational through the tracking of artifacts by sequence number, within unit, and within level. The successor to *D-base IV*, in the computer field, is the Borland software product known as *Paradox* (there is a windows based system). This is the package used in the construction of the Ṭor Faraj "relational" data base. When data are entered into *Paradox*, it can be queried to retrieve almost any imaginable subset of the data. For example, it might be desirable to construct the distribution of all hafted Levallois points. Or the distribution of all Levallois points with evidence of woodworking. Or, it might simply be of interest to document wear pattern variability for all utilized artifacts within two meters of a hearth, or the backwall of the shelter. The variations are endless but the relational data base system allows these kinds of queries to be posed. Of course, any spatial data base can be related to contextual information gained from standard stratigraphic sampling of sediments for micromorphologic, palynologic and phytolith studies.

Sampling for phytolith analysis were collected from hearths and ash lenses and samples for phosphorous analysis were collected from the centers of one meter square units across the excavation block (Henry *et al.* 1996). In addition, a high proportion of artifacts from one floor were systematically analyzed for wear patterns.

Paleosurfaces

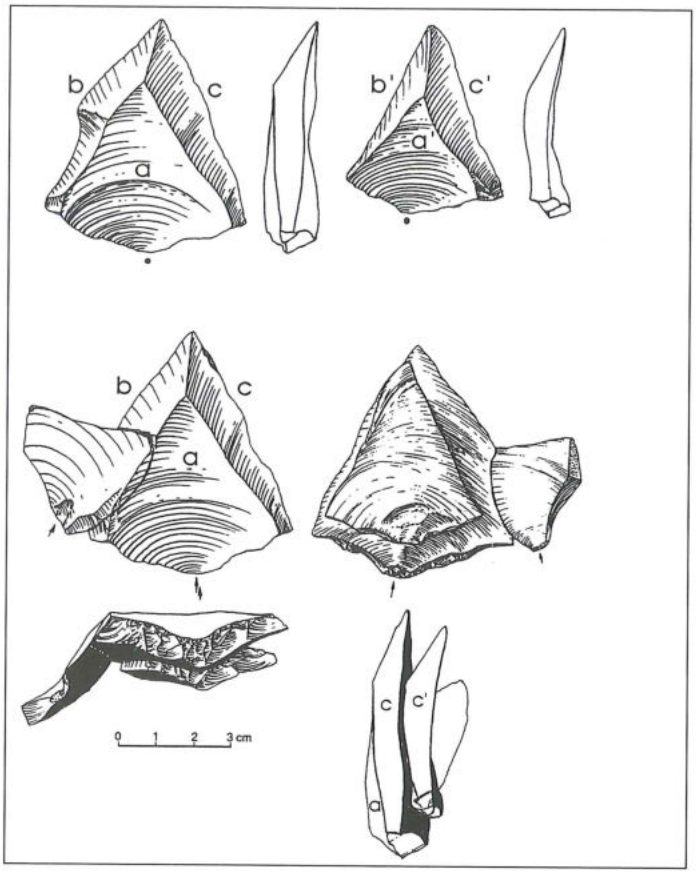
Meaningful interpretations of spatial data are only possible if prehistoric living floors (paleosurfaces), associated with material culture, can be realistically identified. Initial efforts toward identifying living floors involved the tracing of sedimentary bedding planes, assessing the degree of post-depositional disturbance, and examining the associated spatial distributions of artifacts, artifact 'refits', artifactual wear patterns and hearths (covered in the next section). The sedimentary information from the first season have been examined in detail (Henry *et al.* 1996) where the bedding planes are realistically concluded to be near-level.

Little post-depositional disturbance follows from several lines of evidence. The presence of shallow hearths and thin ash lenses suggests rapid burial. Many thermally fractured artifacts were found in place, with their pieces still articulated. Artifact refits within the Mousterian deposits were generally close and separated by no more than 10 cm vertically. Refits refer to artifacts that are fitted together and describe, minimally, a part of a core reduction sequence. One interesting refit sequence from the first field season shows the refitting of two Levallois points and a lateral flake (FIG. 4). The sequence assists in tracing the initial steps of core shaping: A central plane is first formed followed by the removal of lateral convergent elements to form a Y-arrete pattern that, in turn, guided the removal of the Levallois point. It is important to note here that the core was significantly reduced in volume to produce the second Levallois point. One reconstructed core, from the second field season, involved 9 pieces. For this core, 7 of the 9 pieces were in a single 50 cm by 50 cm unit, quadrant D5a, with a maximum vertical separation of 10 cm.

Finally, outside of artifacts from the D layer, the preservation of the flint surfaces is exceptional, more than sufficient for wear pattern studies (Laura Longo, pers. comm.). This excellent preservation suggests rapid burial of the artifactual material.

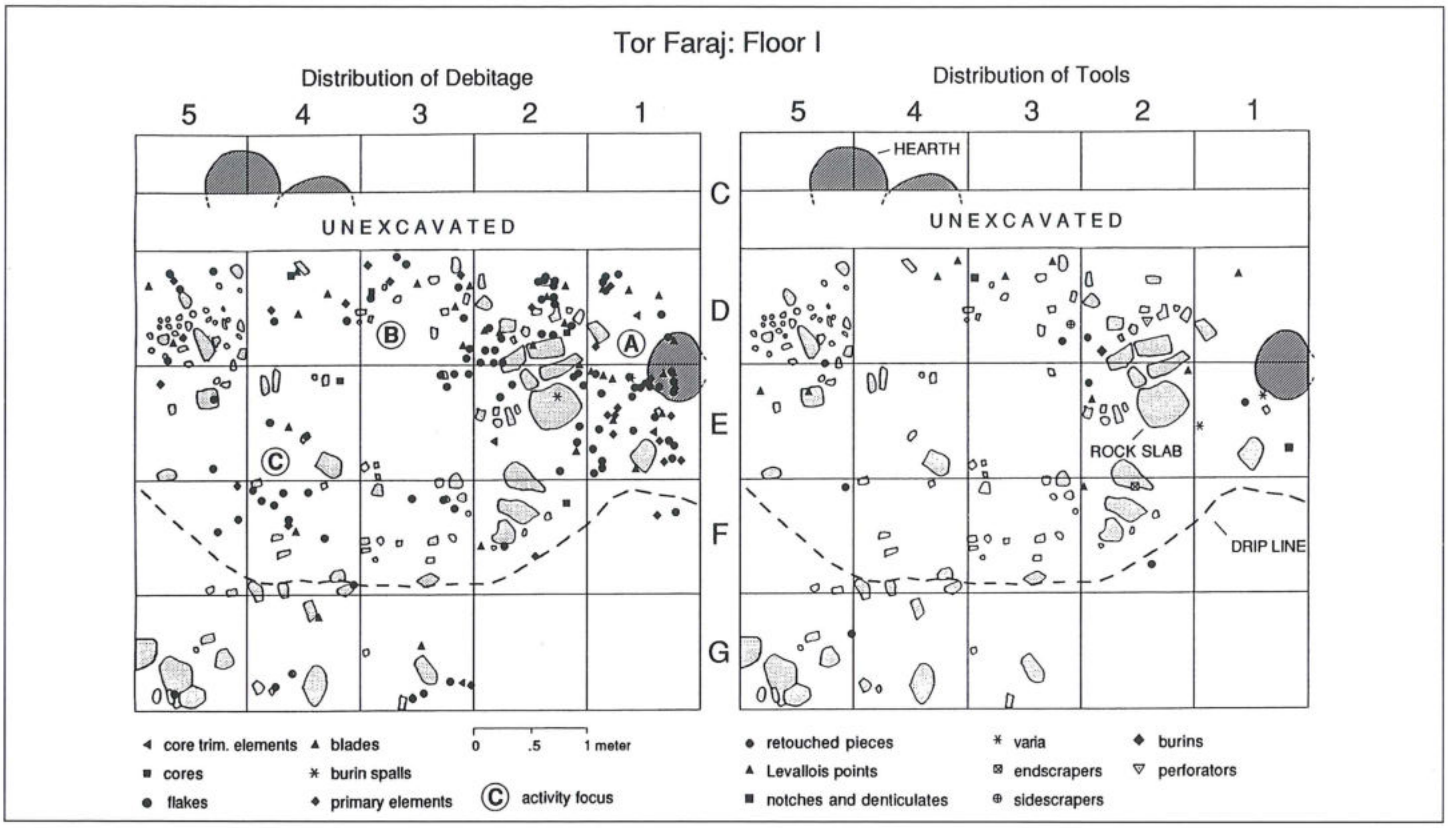
Intrasite Spatial Patterns

The distributions of artifacts and hearths suggest the existence of, at least, two living floors, tentatively designated as Floor I (160-170 cm below datum) and Floor II (180-185 cm below datum). Hearths are level bedded (FIG. 2), and exist in two horizons within Layer C. These two horizons are, not surprisingly, synonymous with the initial definitions of Floors I and II. In addition, the hearths are remarkably consistent in their horizontal positioning (FIGS. 5-8). The hearths are generally positioned about 2-3 m from the backwall of the shelter. This is a common pattern that is known for occupants of sheltered sites (Thomas 1983: 432-433); Binford 1983:160-163). This pattern has been interpreted as providing warmth between the hearth line and the backwall for specific activities, including sleep. The location of the hearths at Ṭor Faraj are predominantly consistent with a winter occupation since they are mostly adjacent to the NE backwall which absorbs the greatest intensity of sunlight in the afternoon. During the winter months this would be a favorable situation since the backwall would continue to radiate heat in the evening. In addition, the distances between hearths is fairly regular, suggesting single, rather than repeated occupations. This has been noted elsewhere in the Levant (Hietala 1984). But, there must be artifactual corollaries for these presumed interpretations.

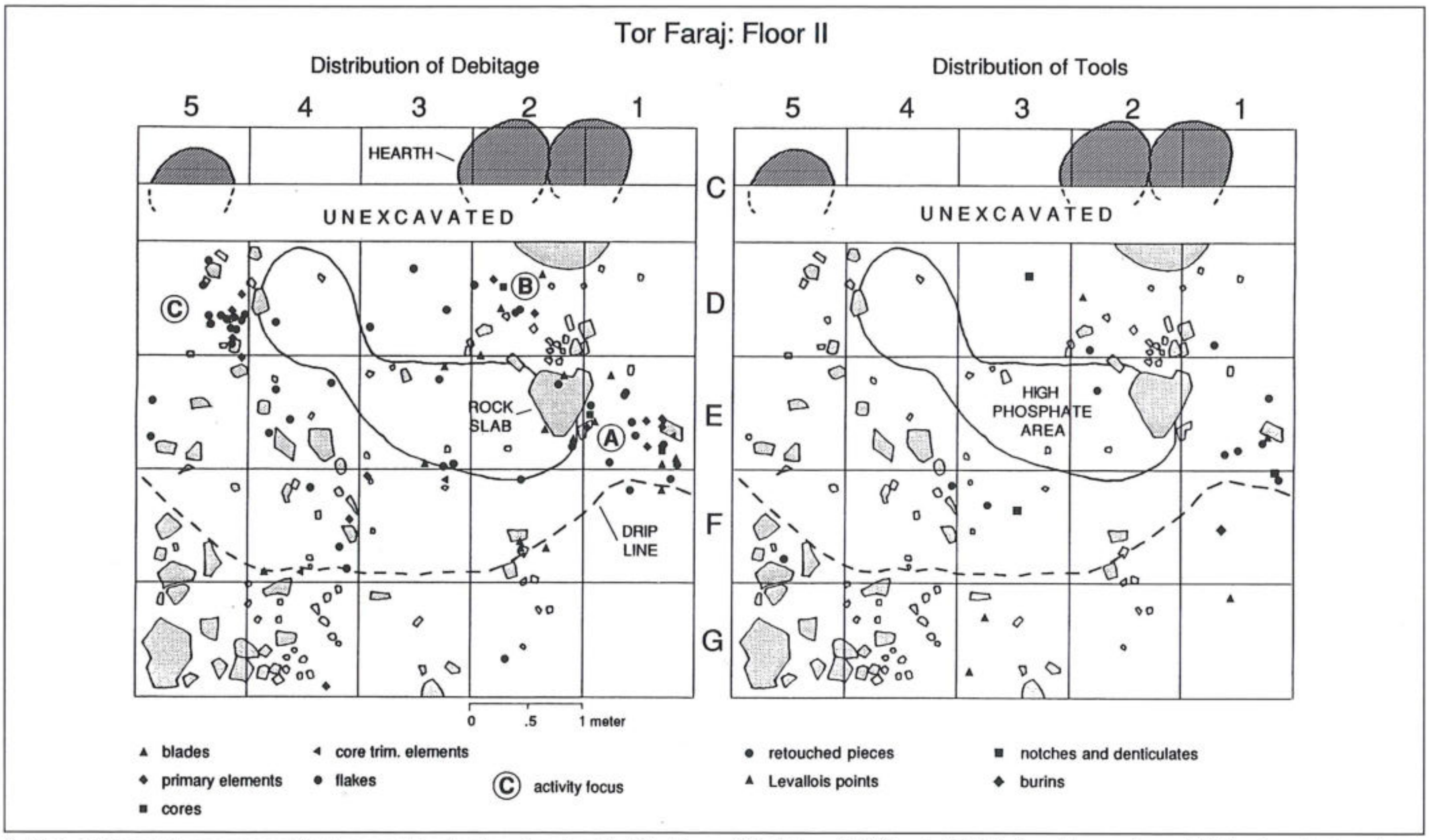


4. Illustration of refitted Levallois points from Ṭor Faraj. Note the ca. 40% reduction in the size of the second point.

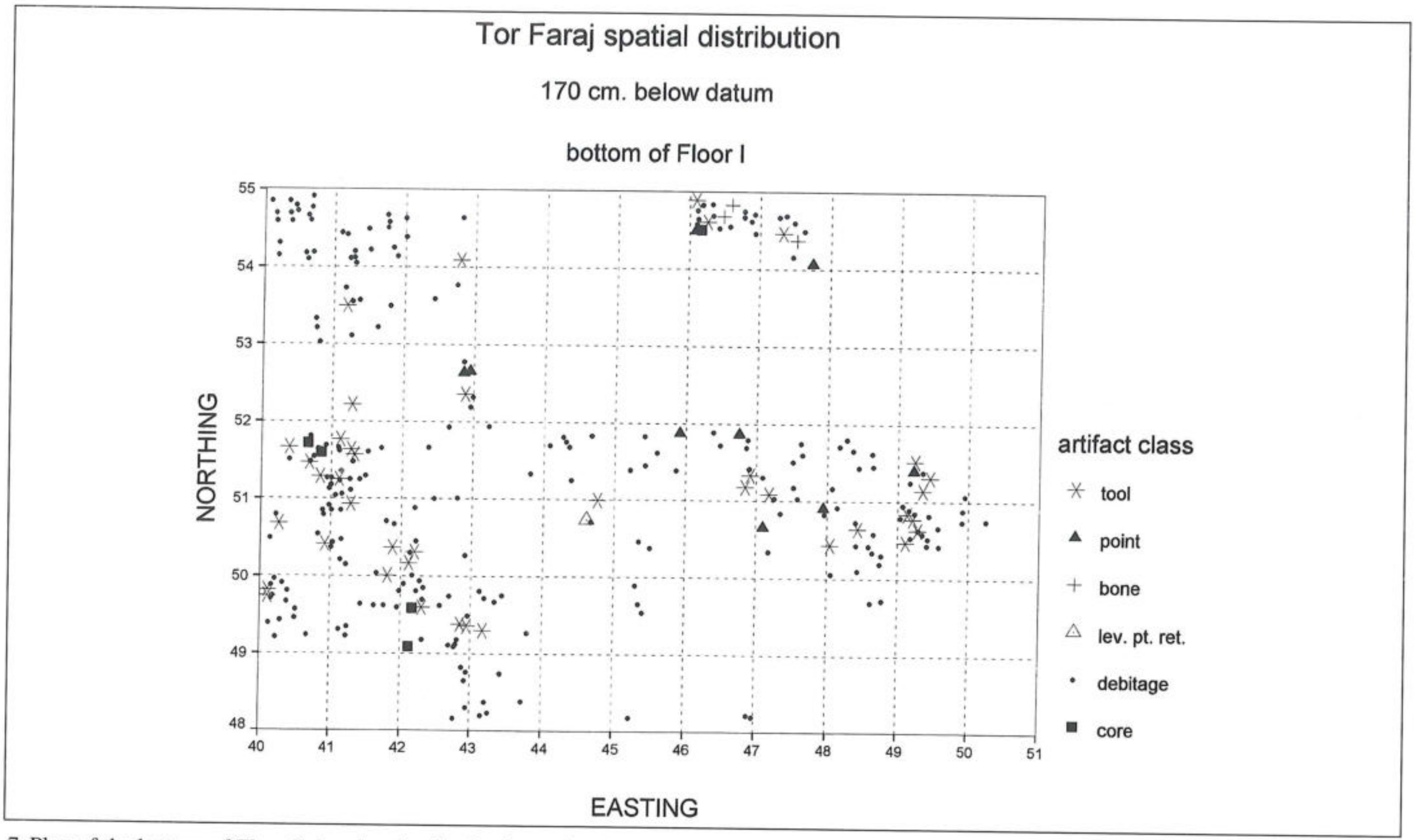
Floor I (FIG. 5) and Floor II (FIG. 6) show similar, but presumably distinct, patterns in the eastern block. The



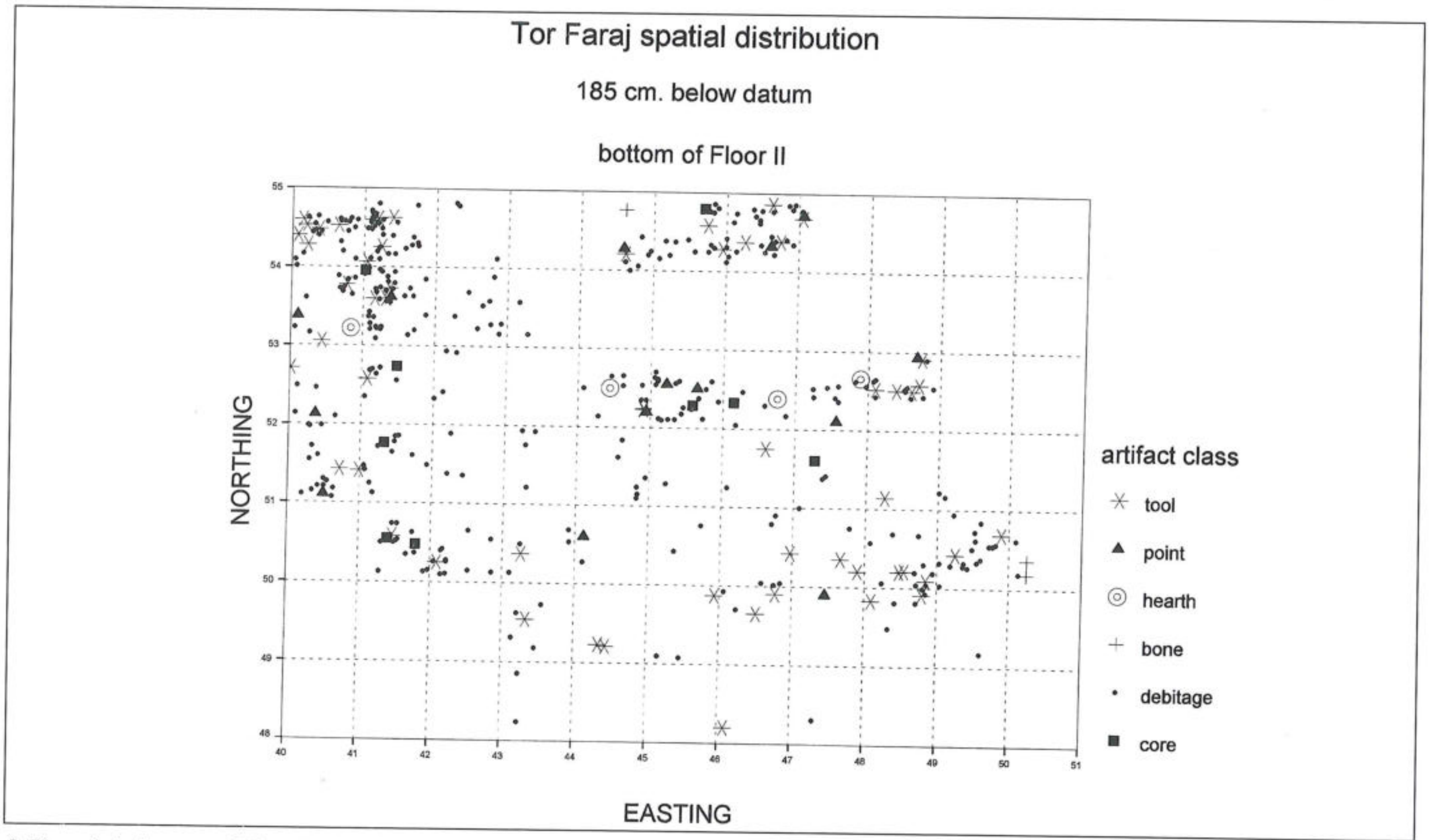
5. Plan of Floor I, as exposed in the east block, showing the distributions of debitage (left) tools (right), hearths and rocks. Note the three artifact clusters (A,B,C) and the marked decline in artifact density beyond the drip line.



6. Plan of Floor II, as exposed in the east block, showing the distributions of debitage (left) tools (right), hearths, rocks and high phosphate values. Note the three artifact clusters (A,B,C) and the marked decline in artifact density beyond the drip line.



7. Plan of the bottom of Floor I showing the distributions of artifacts by class. Note the multiple clusters and the segregation of cores and points.



8. Plan of the bottom of Floor II showing the distributions of artifacts by class. Note the regular spacing of the hearths and the occurrence of artifact clusters associated with and without hearths.

principal patterns are as follows: (1) Both floors show a much higher density of artifacts behind the dripline of the shelter and (2) both floors show specific concentrations (A and B) of artifacts tethered to hearths and rock slabs. In Floor I , cluster A is positioned between a firepit and a cluster of tools, adjoined by sandstone slabs. Clusters A and B contain significantly higher frequencies of cores and primary elements than found in Cluster C. This implies that initial lithic processing activities were emphasized to a greater extent in the areas of Clusters A and B than C.

Floor II shows similar patterning, although the position of Cluster C is located closer to the backwall of the shelter, centered in Unit D5. Another source of patterning for Floor II is the distribution of phosphate concentrations identified from sediment samples. As an indicator of organic remains, the high phosphate values recorded for the area resting between the three artifact concentrations indicate that it was used for butchery, food preparation, or refuse (Henry *et al.* 1996).

Conclusions and Summary

The patterns observed for hearths, artifact distributions, and phosphorus concentrations indicate a site structure at Ṭor Faraj that differs little from the structures observed for modern foragers inhabiting rockshelters. The spacing of the hearths relative to other hearths and to the natural features of the shelter is statistically indistinguishable from that recorded for modern foragers.

Artifact distributions reveal concentrations indicative of intensive activity areas around hearths resembling the drop zones recognized for modern foragers. Beyond the dripline artifacts as a whole decline in frequency, but fine residue is virtually absent. This again resembles that aspect of the site structure of modern foragers inhabiting shelters as reflected in a drop zone inside the dripline and a toss zone outside the shelter.

The site structure of the Ṭor Faraj living floors, as revealed by the contextual relationships of artifacts, hearths, and phosphate concentrations, is both complex and diverse.

This is consistent with the structure of a long-term encampment of modern foragers, but contrasts with the redundant, homogeneous structure thought to be associated with the occupations of archaic foragers and "protocultural" behaviors.

Acknowledgements

We would like to give our great thanks to Dr Pierre Bikai and the staff of the American Center of Oriental Research (ACOR) along with Dr Safwan Tell, then Director–General of the Department of Antiquities and his staff for their assistance.

Grants from the National Science Foundation (DBS-9223855) and the office of Research, University of Tulsa, provided support for this study.

Bibliography

Bar-Yosef, O., Vandermeersch, B., Arensburg, B., Belfer-Cohen, A., Goldberg, P,. Laville, H., Meignen, L,. Rak,Y., Speth, J., Tchernov, E., Tillier, A-M. and Weiner, S. 1992. The excavations in Kebara Cave, Mt. Carmel. *Current Anthropology* 33:497-550.

Binford, L. 1983. *In Pursuit of the Past*. New York: Thames and Hudson, Inc.

Gilead, I. and Grigson, C. 1984. Far'ah II: A Middle Palaeolithic open-air site in the Northern Negev, Israel. *PPS* 50: 71-97.

Goren-Inbar, N. 1990. *Quneitra: A Mousterian Site on the Golan Heights*. Jerusalem: *Qedem* 31. Hebrew University.

Henry, D.O. 1986. Prehistory and Paleoenvironments of Jordan: An Overview. *Paléorient* 12:5-26.

___1992. Transhumance During the Late Levantine Mousterian. Pp.143-162 in H. Dibble and P. Mellars (eds), *The Middle Paleolithic: Adaptation, Behavior, and Variability*. Philadelphia: The University Museum, University of Pennsylvania, University Museum Monograph 72.

___1994. Prehistoric cultural ecology in southern Jordan. *Science* 265:336-341.

___1995. *Prehistoric Cultural Ecology and Evolution: Insights from Southern Jordan*. New York: Plenum Publishing Corporation.

Henry, D.O., Stephen A. Hall, Harold J. Hietala, Yuri E. Demidenko, Vitalie I. Usik, Arlene M. Rosen and P. A. Thomas. 1996. Middle Paleolithic Behavioral Organization: 1993 Excavation of Tor Faraj, Southern Jordan. *JFA* 23:1-23.

Henry, D.O. and Miller, G. 1992. The Implications of Amino Acid Racemization Dates of Levantine Mousterian Deposits in Southern Jordan. *Paléorient* 18:45-52.

Hietala, H. J. 1984. Boker Tachtit: Intralevel and Interlevel Spatial Analyses. Pp. 217-281 in A. E. Marks (ed.), *Prehistory and Paleoenvironments in the Central Negev, Israel*, Vol. III. Dallas: Department of Anthropology, Southern Methodist University.

Hietala, H. and Marks, A. 1981. Changes in Spatial Organization at the Middle to Upper Paleolithic Transitional Site of Boker Tachtit, Central Negev, Israel. Pp. 305-318 in J. Cauvin and P. Sanlaville (eds), *Prehistoire du Levant*. Paris: CNRS.

Hietala, H. and Stephens, D. 1977. Spatial Analysis: Multiple Procedures in Pattern Recognition Studies. *AA* 42:539-559.

Kent, S. 1991. The Relationship Between Mobility Strategies and Site Structure. Pp.33-60 in E. Kroll and T. Price, (eds), *The Interpretation of Archaeological Spatial Patterning*. New York: Plenum Press.

Lee, C. 1987. *A Functional Analysis of Levallois Points from two Middle Paleolithic Sites in South Jordan: Results and Interpretations*. M.A. Thesis, University of Tulsa, Tulsa, Oklahoma.

Marks, A. and Freidel, D. 1977. Prehistoric Settlement

Patterns in the Avdat/Aqev Area. Pp.131-158 in A. E. Marks (ed.), *Prehistory and Paleoenvironments in the Central Negev, Israel*, Vol. II. Dallas: Department of Anthropology, Southern Methodist University.

O'Connell, J. F. 1987. Alyawara Site Structure and its Archaeological Implications. *AA*. 52:74-108.

Shea, J. 1991. *The Behavioral Significance of Levantine Mousterian Industrial Variability.* PhD dissertation, Harvard University, Cambridge.

Thomas, D. H. 1983. *The Archaeology of Monitor Valley: 2 Gatecliff Shelter*. New York: Anthropological Papers of the American Museum of Natural History. Vol. 59.