KENYA

Early hominin activity traces at FxJj43, a one and a half million-year-old site in the Koobi Fora Formation in northern Kenya

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This paper describes a sinuous strip of outcrops that lies towards the top of the Koobi Fora Formation in northern Kenya and a research project established to investigate what this locality can reveal about the empirical structure of the early Pleistocene archaeological record and the behavioral information that can be generated from it. This is a logical pre-requisite to any attempt to reconstruct the behavior of early African *Homo erectus* (or indeed, any other debris-generating human ancestor). The main purpose of this paper, however, is to summarize the results of the first round of field research at FxJj43 and to consider their implications for future investigations.

The Koobi Fora Formation is made up of discontinuous outcrops scattered across an area of some 1200 km² on the east side of Lake Turkana (Figure 1). FxJj43 lies toward the top of a narrow band of tuffaceous sediments (known as the Okote Tuff Complex; Figure 2) that outcrops extensively along the eroding western face of the Karari Ridge and which contains the most abundant set of archaeological traces within the Koobi Fora Formation (Isaac and Harris 1978; Harris and Isaac 1997). FxJj43 is one of a series of Early Stone Age sites within the Okote Tuff Complex and exhibits many of the features that characterize the sites excavated by an earlier generation of researchers (Isaac 1997). However, it also differs in a number of critical ways that lend it particularly well to the problem of enhancing current understanding of how the Early Stone Age record is structured (Stern 2004).

Background and rationale

During the 1970s the Koobi Fora Formation was the focus of a dynamic research endeavor, one that set a new benchmark in expectations about the contribution that archaeology could make to an understanding of human evolution (Isaac 1976, 1981, 1997). Driving that research was the goal of using archaeological data to write a natural history of the early stone tool-users (Isaac 1966, 1997). This led to pioneering efforts to relate configurations of material remains to the activities that contributed to their accumulation (Behrensmeyer 1975; Bunn 1982; Schick 1984; Toth 1982). It also involved the use of evolutionary and ecological theory to assess the role

Figure 1. Map of the Turkana depression in northern Kenya, showing the location of FxJj43 on the Karari Ridge and the distribution of outcrops of the Koobi Fora Formation on the east side of the modern lake. Deposits of similar age and origin are found to the west and north of Lake Turkana: the Nachukui and Shungura Formations respectively.

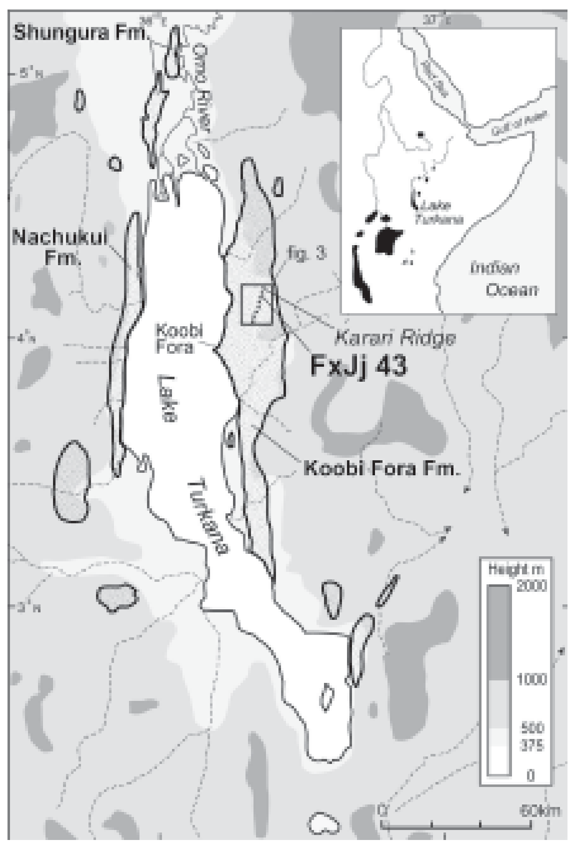
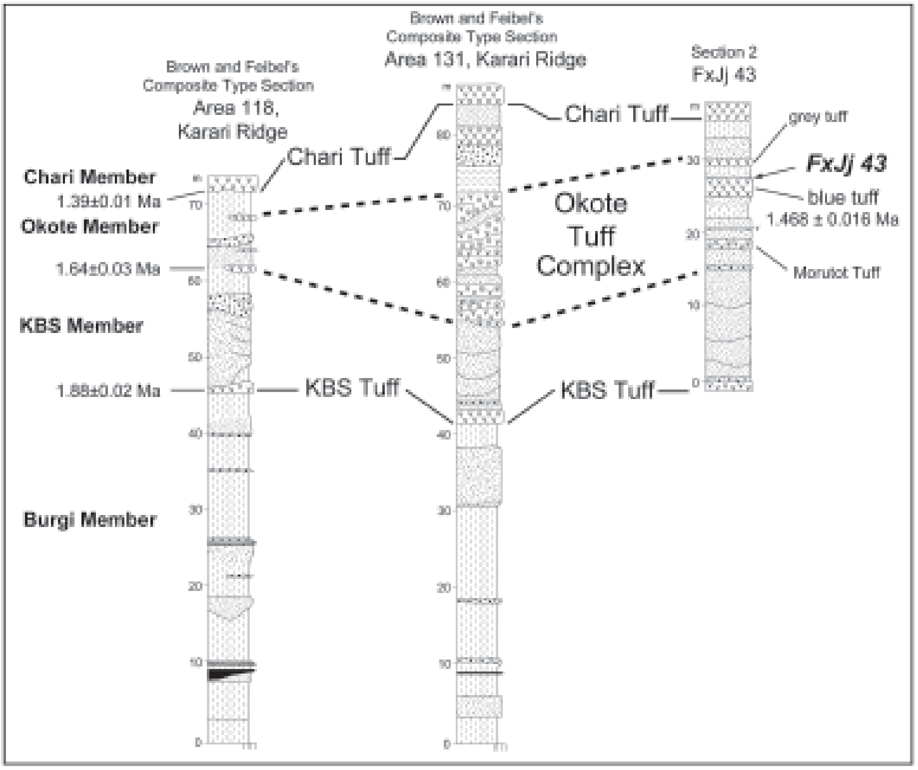


Figure 2. Correlated sections showing the stratigraphic position of the blue tuff, FxJj43 and the Okote Tuff Complex within the Koobi Fora Formation.



those behaviors played in an adaptive system (Blumenschine 1986; Sept 1984, 1986, 2001). When this research agenda was initiated it seemed reasonable to expect that the corpus of actualistic data being collected would not only help establish the behavioral repertoire of the early tool-users but also help identify the role those behaviors had played in our evolutionary history (Isaac 1978).

In the three decades that have elapsed since that research agenda was initiated, it is clear that unambiguous interpretation of the earliest archaeological traces has not been achieved (Plummer 2005). There is agreement that around two and a half million years ago one or more hominin made chipped stone tools that were used to gain access to meat and marrow resources. But disagreement abounds about the way in which those resources were obtained, their importance in the overall diet, the shifts in foraging strategies that took place over the next million and a half years and the relationship, if any, between those shifts in foraging strategies, changes in stone technology and expansion of the biogeographic range.

Opinion is divided about the extent to which ongoing debate reflects methodological problems that can be resolved through additional actualistic research (Blumenschine *et al.* 1994; Dominguez-Rodrigo 2001), or whether they are indicative of substantive problems that can only be solved by the development of novel analytical and interpretive strategies (Stern 1993; Lake 1996). Opinion is also divided about the extent to which these interpretive difficulties can be solved by targeting for investigation rare, fine-grained records that apparently preserve relatively un-complicated behavioral records (Conard 1994). The research at FxJj43 was initiated in the belief that these debates are driven, at least in part, by a limited understanding of the impact of time-averaging on the composition and characteristics Early Stone Age assemblages and on the categories of behavioral information that can be generated from them (Stern 1993, 1994).

As a result the work at FxJj43 was designed to investigate the relationships that exist between rare, discrete clusters of debris that arguably represent single activities and larger, denser agglomerations of debris that resulted from many different activities, performed at different times. FxJj43 lends itself to this exercise by virtue of an unusual set of depositional circumstances, which are summarized briefly here but presented in detail by Stern *et al*. (2002).

Geological setting

The outcrops at FxJj43 form a 50-wide band that can be traced around the edge of the modern erosion front for more than half a kilometer (Figure 3). They preserve 8 meters of flat-lying sands, tuffs, and mudstones that represent a number of different fluvial depositional environments. The oldest sediments preserved are sands that were deposited by a broad, westerly flowing sandy river channel (Figure 4). About one a half million years ago this river was choked by a viscous-slurry of ash and water and topped its banks and draped the surrounding countryside with up to 2.5 meters of ash, referred to informally as the blue tuff.

This tuff has an Ar/Ar determination of 1.468 ± 0.016 Ma (Stern *et al*. 2002:381-387) and its chemical composition identifies it as one of a series of tuffs erupted from the same source in the Ethiopian highlands over a 50,000-year time interval and carried south into the Turkana area by the proto-Omo River (Stern 2004:239). Feibel and Brown (1993) have shown that one and a half million years ago the proto-Omo meandered broadly across a vast, flat floodplain but at times, carried so much ash that it devolved into a series of shorter, straighter and more un-stable channel segments. This establishes the broader landscape setting for FxJj43.

The blue tuff is an isochronous depositional unit and as such helps to pick out the lie of the land at the time it was laid down. The main landscape features preserved at these outcrops include part of a sandy river channel, its southern bank, levee and a portion of the adjacent floodplain (Figure 4; Stern *et al*. 2002:370-77). Archaeological debris occurs in varying density all the way along the eroding surfaces of the outcrops but it all derives from a narrow band of sandy mudstones immediately overlying the blue tuff (Figure 4; Stern *et al*. 2002:378-381). This tuffaceous sandy mudstone records the gradual resumption of normal terrigenous sedimentation and the establishment of a vegetated floodplain. Subsequently, soil formation resulted in the impregnation of the archaeological horizon by calcium carbonate percolating through the soil profile and this enhanced the preservation of bone (*ibid.*: 386).

Various lines of evidence indicate that the palaeolandscape features represented by the blue tuff also existed during the accumulation of the archaeo-

Figure 3. Geological map of the FxJj43 outcrops, showing the distribution of the main mappable beds and the locations of the excavations.

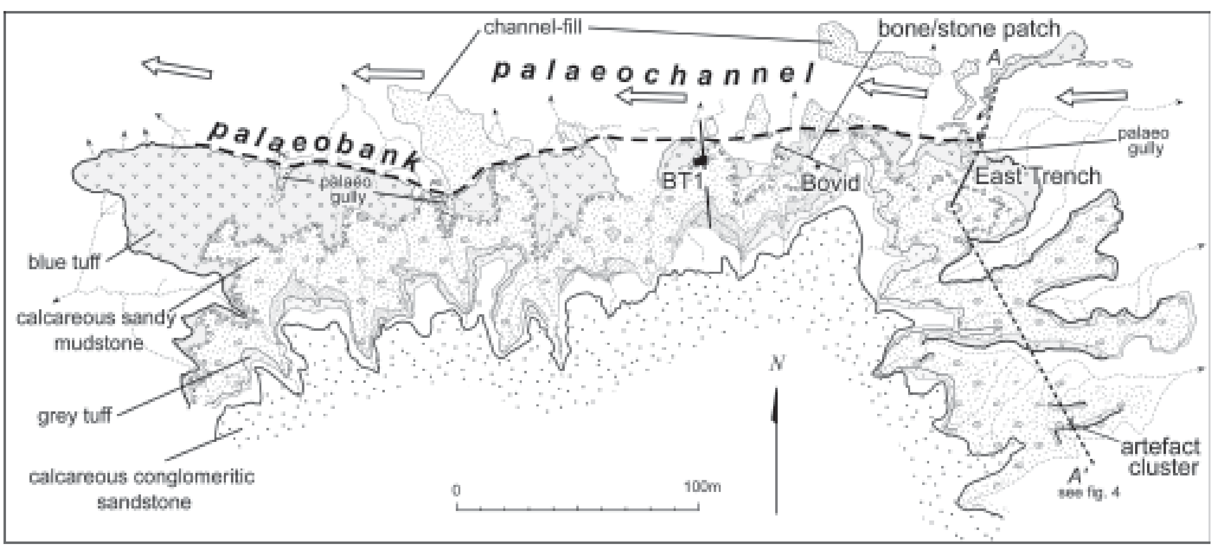
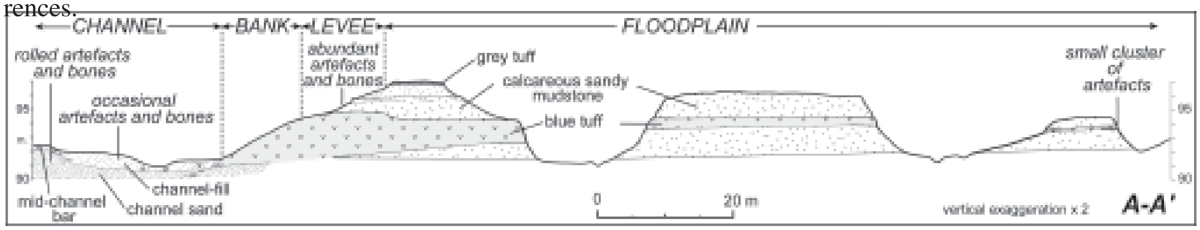


Figure 4. A section through the outcrops at the eastern end of FxJj43 (see Figure 3) showing the main topographic features preserved by these outcrops and the palaeotopographic settings of different archaeological occurrences.



logical debris. Excavation through a portion of the levee and palaeobank revealed that the scatter of archaeological material embedded in the tuffaceous sandy mudstone ends abruptly where the underlying blue tuff falls away to the distal floodplain. Here and elsewhere the tuffaceous sandy mudstone has a gradational contact with the underlying blue tuff and drapes over the topographic features picked out by the blue tuff.

The massive flood event that blanketed this landscape with two and half meters of ash also destroyed the local vegetation cover and initiated a period of bank erosion. This erosional episode is reflected in marked breaks in the slope of the palaeobank itself, in the dissected surface of the blue tuff, and in the formation of gullies through the palaeobank (Figure 3; Stern *et al*. 2002:373-374, 378). Comminuted clods of blue tuff interspersed with the channel fill sediments indicate that this episode of bank erosion was coeval with the infilling of the sandy channel. The presence of chipped stone artifacts and broken up animal bones in both the gully-fills and the channel-fill sands show that the archaeological debris accumulated whilst the channel was filling with sand (*ibid.*: 373-6). By the time the channel had filled with sediment hominins had abandoned the area: another 2 metres of floodplain sediments subsequently accumulated at this locality, but none of the overlying deposits contain any archaeological remains (*ibid.*: 387).

Although it is impossible to determine exactly how long it took for the channel to fill and the archaeological debris to accumulate, average sedimentation rates and the stratigraphic distribution of artifacts and bones indicate that the sediments encasing the archaeological debris took less than 2,000 years to accumulate (*ibid.*: 387-8). Two thousand years represents an upper limit of the time involved because it is evident that bioturbation has resulted in vertical displacement of archaeological material through the stratigraphic profile. Certainly, the bones preserved at this site would have been buried within 10-15 years or they would have disintegrated on the landscape surface (Behrensmeyer 1978). So it is reasonable to characterize FxJj43 as a 'fine-grained' record and as such it offers a useful test of the proposition that such records are the key to resolution of ongoing interpretive dilemmas.

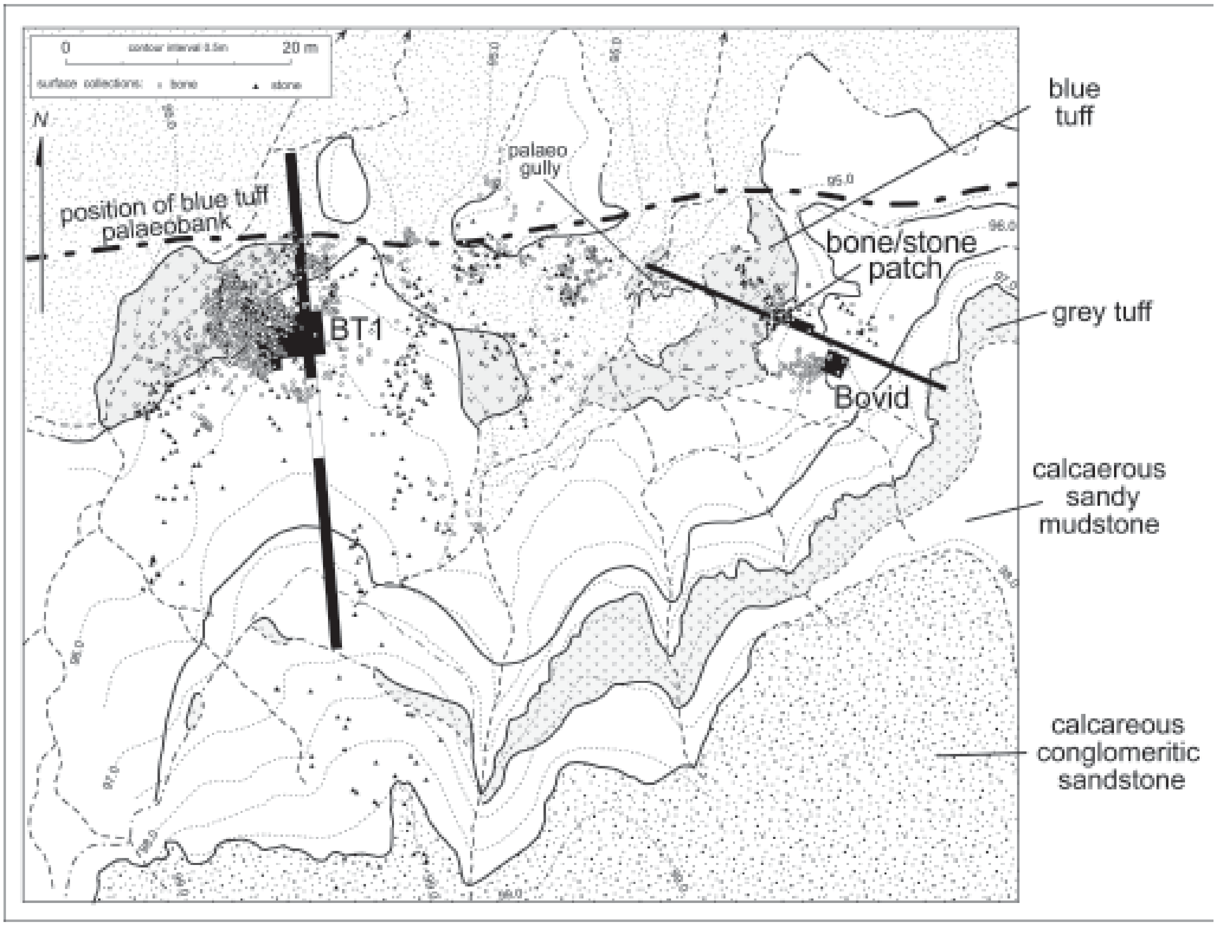
Archaeological occurrences

Because the focus of the fieldwork has been on describing the context of archaeological materials, limited excavations have been undertaken to date. However, these do reveal the existence of a number of different types of archaeological occurrences in different settings. The most conspicuous archaeological occurrences are high-density patches of debris that accumulated on the levee and two of these have been sampled: a large patch of debris at BT/1, and a small bone/stone patch 40 metres further along the same levee (Figure 5).

The artifact assemblages at both patches contain proportions of whole flakes to broken flakes and angular fragments that indicate stone knapping. Although the smaller assemblage contains only flaking debris, cores, hammerstones, and one large, unworked cobble were recovered from the larger patch of debris at BT/1. Differences in the composition of these assemblages are explicable in terms of sample size, which is at least partly a function of accumulation time (Shott 1997; Hiscock 2001). All the cores are small and have been worked intensively and include forms that are characteristic of the Karari Industry (Isaac and Harris 1978, 1997).

Most of the bones recovered from these two patches are well preserved, however, a few bones from the larger assemblage recovered from BT/1 were

Figure 5. Geological and topographic map of the area around BT/1, the bovid locality and bone/stone patch, showing the locations of step-trenches and excavation squares and the distribution of surface archaeological debris.

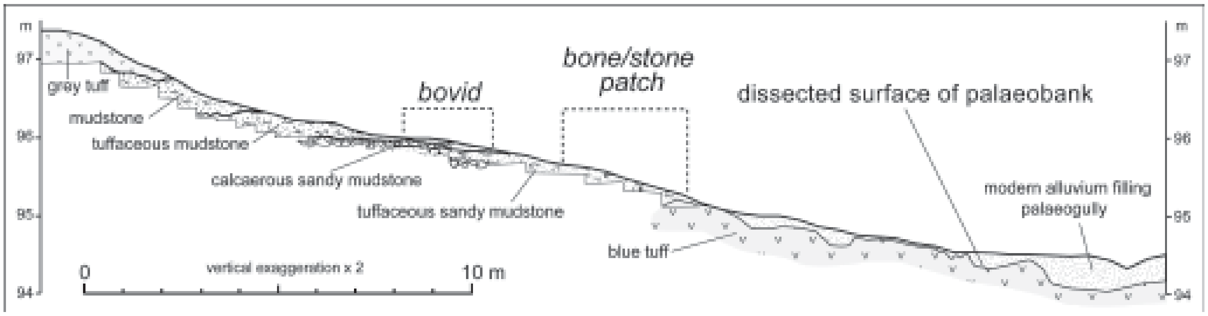


weathered to the point of disintegration. Both assemblages include taxa characteristic of closed habitats and aquatic environments and not surprisingly, bovids dominate. However, the larger assemblage includes a wider variety of animals and seems to have sampled more of the mosaic of habitats that existed in the vicinity and/or accumulated over a longer time span. Carnivore tooth-marks and stone tool-inflicted cut-mark, and hammer-stone percussion marks are found on some of the bones from each patch and indicate that more than one agent was responsible for accumulating and modifying the bones preserved in these assemblages.

In addition to these two high-density patches of debris, two smaller, less dense patches of debris were excavated. One of these was a partial bovid skeleton excavated to determine whether hominins and/or carnivores had interfered in any way with the carcass. The geological trench shows that the bovid skeleton lies higher in section than the adjacent bone/stone patch (Figure 6). No artifacts were recovered and no surface modifications were found on any of the bones suggesting that this represents the remains of a very large and very old Greater Kudu that died a natural death. This may indicate that hominins had already abandoned the area by the time this animal died.

One small cluster of artifacts located in a distal floodplain setting was also investigated and two hundred rhyolite artifacts recovered from the surface of the eroding outcrops and from a small excavation (Figure 4). None of the flakes could be refitted although a number of them appear to have been struck from the same platform at a similar stage in the

Figure 6. The south face of the geological trench cutting through the bovid and bone/stone patch, showing the stratigraphic relationship between these two archaeological occurrences.



reduction of a water-worn cobble. The overwhelming predominance of angular fragments and flakes < 1cm in maximum dimension, together with the size distribution of the flakes and the presence of a single core (partially exfoliated) suggests *in situ* knapping of a single block of raw material.

Diffuse scatters of artifacts and bones are found in the channel-fill sands and some of the gully-fills (Figure 4). The edges of some of the artifacts and bones in the channel-fill sands are abraded while those of others are fresh suggesting that some of this material lies more or less where it fell and that the rest was transported downstream as bed-load during periodic channel flow. Numerous depositional hiatuses can be identified in the channel-fill sands, but no two artifacts or bones were recovered from the same lens of sediment.

Discussion

It is clear that FxJj43 preserves a variety of archaeological occurrences that accumulated over a relatively short span of time on a well-defined palaeolandscape. Some of these represent single activities or events (like the knapping of a single block of raw material), but in most settings depositional circumstances did not favor the separation of one set of material traces from another. So despite being a fine time line, most of the archaeological record at FxJj43 comprises agglomerations of debris whose accumulation involved various amounts of overprinting.

Intuition may suggest that archaeological occurrences whose formation involved limited overprinting have less complex taphonomic histories and are less intractable behavioral records to study than those whose formation involved a lot of overprinting. But what type of a behavioral record would be being studied if the focus of attention were only those occurrences that did not involve overprinting of the material traces of different activities? It is obvious that some time-averaging is required to create an archaeological record in the first place. But it is not clear how much time-averaging is needed to create a useable record and nor is it clear how much time-averaging takes place before a completely indecipherable record results. The crucial question that future investigations will have to address is whether a series of single-event occurrences preserve the same information as one, large, time-averaged agglomeration of debris.

It is recognized that there is a relationship between the size of an assemblage and its composition (Hiscock 2001) and that assemblage size is partly a function of time (Shott 1997): larger assemblages, accrued over longer periods of time, have a greater probability of capturing the material traces of rare and infrequent events. For this reason, time averaging should be viewed as a process that generates information to which there would otherwise be no access (eg Palmqvist and Arribas 2001). However, when it comes to working out what information is preserved in these assemblages a tendency to treat time-averaged assemblages as though they were an average representation of past activities has to be recognized. This is a consequence of the fact that most established analytical and interpretive strategies were not designed to deal with the logical consequences of studying time-averaged agglomerations (Stern n. d.).

However, it is important to recognize that the mixing of debris from temporally unrelated activities is not the same as creating an assemblage in which objects occur in the same proportion as the frequency with which the debris-generating activities were undertaken. As a first step toward developing the methodological tools needed to decode time-averaged agglomerations future work at FxJj43 is designed to enhance current understanding of the behavioral information encapsulated in palimpsests of debris representing different amounts of overprinting.

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