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Middle Palaeolithic occupations at Bir Tarfawi and Bir Sahara East, Western Desert of Egypt

Recent excavations at several Middle Palaeolithic sites in the two adjacent basins of Bir Tarfawi and Bir Sahara East, in the Western Desert of Egypt, have significantly modified our earlier interpretations of the Late Pleistocene climatic events there, of the nature of the archaeological assemblages associated with those events and of their chronology. The lacustrine and aeolian deposits within the basins record a far more complex sequence of wet and arid episodes than we previously believed (Wendorf and Schild 1980). During the Middle Palaeolithic, there were at least five, and perhaps many more, periods when there was much more rainfall than today. Each wet interval was followed by an episode of hyperaridity. Preliminary efforts to date these episodes suggest that the most recent occurred during the final phases of the Last Interglacial (oxygen-isotope Stage 5), and that the earliest may relate to the Penultimate Glaciation (Stage 7). Earlier lakes, associated with the Late and Final Acheulean artifacts, also occur in both basins but have not been studied in detail.

The two basins, about 11 km apart, are cut into earlier Quaternary sands and gravels that fill an older and much larger deflational depression in the Nubia Sandstone bedrock (Fig. 1). Today they are deflated to just above the modern water-table, which is *ca.* 242 m a.s.l. in Bir Tarfawi and 246 m a.s.l. in Bir Sahara East.

The geological history of the two basins is intimately tied to fluctuations in the water-table. During periods of hyperaridity, the water-table would fall and deflation would remove the softer sediments, creating basins of various sizes. During periods of increased rainfall, both locally and farther south, the water-table would rise, ponds would form in the deflated hollows and lacustrine sedimentation would occur. The recovered fauna indicates a high probability of occasional, even if short-lived, water connections with other areas (Kowalski *et al.* 1989).

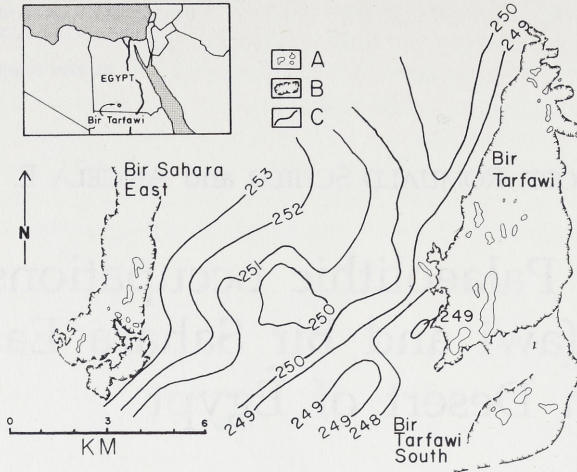


Fig. 1. Contour map of the area of Bir Tarfawi and Bir Sahara East; A: lake remnant; B: outline of basin defined by plateau escarpment; C: 1-m contour interval.

Archaeological excavations in 1985-88 disclosed a sequence of five, or probably six, separate Middle Palaeolithic lake episodes at Bir Tarfawi and five at Bir Sahara East. The chronological relationships between the events in the two basins are not firmly established. Their proximity and the similarities in the number and pattern of intensity of the lacustrine events strongly suggest that the lakes in the basins were synchronous. This conclusion, however, is problematical because the differences between the archaeological remains in the basins are difficult to explain if they are not chronological.

Geology of the basins

Lacustrine sequence at Bir Tarfawi

The earliest Middle Palaeolithic wet episode in the Bir Tarfawi sequence was a seasonal, rain-fed pool in a Silt-Pan in the southern part of the depression. It probably represents a period separate from and earlier than the first Middle Palaeolithic lake in the northern part of the depression, the White Lake, which was an extensive lake fed by high ground-water. After a White Lake, deflation created a large depression in the northern area of Bir Tarfawi, in which a series of four Middle Palaeolithic lake-events are recorded, three "Grey-Lakes" and the "Olive-Green Lake" (Wendorf *et al.* 1987).

Grey Lake 1 formed in a small (*ca.* 40 m in diameter), deep, deflational hollow, initially as a result of both a rising water-table and local rainfall. Later in the sequence, a regimen of seasonal drying, churning, fires and aeolian deposi-

tion is indicated. The uppermost deposits of Grey Lake 1 have been removed by deflation, which hollowed out another, much larger basin, during a period of hyperaridity and lower water-table.

Even in the initial stage of Grey Lake 2, there were semipermanent or permanent pools of water, although deposition was interrupted by at least two periods of desiccation. A small pool northwest of the main lake yielded a large collection of microfaunal remains, which is almost exclusively Ethiopian (sub-saharan) with a few older desert elements; there are no Mediterranean forms. This accords with our model of a northward advance of the rainfall, and indicates that there may have been as much as 500 mm of rain *per annum* at this time (Kowalski *et al.* 1989; Wendorf *et al.* 1991).

Grey Lake 3 followed the period of aridity in which the upper beds of Grey Lake 2 were markedly deflated. This lake was areally the largest in sequence, so that its later shores lie far from the center and have been completely removed.

A period of hyperaridity, recorded by another major deflation, separated the last Grey Lake from the Olive-Green Lake. In the northern part of the Tarfawi deflation, the shores of the lake have been removed by deflation, but it had a considerable areal extent, perhaps similar to that of Grey Lake 3. Some of the distinctive color of the olive-green silts is due to gley development, which shows that they continued to be waterlogged after the disappearance of open water. Water would thus still have been available for a time to the people and animals that could dig for it. The period of the Olive-Green Lake was the last time the Eastern Sahara was inhabitable until the Holocene.

Lacustrine sequence at Bir Sahara East

Lake 1

The oldest Middle Palaeolithic lake-event in the Bir Sahara East basin is known only from a small remnant near the southern end of the depression. The sediments of this small lake consist of a thick series of lithified limestones resting on (or interfingering with) lacustrine silts. The top of the limestones is at 256 m a.s.l., some 3 m above the highest later Middle Palaeolithic lacustrine deposits. Several Middle Palaeolithic artifacts (a Mousterian point and several denticulates) occurred on the surface of the limestone, while others appeared to be weathering out of beach sediments at the northern end of the remnant. This locality was discovered only in the last few days of the 1988 season and the only detailed studies made here were sedimentary analyses.

This lake is separated from later ones by a long period of hyperaridity and massive deflation. A large deep hollow was excavated to a depth below 245 m a.s.l., about 1 m below the modern water-table and some 11 m below the top of the lithified sediments of the first lake. A dune and then a coarse aeolian sand sheet 8 m thick filled the hollow. The deflation and thick aeolian deposits record

a major period of hyperaridity which may have been complex: the subsequent lakes are set in a large north-south trough formed in the sandsheet and deflation of the trough probably represents another arid pulsation.

Lake 2

The earliest of the four later Middle Palaeolithic lake-events was a relatively small body of water. Its base was slightly below the modern water-table at 246 m a.s.l. Deposition began with a dark grey organic soil, followed by a relatively thick bed of lithified carbonates and limestones with numerous snail shells. A large, rich cluster of Middle Palaeolithic artifacts (Site BS-11) occurred within the grey sands on the eastern shore of the lake.

Lake 3

An episode of deflation and the deposition of aeolian sands separate the second lake from the third, which was very large lake, covering an area of several square kilometers. Extensive exposures of the shallow-water and near-shore sediments of this lake are still preserved around the northwestern margin of the depression and massive carbonate remnants can be traced throughout its lower parts. The lake corresponds to the "Lower Lacustrine Series" of 1973 (Schild and Wendorf 1981; Wendorf and Schild 1980). A dark grey, organic soil, presumably indicating rising ground-water, preceded the main carbonate deposition in the deep-water sections of the lake. Near the gently sloping shores, deposition consisted of silts, clays and shallow-water carbonates, with casts of *Phragmites* and other aquatic plants, wasp nests and worm tunnels. The declining phase of the lake is marked by invading phytogenic dunes that interfinger with the shallow-water carbonates.

Most of the known Middle Palaeolithic occupations are associated with Lake 3, especially with the organic soil of the initial phase. One site, BS-12, has several pits, 0.5 - 2 m in diameter, dug down to the water-level of the period. These features, which were presumably wells, intersect each other in a complex sequence, and one has a shelf or platform around a central hole, which is about 1 m deep. Two other excavated Middle Palaeolithic sites, BS-1 and E-88-11, were on the shore of a peninsula that extended between two arms of the lake. The occupations at both sites were within a soil marked by the development of a zone of iron enrichment that graded down into an "upper vegetation horizon" and then into near-shore silts.

Lake 4

Following another period of aridity with extreme deflation and deposition of aeolian sand, deposits of Lake 4 are found only in a very limited area, < 0.5 km in diameter, near the center of the Bir Sahara East basin. The deposits consist of bedded marls and near-shore facies of Olive-Green silts and fine sands. No archaeology was associated with this lake.

Lake 5

Another episode of deflation and deposition of aeolian sands separates the deposits of Lake 4 from those of the last lake-episode recorded at Bir Sahara East. The deposits of Lake 5 occur in many parts of the basin. They are always thin and consist of grey marls that are rich in snail shells. The marls are frequently topped by a dark brown soil, which contains evaporitic salt wherever it is protected by overlying deposits. The encroaching aridity that ended this final lake is recorded by the deposition of phytogenic dunes over the dark, marshy soil. There are no excavated archaeological sites directly associated with Lake 5, but an extensive Middle Palaeolithic site, E-88-2, occurred adjacent to it, within a dune deposited over the truncated lacustrine beds of Lake 3. Occupation was probably contemporary with Lake 5.

Chronology of the basins

The dating of the Middle Palaeolithic lacustrine events at Bir Tarfawi and Bir Sahara East is difficult. We know from the earlier work that both sequences lie beyond the range of radiocarbon dating (Wendorf and Schild 1980), and we are obtaining chronometric dates from a suite of new, and still experimental, techniques: thermoluminescence dating of the sediments; uranium-series dating of ostrich eggshells from the excavated archaeological sites and the calcites which formed in the lakes; electron spin resonance dating of the ostrich eggshell and tooth enamel from the archaeological sites (with the ages estimated by the linear uptake method); and amino acid racemization of ostrich eggshell.

The available preliminary results of these dating efforts have been published elsewhere (Miller *et al.* 1991; Wendorf *et al.* 1991). The uranium-series analyses indicate that the Late Acheulean lakes in Bir Tarfawi are > 350,000 years old, and that the White Lake is about 160,000 years old. The subsequent series of three Grey Lakes, although representing separate lacustrine events, are all about the same age: 135,000 ± 10,000 years ago. The most recent event in Bir Tarfawi, the Olive-Green Lake, is dated between 70,000 and 90,000 years old. Ostrich eggshell racemization indicates an age of 175,000 years for the Silt-Pan in the southern area of Bir Tarfawi, suggesting that it is, indeed, separate from the White Lake. The three Grey Lakes all fall within a span of some ten thousand years, about 130,000 years ago, and the Olive-Green Lake dates to about 104,000 years B.P.

At Bir Sahara, the results are less cohesive. The uranium-series analyses have not been completed, but thermoluminescence dating of the two burned layers in the Lake 3 gave dates slightly more than 100,000 years old. This would suggest that the events in Bir Sahara East are synchronous with those in Bir Tarfawi. On the other hand, ostrich eggshell racemization suggest that Lake 3 (if the occupation of E-88-1 was associated with that event, as we now believe) is about the same age as the Silt-Pan at Bir Tarfawi, about 175,000 years old, while Lake 5 is about the same age as the Olive-Green Lake. This would indicate that most of the Bir

Sahara East sequence precedes that of Bir Tarfawi. We expect that these problems of correlations between the two basins will be resolved when the remaining uranium-series and thermoluminescence samples have been analyzed.

Middle Palaeolithic archaeology of Bir Sahara East and Bir Tarfawi

There are interesting differences between the Middle Palaeolithic assemblages found in the two basins. At Bir Tarfawi, the earliest Middle Palaeolithic, associated with the Silt-Pan and the White Lake, lack bifacial foliates, has rather more converging denticulates than do later assemblages and shows a tendency to use larger blanks for retouched tools. On the other hand, the assemblages associated with the Grey and Olive-Green Lakes consistently include rare bifacial foliates. Pedunculated pieces occur only on the surface of the Olive-Green Lake, and none has been found *in situ*; they were presumably from later occupations associated with the upper part of the Olive-Green Lake and subsequently removed by deflation.

At Bir Sahara East, only the most recent Middle Palaeolithic assemblage, which is believed to be associated with Lake 5, has tools like those with the Grey and Olive-Green Lakes at Bir Tarfawi (Figs. 2 and 3). The Bir Sahara assemblages associated with Lakes 2 and 3 lack foliates, have many converging denticulates, and some of them have larger blanks for the tools (Fig. 4). One site (BS-11 with Lake 2) also contained several stone balls, similar to those oc-

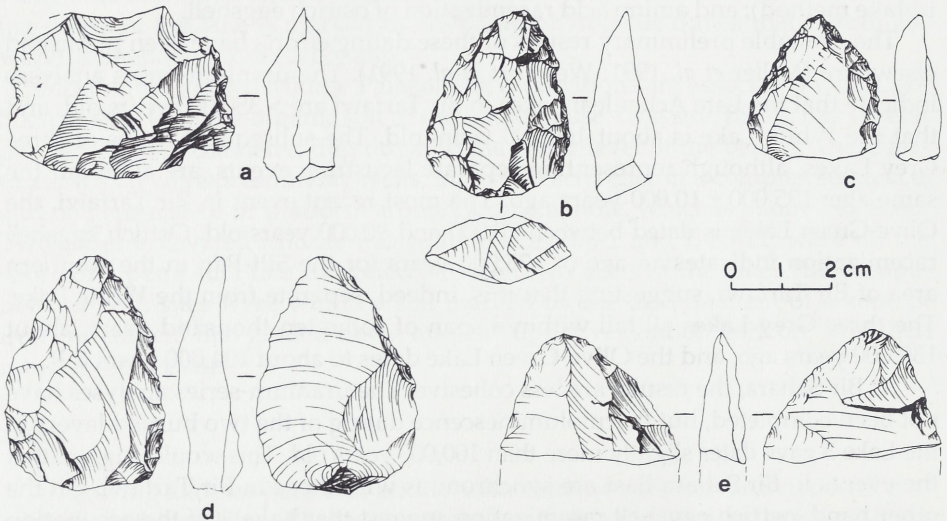


Fig. 2. Middle Palaeolithic retouched tools from Site E-88-2, probably associated with Lake 5 at Bir Sahara;

a: denticulate; b - d: Mousterian points; e: bifacial piece.



Fig. 3. Middle Palaeolithic retouched tools from Site E-88-2, probably associated with Lake 5 at Bir Sahara;

a, b, h: sidescrapers; c, e, g: endscrapers; d, f: denticulates.

asionally found in Late Acheulean sites in this area, but otherwise unknown in the local Middle Palaeolithic.

These differences may well have chronological significance if most of the Bir Sahara lakes and the associated sites preceded all but the Silt-Pan and the White

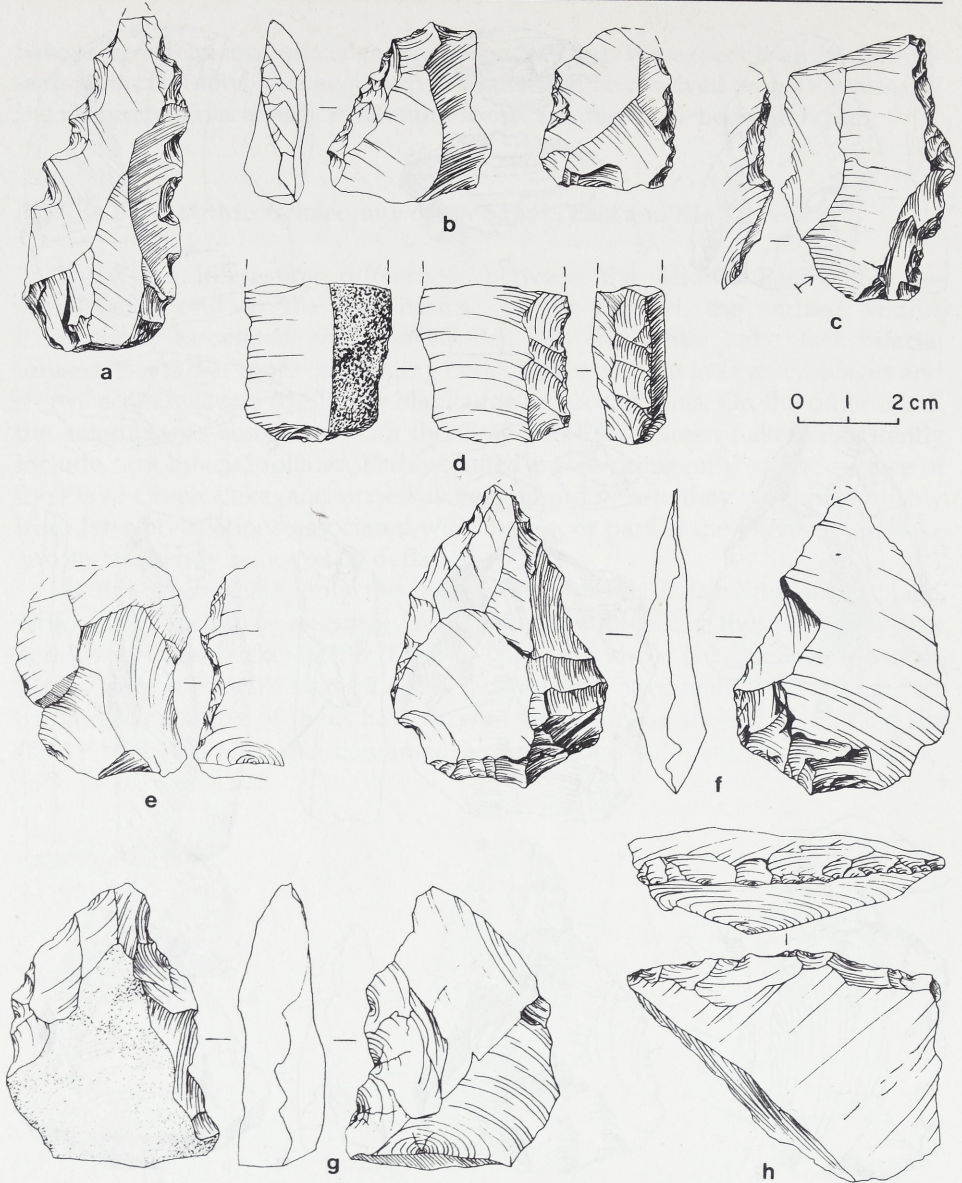


Fig. 4. Middle Palaeolithic retouched tools from Site E-88-1, probably associated with Lake 3 at Bir Sahara;

a, g: converging denticulates (Tayac points); b: sidescraper; c: denticulate; d: inverse sidescraper; e: retouched piece; f: Mousterian point; h: transverse sidescraper.

Lake at Bir Tarfawi. However, the similar patterning of the lacustrine events in the basins strongly argues that they were synchronous; if this was so, the archaeological differences must indicate that the basins were used differently, since their proximity would argue against the existence of two cultural tradi-

tions. Some of the differences may reflect the greater distance of Bir Sahara East from the sources of lithic raw material, the ecology of the lakes may have differed, or the lakes may have been used at different seasons for different purposes.

In any case, the absence of foliates from the earliest Middle Palaeolithic assemblages, their presence in the latest sites in both basins and the restriction of tanged pieces to surface occurrences suggest a sequence of three kinds of Middle Palaeolithic in this area. The initial group, a Mousterian, used slightly larger blanks, more covering denticulates and, occasionally, stone balls. The second group was characterized by rare foliates. The third group had both foliates and tanged tools. We suggest that the term "Aterian" be reserved for the last group and that the second group, with rare foliates and no tanged pieces, be called "Aterian-related".

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