Journal of Anthropological Archaeology 38 (2015) 8–16

Contents lists available at ScienceDirect

Journal of Anthropological Archaeology

journal homepage: www.elsevier.com/locate/jaa

Artifact densities and assemblage formation: Evidence from Tabun Cave

Steven L. Kuhn *, Amy E. Clark

School of Anthropology, University of Arizona, United States

A R T I C L E   I N F O

Article history:
Available online 20 January 2015

Keywords:
Artifact discard behavior
Mousterian assemblages
Tabun Cave
Israel
Middle Pleistocene
Land use
Raw material procurement

A B S T R A C T

Archaeological assemblages are fundamentally records of discard behavior. Lewis Binford's pioneering ethnoarchaeological research focused attention on the differing pathways that lead to artifacts being abandoned in different locations on the landscape. Recurring relationships between artifact density and assemblage content at Middle and Upper Paleolithic sites reflect simple behavioral dynamics pertaining to artifact production and discard. In the very long archaeological sequence from A. Jelinek's excavations at Tabun Cave, Mousterian assemblages show the expected pattern, but earlier Acheulean, Amudian and Yabrudian assemblages do not. In combination with evidence that different classes of artifacts were discarded at different rates, these results suggest that land use and raw material provisioning in the later Middle Pleistocene were organized differently than they were among later populations of Neanderthals and modern humans.

1. Introduction

Along with Schiffer (1972, 1976, Reid et al., 1975), Lewis Binford is largely responsible for convincing archaeologists to think about the archaeological record as the outcome of a diverse set of behavioral and natural processes. Rather than treating the record as a sequential set of static snapshots capturing a narrow range of invariant past conditions (cultures, phases, etc.), both Binford and Schiffer emphasized, in different ways, the essential project of linking contemporary observations about artifacts, features and assemblages to past behaviors that varied at a range of temporal and spatial scales. Binford's seminal work on hunter–gatherer subsistence adaptations and mobility (1977, 1979, 1980, 1982, 2001) further focused the attention of archaeologists on artifact life histories and land use as key factors for explaining variability in the material record of foragers. In this intellectual framework, artifacts and other debris may be treated as trace fossils of people moving across landscapes (Ebert, 1992; Holdaway and Wandsnider, 2006). What we call sites are essentially depositional phenomena, places where, for behavioral or geologic reasons, artifacts and other debris accumulated in sufficient concentrations to attract the attention of archeologists. Land use is also a major determinate of how, and in what conditions artifacts are abandoned (Binford, 1979; Kelly, 1992; Kuhn, 1995).

The ideas proposed by Binford, Schiffer and others concerning the formation of sites and assemblages have fundamentally altered standard practice in Paleolithic archaeology across the globe. However, it remains difficult to match explanatory models to the temporal resolution of the archaeological record. Paleolithic archaeologists, almost regardless of theoretical position, employ the geologically-defined assemblage as a minimum unit of analysis, measuring variability in terms of differences among assemblages. Yet they often favor explanatory models founded in ethnographic scales of observation. This can lead to a profound mis-match in scale between the behavioral dynamics of interest and the empirical evidence. Ideas about variation in hunter–gatherer mobility and artifact production expressed at the scale of days or seasons are mapped directly onto archaeological assemblages that accumulated over centuries. In some cases a view of the record as a series of superimposed culture phases has been replaced with views of the record as a series of superimposed site types or mobility regimes.

There are two responses to mismatches in scale between behavioral models and the temporal grain of the archaeological record. One is to concentrate on the best preserved localities and most finely reticulated stratigraphies, unique sites that afford something like an "ethnographic" scale of resolution on past behavior (e.g., Leroi-Gourhan and Brézellon, 1972; Roebroeks, 1988; Vaquero, 2008; Vaquero and Pastó, 2001; Zubrow et al., 2010). An alternative strategy is to accept the coarse chronological resolution of many stratigraphic records and to consider how processes operating at

* Corresponding author.
E-mail address: skuhn@email.arizona.edu (S.L. Kuhn).

http://dx.doi.org/10.1016/j.jaa.2014.09.002
0278-4165/

comparatively brief time scales might be expressed at longer timescales (see Akoshima and Kanomata, 2015 for a similar perspective on very different data).

Here the problems are more theoretical and analytical than they are technical. Following the lead of some of Binford's (1982, 1987) pioneering studies, this paper takes the second path. We use the inherent temporality of the archaeological record to investigate changes over time in hominin mobility and technological responses to it. In part, this is accomplished by shifting scales, by comparing patterns of variability both within and across stratigraphic and "cultural" units. The paper examines evidence for behavioral shifts over the period of ca. 400–100 ka at the site of Tabun Cave (Israel). This interval saw important evolutionary developments in lithic technology as well as in hominin populations. Application of a series of simple models of assemblage formation points to significant changes in the ways that assemblages of stone artifacts were accumulated over the long history of occupation of Tabun. These in turn implicate changes in the organization and mobility of hominin groups.

2. Background: the archaeological record at Tabun Cave

Tabun Cave, with its remarkably deep stratigraphic sequence, remains the key sequence for the Lower and Middle Paleolithic of the Levant. The well-known site is situated on the western slopes of Mt. Carmel in the Nahal Me'arot (Wadi el-Mughara), Israel. D.A.E. Garrod conducted the first excavations of Tabun from 1929 to 1934 (Garrod and Bate, 1937:1–2), exposing a sequence of Paleolithic layers nearly 25 m thick. She divided the cultural stratigraphy into seven cultural layers, beginning with the so called "Tayacian" (layer G) and ending at the late Mousterian (layer B) (Garrod and Bate, 1937). A. Jelinek (Jelinek et al., 1973; Jelinek, 1982a, 1982b) worked at Tabun from 1967 to 1971, re-excavating a face ten meters high and six meters wide that penetrated roughly two meters into the intact profile. Excavations continued from 1975 to 2003 under the direction of A. Ronen (Gisis and Ronen, 2006; Ronen and Tsatskin, 1995).

The geology and sedimentology of Tabun Cave have been reported in various publications (Bull and Goldberg, 1983; Goldberg, 1973, 1980–81; Jelinek et al., 1973; Jelinek, 1982a). Jelinek divided the sequence into beds and units. Beds represent the finest sedimentary "package" discernable in the field. Units represent larger groups of beds that show similar macroscopic characteristics and appear to represent similar depositional conditions. Units are separated by disconformities. Jelinek recognized 14 major stratigraphic units (Jelinek, 1982a), which correspond to Garrod's layers C–E and possibly the top of layer F. Jelinek's studies provided much better stratigraphic resolution than earlier excavations. His teams were able to follow steeply inclined beds and identify areas of erosion and infilling that Garrod had not observed.

Major erosional gaps are present at the top of unit XIV (Ronen et al., 2011) and at the top of Garod's layer D (units III–IX) (Farrand, 1979). From unit XIII up through Jelinek's unit II, the Tabun stratigraphy is dominated by aeolian sedimentation. The sandy sediments in the earliest levels (Garrod's layers G and F) probably had a marine origin. Over time, proportions of silt and fine sand (still aeolian) increase. The upward fining could have simply resulting from the progressive infilling of the cave: as sediment layers rose, progressively smaller particles were deposited inside (Jelinek, personal communication, 2010). A major change in sedimentation occurs with units II and I. Sediments in unit II are more strongly anthropogenic, with much evidence of fire. Units II and I also show an influx of colluvial and alluvial sediments from a hole that opened in the cave's roof.

Units I and II, the most recent deposits excavated by Jelinek's team, correspond to Garrod's layer C and the lower part of B. The Levallois Mousterian assemblages from these layers are dominated by centripetal preferential or recurrent Levallois production, although Tabun C-type assemblages may contain a diversity of Levallois production methods (Hovers, 2009). Retouched tools are comparatively scarce. At Skuhl and Qafzeh, Tabun C-type assemblages are associated with fossils that share many features with *Homo sapiens* (Klein, 1999: 402–403). However, the Tabun 1 Neanderthal skeleton discovered by Garrod may have come from the layer C. Radiometric dates from Tabun C range from 165 ± 16 (TL) to 135 + 60/−30 (ESR) (Grün and Stringer, 2000; Mercier and Valladas, 2003; Bar-Yosef, 1995).

Unit IX, equivalent to the lower part of Garrod's layer D, contains assemblages attributed to the early Levantine Mousterian. The assemblages are fairly homogeneous. Unidirectional parallel or convergent Levallois production predominates: non-Levallois blade production is less common and centripetal Levallois flake production is rare. Most blanks are elongated, but shorter flakes as well as naturally backed knives were also produced from the same cores (Shimmelmitz and Kuhn, 2013). Retouch is frequent and well developed compared to other Levantine Mousterian assemblages. To date no diagnostic hominin fossils are associated with early Levantine Mousterian assemblages. Unit IX has been dated by TL to 256 ± 26 kyr (Mercier and Valladas, 2003) although a combined model of U-Series and ESR provided an age of 143 + 41/−28 (Grün and Stringer, 2000). ESR-dated bones came from Garrod's excavation so their precise position relative to Jelinek's stratigraphy remains uncertain.

Units III through VIII were formed through a complex series of cut and fill events. As a consequence, the assemblages contain a large number of artifacts re-deposited from lower beds. Because they are mixed, the materials from these units are either excluded from or are treated separately in the analyses below.

Units XI–XIII, which corresponds roughly with Garrod's layer E, contain a range of assemblage types that make up Jelinek's Mugharan tradition (1990), also referred to as the Acheulo-Yabrudian complex. This complex or tradition is comprised of three facies – today termed Acheulean/Acheulo-Yabrudian, Yabrudian and Amudian/Pre-Aurignacian. The Acheulean facies is characterized by comparatively abundant bifacial tools, the Yabrudian mainly by flake production and heavy scrapers, often with scalar Quina retouch, and the Amudian by blade production and 'Upper Paleolithic' tools forms. These differences are more quantitative than qualitative: elements such as handaxes, heavy scrapers and blades occur in varying frequencies in most assemblages (Copeland, 2000; Jelinek, 1981). Jelinek (1981) ascribed unit XIV, which may have no clear counterpart in Garrod's scheme, to late Acheulean, although the abundance of heavy scrapers suggests that these assemblages may still be part of the Acheulo-Yabrudian complex (Gisis and Ronen, 2006; Ronen et al., 2011).

The Acheulo-Yabrudian complex occupies an ambiguous position with respect general classification of Paleolithic industries. Most researchers assign it to the late Lower Paleolithic (Bar-Yosef, 1995; Copeland, 2000; Gopher et al., 2005), although some consider the assemblages to be more Middle Paleolithic in character (Jelinek, 1982b; le Tensorer et al., 2007). Fossil hominins associated with Acheulo-Yabrudian and Amudian assemblages in other sites have been variously classified as archaic *H. sapiens* or *Homo hiedelbergensis* (e.g., Hershkovitz et al., 2010; Sohn and Wolpoff, 1993). Associated TL dates have a mean of 264 ± 28 kyr for unit XI, 324 ± 31 kyr for unit XII and 302 ± 27 kyr for unit XIII (Mercier and Valladas, 2003). ESR/U-series date of Garrod's sub Layer Ea is 208 + 102/−44 kyr (Grün and Stringer, 2000), whereas animal teeth from sediments equivalent to Garrod's sub-layer Ed provided a mean age of 387 + 49/−36 kyr by ESR/U-series (Rink et al., 2004).

Unit X at Tabun is also somewhat controversial. Levallois elements are fairly abundant in the uppermost layers but decline with