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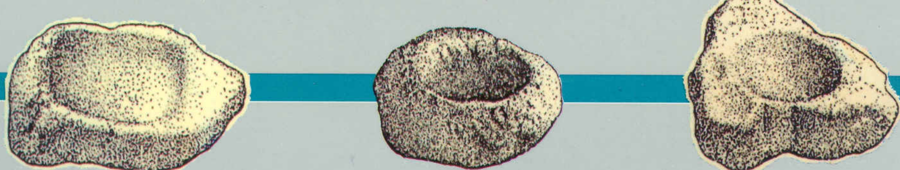
SILICEOUS ROCKS AND CULTURE



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MONOGRÁFICA ARTE Y ARQUEOLOGÍA

Middle Palaeolithic Chert Mining in Egypt

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RESUMEN

Los cantos de chert de los depósitos de terraza de Nazlet Safaha y Taramsa Hill fueron ampliamente explotados por medio de un sistema de trincheras y pozos a cielo abierto. La talla se realizaba en el mismo lugar por medio de diferentes métodos Levallois: nubio, clásico, evolucionado y un método afín al Levallois para la producción de lascas alargadas y hojas. La producción de foliáceos bifaciales está constatada durante las fases de extracción más antiguas documentadas en Taramsa Hill. Algunos de estos acontecimientos se extienden en el tiempo a un periodo de 41 ka según las dataciones ópticas, mientras que otros son más antiguos que los 37.000 BP indicados por la datación C14. Actualmente se conocen yacimientos del Paleolítico Superior Antiguo con similares métodos de extracción (35-30.000 años de radiocarbono BP) pero en estos casos también se ha practicado la minería subterránea.

PALABRAS CLAVE: *SILEX, CHERT, MINERIA, CANTERAS, PALEOLITICO MEDIO, TRABAJO ARQUEOLOGICO DE CAMPO.*

ABSTRACT

Nazlet Safaha and Taramsa Hill are sites where chert cobbles from terrace deposits have been extensively exploited by a system of open pits and trenches. Knapping proceeded on the spot, mainly by different Levallois methods: Nubian, Classical, Evolved and a Levallois related method for blade and elongated flake production. Bifacial foliates have been produced during the earlier extraction phases at Taramsa Hill. Some of these occurrences go back in time to a period of 41 ka according to optical dating whereas others are older than 37,000 radiocarbon years BP Sites with similar extraction approaches are already know from the Early Upper Palaeolithic (35-30,000 radiocarbon years BP), but here also underground mining has been practized.

KEYWORDS: FLINT, CHERT, MINING, QUARRYING, MIDDLE PALAEOLITHIC, ARCHAEOLOGICAL FIELD WORK.

Research in the Nile valley near Qena by the Belgian Middle Egypt Prehistoric Project of Leuven University led to the discovery of several Middle Palaeolithic chert exploitation sites of which Nazlet Safaha and Taramsa Hill are the most important[1].

NAZLET SAFAHA

The area of Nazlet Safaha is situated on the west bank of the Nile, downstream of Dandara Temple (Vermeersch *et alii* 1986, Vermeersch *et alii* 1990)[2]. It is located on a Nile cobble terrace remnant. The bars of the former channel deposits, with their top at about 7 m above the

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[2] In that publication the site has been named Nazlet Sabaha. In later publications the name has been unfortunately changed in Nazlet Safaha, whereas the former was in fact correct. For practical reasons we will hold on to the name Nazlet Safaha.

Nile floodplain, are 2 to 3 m thick and rest disconformably on very coarse Nile sands. The terrace deposits contain mainly metamorphous and eruptive materials, but also quartz and round or ellipsoidal chert cobbles, the latter with a diameter of up to 0.2 m. The matrix material is composed of pebbles and coarse (mean diameter: ± 4 mm) sands. The cobble deposit is overlain by a layer of variable thickness (about 0.5 m) of granulous sands.

In the area, several distinct sectors have been identified of which only sector 1, 2 (figs. 1 and 2) and 3 have been studied.

Exploitation system

Prehistoric man extracted the chert cobbles from the terrace deposits in open ditch or pit systems with a mean extraction depth of around 1.5 m and a maximal depth of about 1.7 m. He proceeded from an exploitation front composed of sterile sands at the top and the upper part of the cobble terrace. Exploitation of the cobble layer is generally restricted to a depth of about 0.5 to 0.8 m. This means that only the uppermost part of the cobble terrace, mostly six cobbles thick, was extracted. The extraction ditches exhibit vertical walls with only minor undercutting of the sandy deposits. This is dictated by the low rate of consolidation of the granulous sands. Under certain circumstances we observed the collapse of larger blocks of these sands.

The ditch width is highly variable. The exploitation trenches (fig. 3), especially in sector 2 display an irregular plan. Many lateral bulges can be observed, giving the impression that a new ditch was started, which later was abandoned. The tortuous lay out of the ditches is suggesting that exploitation has been discontinuous in time or that prehistoric man was restricted in his planning capacities.

The very heterogeneous infillings of the exploited ditches are composed of patches of

Figure 1.—Picture of the site in north direction with the black desert pavement coinciding with the extent of sector 1.

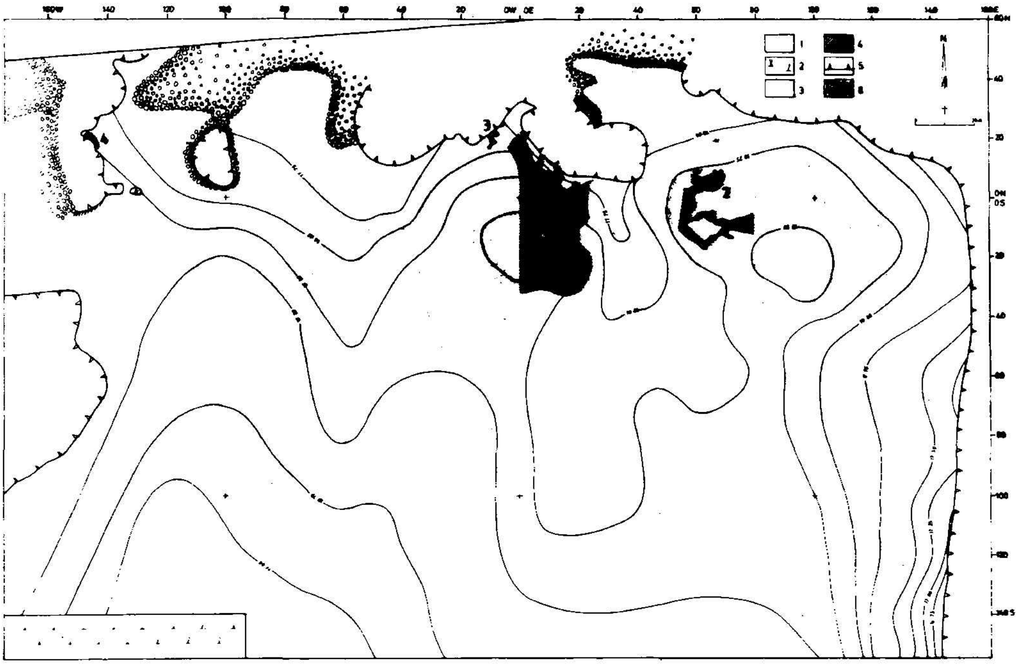

Figure 2.—Nazlet Safaha with sites 1, 2, 3 and 4. 1: abandoned Maghar Canal; 2: cultivated area (1988); 3: desert pavement; 4: area exploited by Middle Palaeolithic man as reconstrcuted in excavations; 5: recent quarry edge; 6: recent quarry dump.

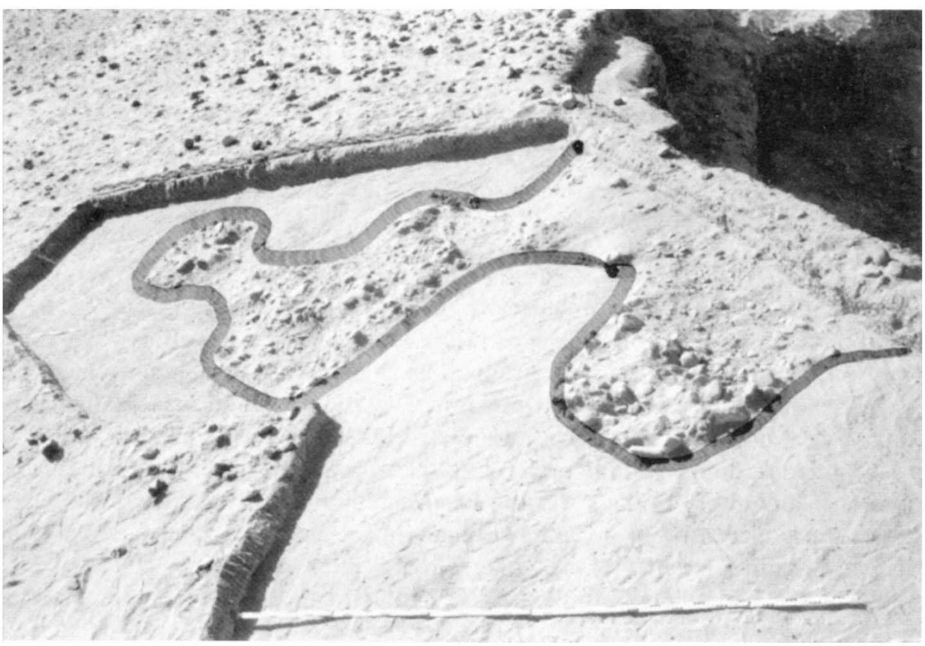

Figure 3.—Nazlet Safaha: Extraction trench lay out with the trench infillings outcropping through the sterile sands.

pure aeolian sands, patches of cobbles or a mixture of both, and suggest an infilling and consequently probably also an exploitation in different steps. Prehistoric man probably scraped off the sterile sands from small surfaces, dumped the sands behind him and extracted the cobbles individually. No excavation tools have been recovered, suggesting that they either did not exist or were made from organic materials such as wood, bone or antler, which have not been preserved. In the course of the extraction procedure man sorted out the chert cobbles and sometimes also the largest quartz pebbles. Cobbles of other petrographic composition were dumped in the immediate vicinity, mostly in the ditch itself. Within the anthropogenic infillings of the prehistoric ditches, pure matrix material from the terrace deposits is rare. It seems that the matrix material occurs concentrated at the base of the infilling and on top of the in situ cobble deposits, suggesting that the matrix was not removed from the ditch in the extraction process, at least for the lower cobble layers. At the end, the bulk of the matrix material accumulated on top of the in situ cobbles, has prevented further extraction in depth.

In the southern part of Nazlet Safaha 1, exploitation was so intensive, that an area of more than 600 m^2 was completely exploited. The total areal extent of the exploited area can be evaluated at about 2500 m^2. If we accept 0.75 m as the mean thickness of the extracted cobble layer, we arrive at a volume of 1875 m^3 extracted cobbles. We estimate that about 100 cobbles per m^3 were available for knapping purposes. This means that Nazlet Safaha 1 could have produced 200,000 cobbles for potential use.

Data on the extent of the extraction surface on Nazlet Safaha 2 and 3 are less secure because of the fact that not the whole surface has been exploited. Indeed, exploitation was mainly performed by ditches of limited extent. Excavations so far have been unable to discover the extent of the extracted area.

Discovery and direct access to the cobble deposit in prehistoric times was possible from the left bank of the River Nile which was probably eroding these deposits as it does now. Moreover, the sand cover is thinning out towards the Nile so that it is likely that the cobbles were outcropping near the river and thus directly available at the surface. It must be stressed that, on the very location of the extraction activity, prehistoric man could not directly observe the cobbles as they were buried under a sand layer. Access to the cobble deposit always had to pass through these sands.

Artifact production

The extraction provided chert cobbles which have been utilized in nearby ateliers mainly for flake production. In most of the recovered assemblages the Levallois reduction strategy was mainly used (fig. 4). All Levallois reduction elements are well represented. Especially Levallois flakes are quite numerous. The classic Levallois method was exclusively present, suggesting a Late-Middle Palaeolithic K-group affiliation, at least for sector 1 and 2. However, in some assemblages, non-Levallois preferential platform cores (one or two platforms) can be quite numerous. Judging from the generally low blade indices, reductions of these types must have primarily produced flakes or laminar flakes rather than true blades. True standardized blade production is in none of the assemblages represented.

In most of the assemblages tools are very rare. In those that contain tools, the most common type, apart from retouched Levallois flakes, are notches and denticulates.

Notwithstanding the fact that chert extraction has been performed, Levallois core to Levallois flake ratios are very low indeed. This means that there are more Levallois flakes

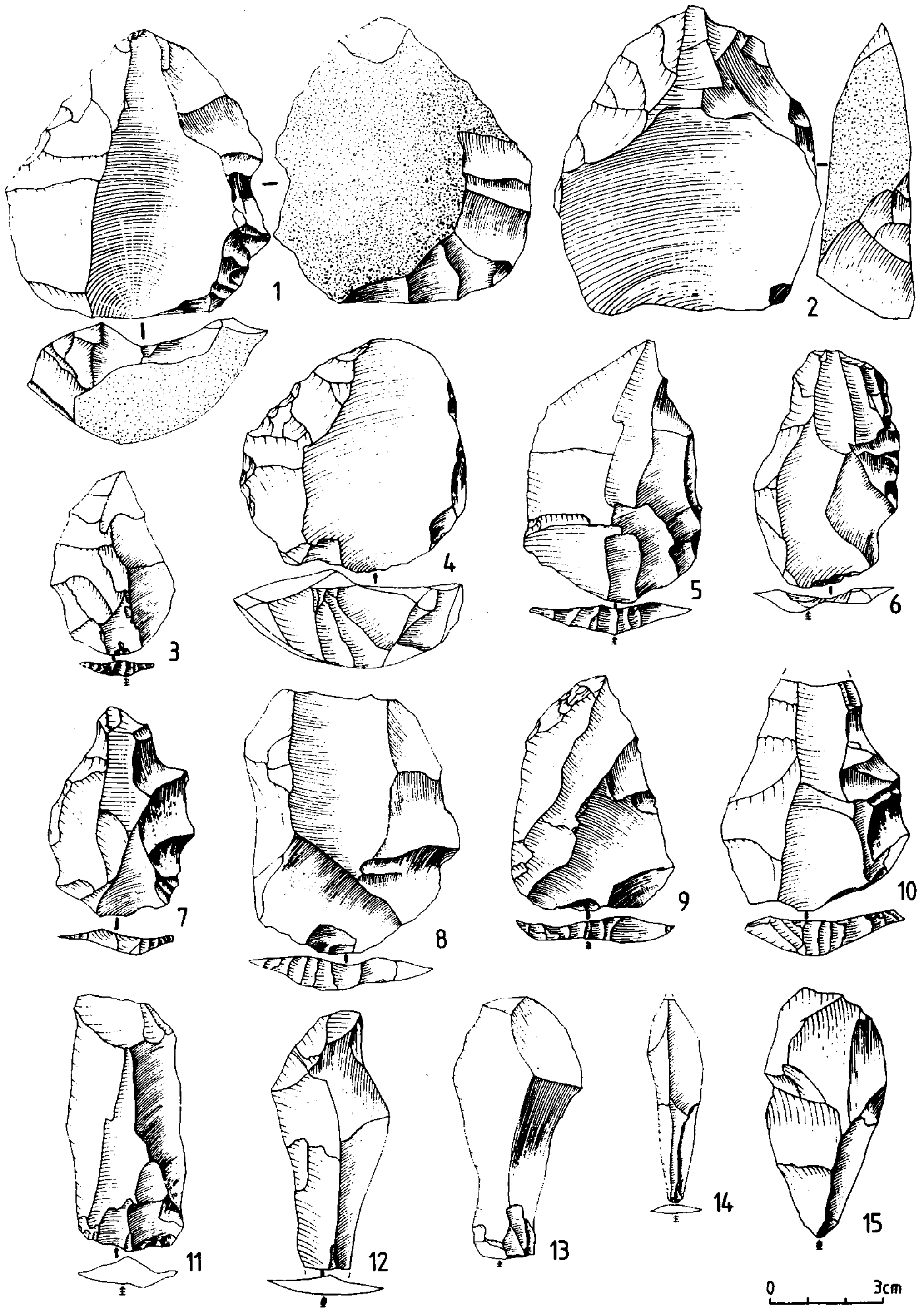

Figure 4.—Nazlet Safaha: Artifacts according to the evolved Levallois of the K group.

than Levallois cores and it would seem therefore that hardly any product has been exported from the site. We know from earlier studies that classical Levallois cores are mostly intended to produce more than just one Levallois endproduct (Van Peer 1991). Thus, even with low ratio's it remains possible that a number of Levallois flakes have been exported from the site, as we would expect for this type of site. Indeed, the quasi total absence of tools suggests that we are not dealing with a living site. This hypothesis is corroborated by the fact that no living structures nor hearths have been recognized. If living sites are ever found, they would contain many tools and few waste products. One would thus expect at least part of the artifact production to be exported to the latter, perhaps located in the floodplain. Given the presence of products from all reduction stages, a plausible scenario may be that groups, based in the Nile floodplain, came to the exploitation site from time to time to collect the number of artifacts needed. At the same time, they might have completed their "stock".

Taramsa Hill

The Taramsa Hill is an isolated landform, situated some 2.5 km southeast of the Dandara temple (fig. 5). The hill culminates at 43 m above the Nile floodplain and at 15 m above the lower desert. It is capped with a 4 m thick deposit of mainly chert cobbles of unknown age. This deposit is intensively rubified. According to their geomorphological position, these deposits are older than the Dandara Formation, which is exposed at lower levels to the north of our site. A black varnish on the cobbles of the desert pavement creates the peculiar aspect of the Taramsa hill which appears as a black hill in a yellow desert. On the eastern side of the hill a sheet of aeolian sand has been accumulated.

The original goal of our research at this site was to understand the presence at the surface of huge quantities of chipped artifacts, which formed with the cobbles a pavement over the hill. Nearly all coarse elements on the surface are artifacts or cobbles suited for knapping. On the hill surface some recent pits (dug by soldiers?) made clear that fresh artifacts were also buried under the surface.

The cobble deposit is composed of more or less horizontal —at least in a section transverse to the hill— beds of cobbles, sometimes with a diameter of more than 0.4 m, but mostly in the order of 0.10-0.15 m. The cobbles are imbedded in a strongly rubified matrix of coarse granulous quartz sands, mixed with well rounded pebbles with a diameter up to 5 cm. The in situ deposits are not consolidated. When taken out of its context an extracted cobble always leaves a clear negative impression which is slightly consolidated by a coating of reddish clay and white salt. The extraction of cobbles, even without tools, is very easy as the cobble unit is not at all consolidated.

The petrographic composition of the cobble deposits is as follows: chert (93%), quartz (4%), silicified limestone (2%) and weathered sandstone (1%). The last two categories are represented only in the smaller grain size fraction. Very often the chert is a rather fine variety with a mostly yellow grey to grey colour and a brown cortex. The chert is often banded. About 50% of the cobbles present a rather spheroid to flat spheroid shape, the others are discoid of ellipsoid in shape. About 60% of all cobbles are rounded to very well rounded whereas the others are rather angular.

The cobbles at Taramsa Hill are of local origin. Indeed, as the deposit dips from the plateau towards the Nile, it can be considered as a former deposit by an episodic competent wadi. At an area, about 2.5 km to the south, the limestones of the exposed Thebes-Formation

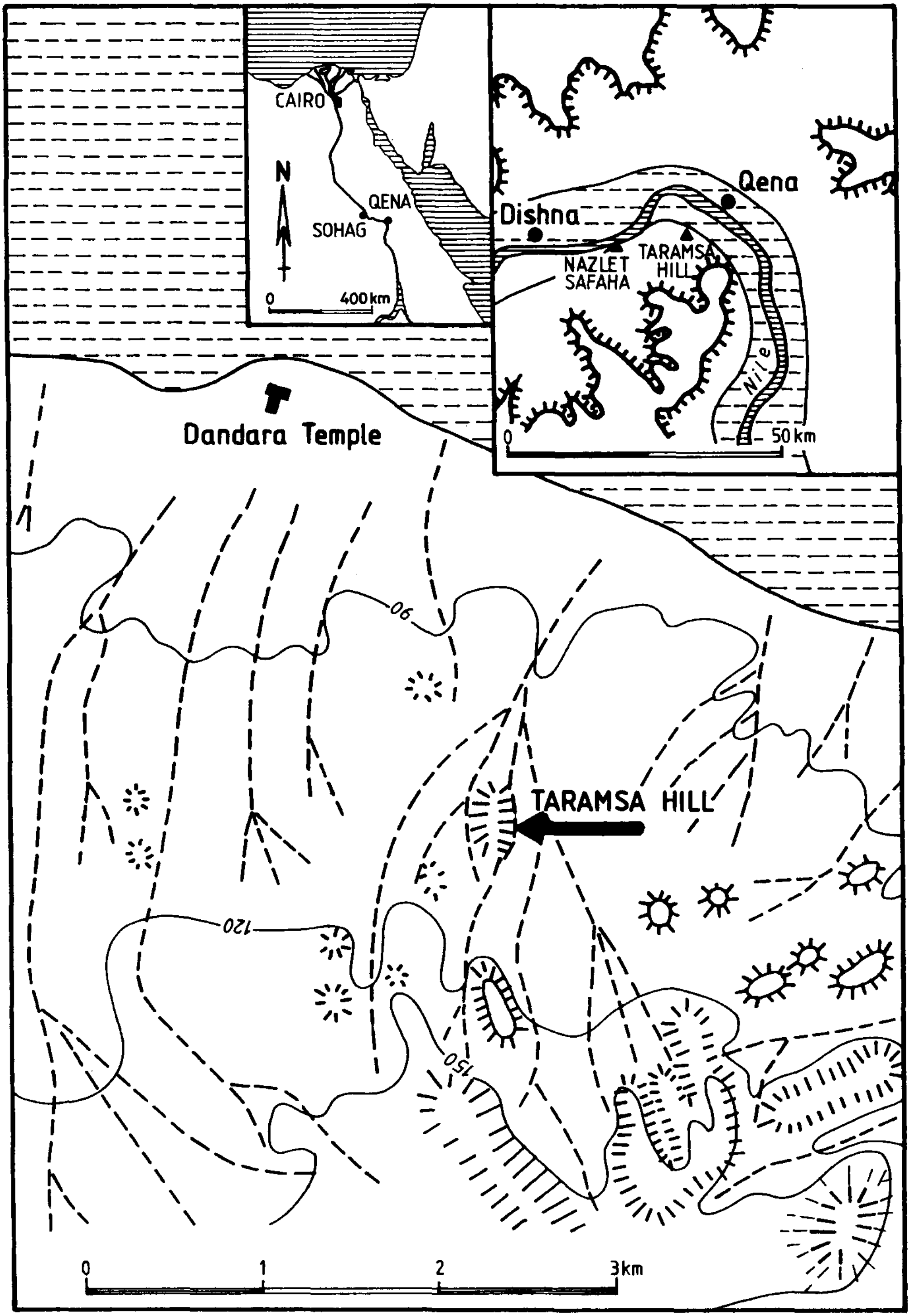

Figure 5.—Taramsa Hill: site location.

contain numerous layers of chert cobbles similar to those on the Taramsa Hill. This area may be considered as the source. In the limestone formation, the chert cobbles are already round. They underwent very little rolling before they were deposited on the hill.

Excavations

Excavations (fig. 6) were carried out in different sectors during two seasons (Sector 89/01-03 and 91/01-08). Moreover, many stratigraphic trenches have been opened in order to study the stratigraphy of the aeolian deposits on the lee slope of the Taramsa hill.

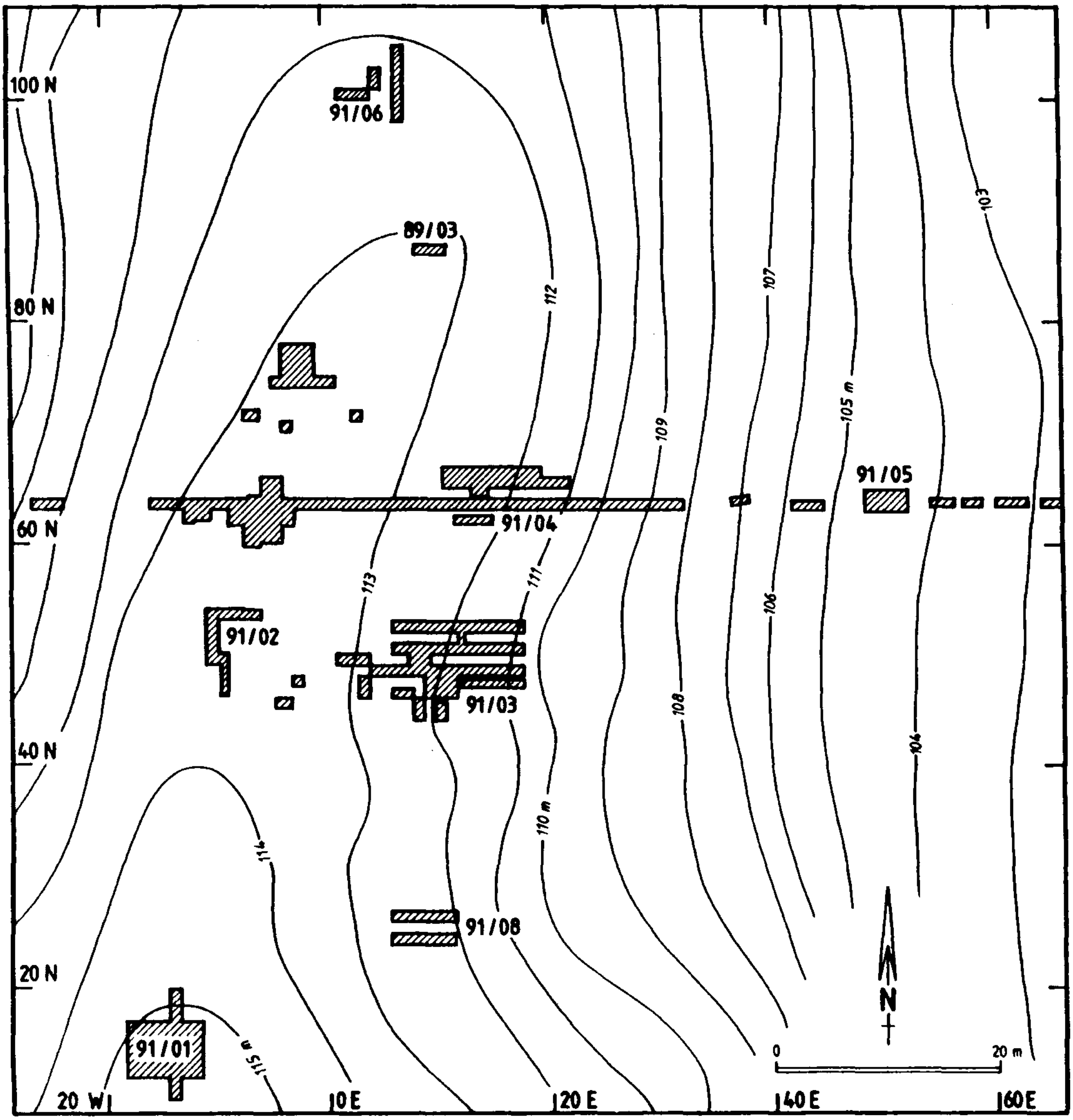

Figure 6.—Taramsa Hill: general plan with the position of the sectors.

Sector 89/01

The excavations in this sector, a little bit south of sector 91/01, were restricted to a small trench cutting a prehistoric extraction. In this sector area numerous Nubian cores and flakes were recovered. A sample for optical dating has been collected.

Sector 91/01

In sector 91/01 an attempt has been made to evacuate all prehistoric dump from an area which we considered to be an eventual prehistoric extraction pit. Our goal was to arrive at the situation such as it has been left by prehistoric man after exploitation. While cleaning, it became clear that the "pit" we created was the result from two main exploitation activities and had never existed as such.

The first exploitation phase was related to the production or the utilization of foliates. Some of them have been found in horizontal position, resting on or just in the red matrix material which, after cobble extraction, remained from the original deposits. None of the foliates was associated with light yellowish brown (10 YR 6/4-6/6) aeolian sands which appear to be a characteristic fill of the later exploitation phase. The foliates show an orange red patina on the face which was in contact with the underlying red matrix material. These observations point to an interpretation which suggest that such localities could be the remnants of an exploitation, where cobbles have been extracted from a nearly horizontal floor without evacuation of the red matrix. This matrix accumulated above the cobbles and finally prevented further extraction. We estimate that such a method permits the extraction of a layer with a thickness of three to four cobbles. As in the dump of this exploitation, no knapping debris have been recovered, it is assumed that the foliates have been used in the extraction activity.

In a much later period, other people came for cobble extraction on the same spot. As the earlier pits may still have been visible in the landscape, it was easy for them to start in such pits, eventually evacuating the aeolian deposits. During this second phase, they had a tendency to deepen the earlier pits. An increase in depth was obtained by extraction with a vertical front. The red matrix material was dumped nearby in the already exploited area. The pits of this second phase were generally not very large. On the floor of these pits and embedded in light yellowish brown aeolian sands, many concentrations of flint artifacts could be recovered. These artifacts seems to be the result from a production of elongated flakes and blades according to a evolved Levallois-related blade technology.

Sector 91/02

In sector 91/02, we excavated resecting pits and an undeep cobble layer belonging to at least three different activity periods. During the first and earliest, bifacial artifacts and foliates have been produced. However, no extraction features from this period have been discovered. During the second activity period, extraction of cobbles took place in pits and led to the production of flakes, performed according to the Nubian method (fig. 7). It seems that still some foliates are connected with this stage. In a third and last activity period, extraction also proceeded by pits and the production of elongated flakes and blades has been achieved by a Levallois-related technology.

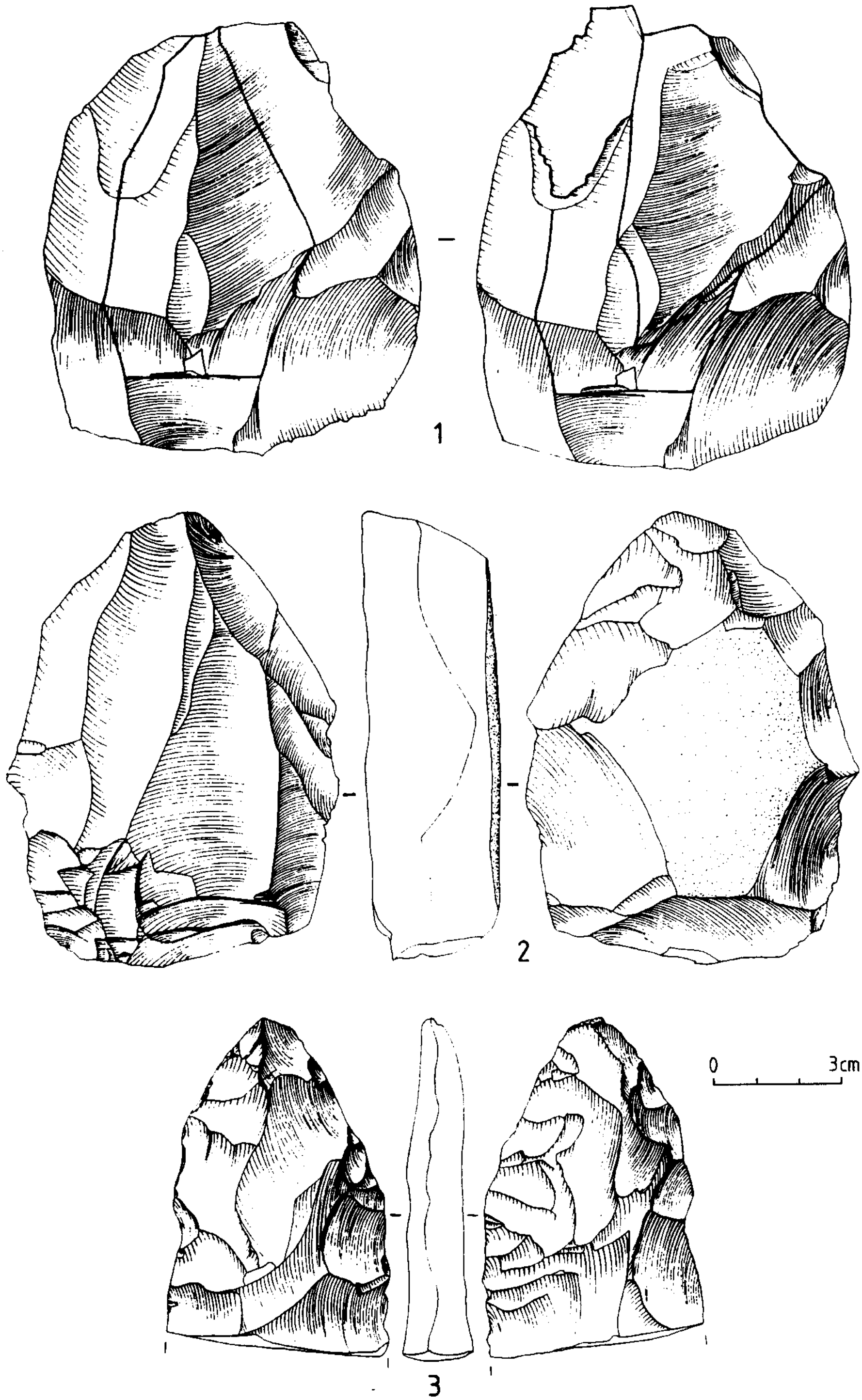

Figure 7.—Taramsa Hill, sector 91/02: artifacts from the earlier extraction pit (extraction phase 4).

We have no idea how long the hiatus between the three stages could have been, but we presume that an important time duration elapsed between the stage two and three. This can also be presumed from the fact that apparently for each of these extraction stages, the previous pits have been ignored, probably because they were not visible any more.

Sector 89/02

In this sector, 10 m north of 91/02, an oval pit has been excavated without arriving at a full understanding of the extraction procedures. In the infilling aeolian sand, which has been sampled for optical dating, an important archaeological material, produced by a Levallois-related technology for large flakes and blades, has been collected.

Sector 91/03

In this sector a complex system of extraction trenches and knapping areas has been found. In this description we will try to present a possible reconstruction of the prehistoric activities on the spot but we are aware that other scenarios might be conceived.

Activities by prehistoric people on the east side of the Taramsa hill resulted in the creation of a 10 to 20 cm thick cobble deposit in which some bifacially worked artifacts and debitage of Nubian technique have been recovered (fig. 8). Due to slope evolution or human activity these artifacts have been dispersed all over the top of the weathered cobble deposit. Some of these artifacts might have rested for long time (some thousands of years?) on the surface of the hill acquiring a dark patination. Later, a rather uniform, about 0.2 m thick aeolian sand layer has been accumulated on the surface of the sector. This layer of aeolian sand is slightly consolidated.

Afterwards, man came back and exploited the area. For that purpose he opened an extraction trench (fig. 9: 3.1) starting from the steeper part of the eastern hillslope. He extracted the cobbles in a vertical front and started a knapping atelier (fig. 9: Cc19, 23) on top of the original surface, just north of the trench. As the extraction proceeded, the rather irregular trench (fig. 9: 3.1, 3.2 and 3.7) was extended upslope to the west. We may presume that the knapping atelier developed in the same direction, still in direct contact with the extraction trench.

Meanwhile, a new extraction trench (fig. 9: 3.4) had been created on the eastern slope. This trench was also lengthened in an upslope direction. Extracting the cobbles from this trench, prehistoric people destroyed part of the earlier knapping atelier (Cc19, 23). It is not clear where the extracted cobbles of this second trench have been knapped. Finally an opening was created from 3.3 towards another trench (fig. 8: 3.5 and 3.6), which may also have started from downslope. Once the extraction in 3.3 was finished, we presume that still some extraction took place in 3.7. The cobbles which have been considered as being not suited for knapping purposes have been dumped in the pit 3.3. The dumped cobbles form a fan with the apex in the west, suggesting that these cobbles were dumped by people extracting somewhere more to the west. Finally aeolian sands covered the whole area and made all structures invisible from the surface. During this aeolian accumulation still some knapping debris have been dumped, indicating that the aeolian accumulation took place when prehistoric man was still active in the sector. Once man left the sector, some more aeolian sand was deposited, slope evolution

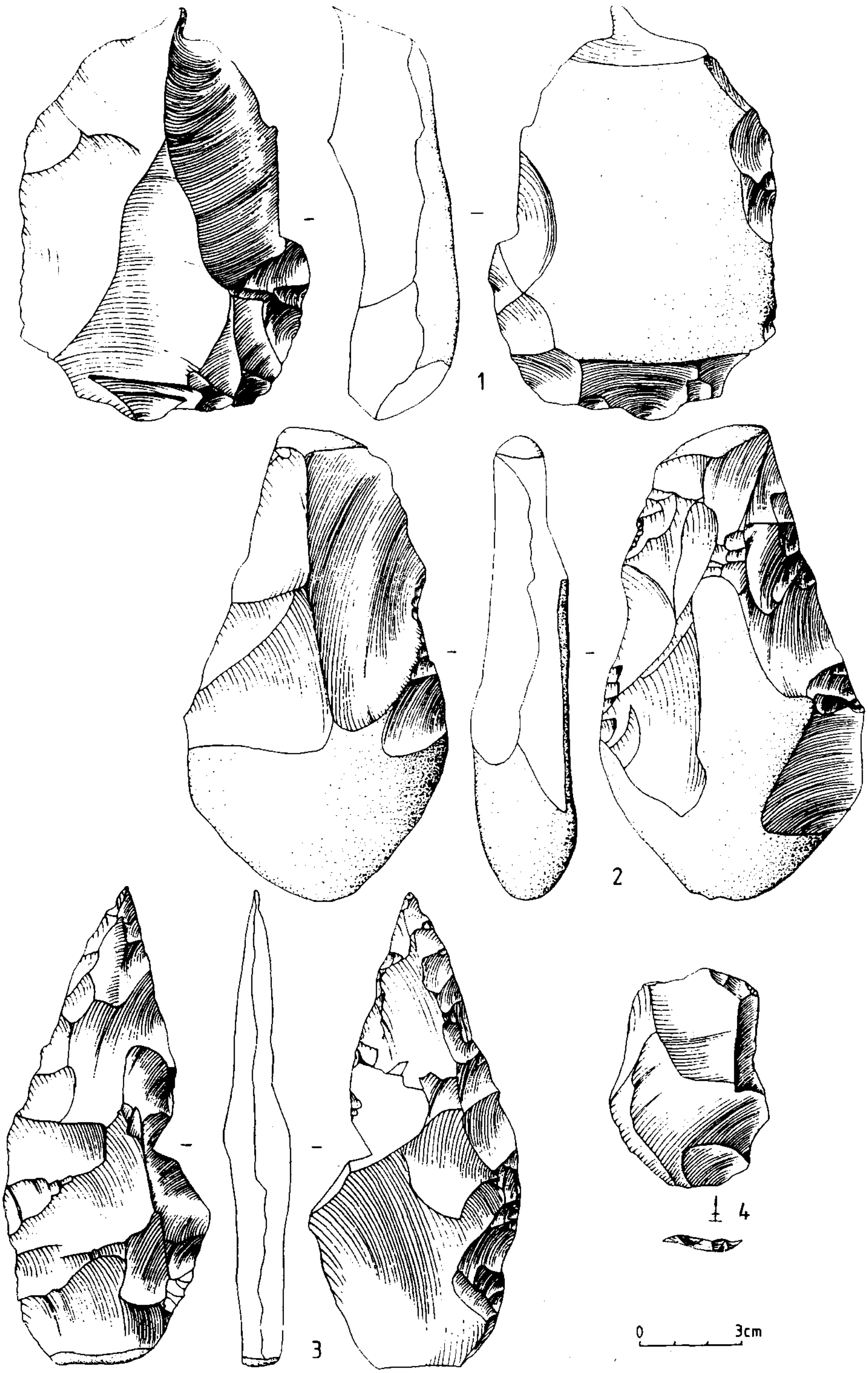

Figure 8.—Taramsa Hill, sector 91/03: artifacts from the gravel deposit (extraction phase 1).

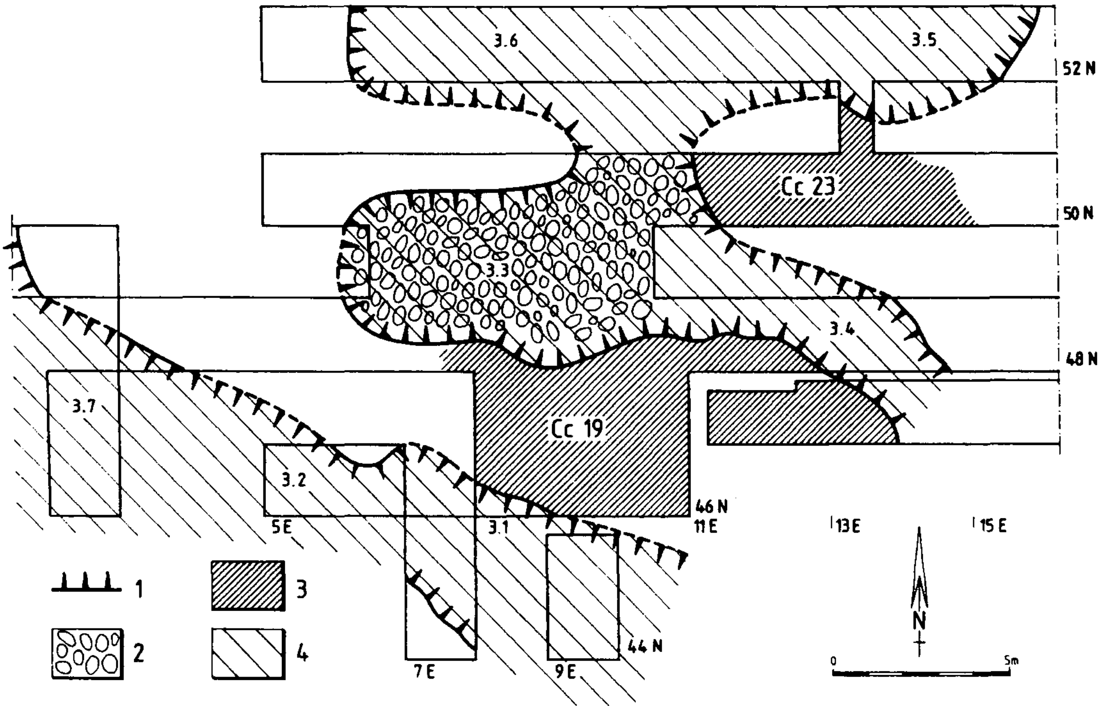

Figure 9.—Taramsa Hill, sector 91/03: lay out of the extraction trenches. 1: trench side wall; 2: cobble fan; 3: knapping atelier; 4: extracted area.

took place, forming a desert pavement and also an incipient soil on top of the present surface.

In this sector all knapping activities have been performed by the large flakes and blades producing evolved Levallois-related technology (fig. 10).

Sector 91/05

The in situ assemblage of sector 91/05 has been collected in stratified position within the aeolian sand sheet on the lee slope of the hill. It is characterized by the classical Levallois technology. Stilistically, it is reminiscent of the K-group Levallois technology, as it occurs in assemblages such as Nazlet Khater 2 (Van Peer and Vermeersch 1990). Therefore, we presently estimate that this sector is relatively older as compared to the sectors characterized by the evolved Levallois-related technology for elongated flakes and blades.

Sector 89/03

A small excavation explored a prehistoric dump, in an extraction structure, which reaches the original cobbles at a depth of 1.5 m. The lower unit is composed of chert boulders in a red matrix of quartz-rich granulous sands. The middle unit is a light yellowish brown sandy dump, with an undeep depression. In this depression an important artifact concentration mixed with

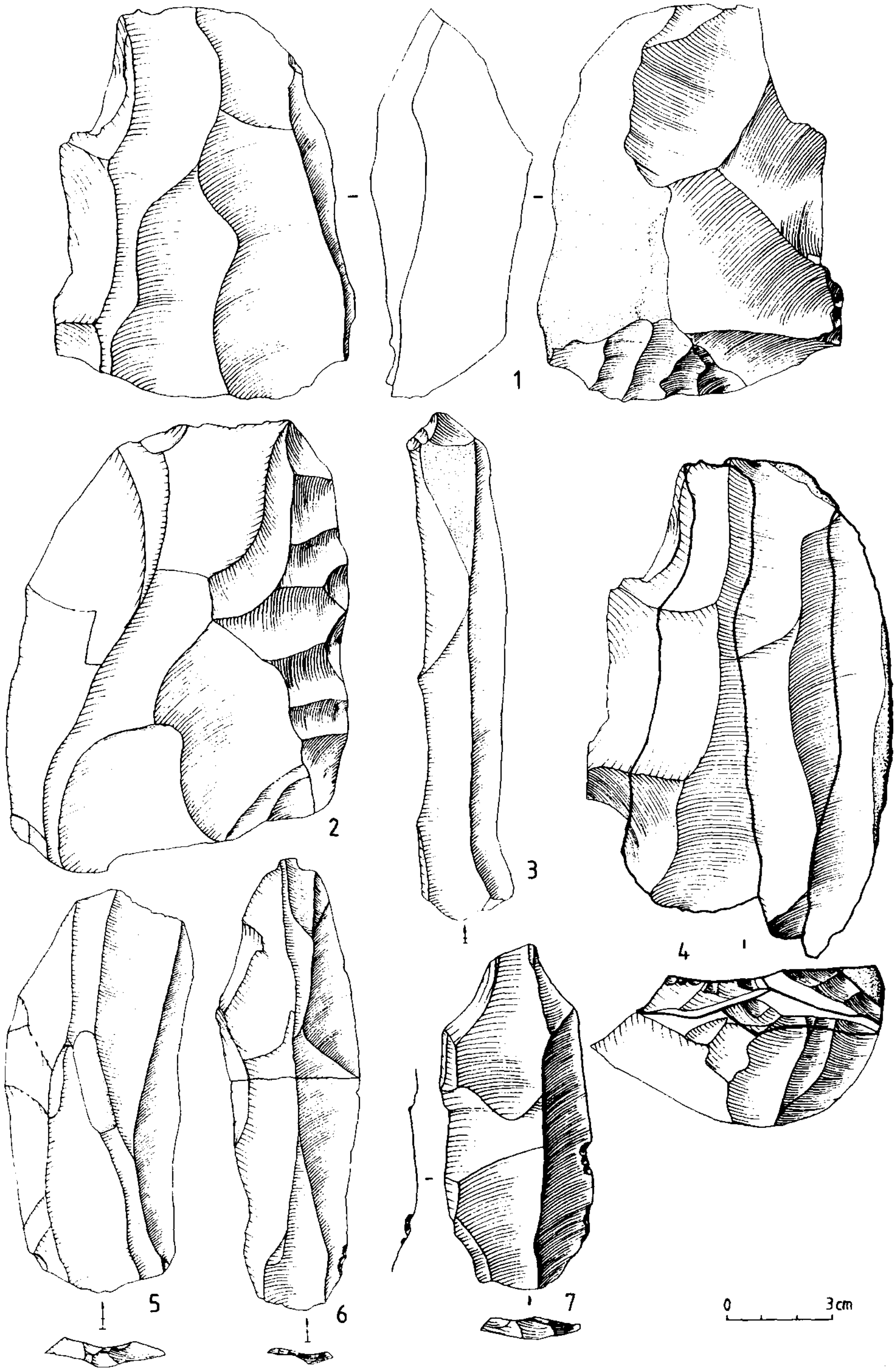

Figure 10.—Taramsa Hill, sector 91/03: artifacts from the atelier Cc19 (extraction phase 5).

some charcoal fragments, which have been dated, were collected. The upper unit of the fill is a layer of aeolian sands which contain numerous scattered chert cobbles. The artifacts, at the contact between the middle and upper unit, have been produced by the evolved Levallois-related technology for elongated flakes and blades.

Palaeolithic activity phases

The presence of Palaeolithic man on the Taramsa Hill is attested by different technologies within the exploitation systems and by different artifact assemblages. They were spread over a long period of time. We can differentiate several phases:

ACTIVITY PHASE 1: The oldest artifacts are represented by the archaeological material situated at the base of the consolidated aeolian sands in sector 91/02 and 91/03. They consists of cores and flakes produced with the Nubian technique but also of foliates and bifaces. No extraction structures could be directly related to these materials.

ACTIVITY PHASE 2: In this phase, which is attested in the Sector 91/01 excavations, an extraction activity is related to artifacts such as foliates and bifaces. The presence of these artifacts could suggest the possibility of a contemporaneity between Activity Phase 1 and 2 but in phase 2 no Nubian material has been recovered.

ACTIVITY PHASE 3: From this phase we recovered only a single atelier, stratified within the aeolian sands on the lee side of the hill (Sector 91/05). We have no real arguments to place this phase in a younger time period than the previous phases except, may be, the fact that the artifacts do not exhibit a reddish patina. It is important to note the presence of the classical Levallois technology, lacking in the other sectors. On technological ground one can provisionally suggest that this technology is older than the classical Levallois technology recovered from Nazlet Safaha 1 and 2.

ACTIVITY PHASE 4: This activity phase is attested by extraction pits in Sector 91/02 and 89/01, both of them filled by light yellowish brown aeolian sands. The archaeological material is of a Nubian technology but comprises, in Sector 91/02, also some fine foliates.

ACTIVITY PHASE 5: The youngest material is always related to pits which have been filled by light yellowish brown aeolian sands. The artifacts have been produced by the evolved Levallois-related technology for elongated flakes and blades. Even if only a small surface on the Taramsa Hill has been explored by our excavations (Sector 91/01, 91/02, 89/02, 91/03, 89/03 and other sectors which have not been discussed in this contribution, we have the impression that this phase is the best represented.

Extraction system

As the chert cobbles for artifact production were fully available at the Taramsa Hill, it appears logic to suppose that, during the five different activity phases, prehistoric man took the raw material from the hill. As we excavated only a very small part of the hill, our knowledge of the chert procurement during the different activity phases is restricted. In a review paper on the palaeolithic chert exploitation in the Nile valley, Vermeersch *et alii* (1990) distinguished four main categories of raw material procurement: incidental collecting, intensive collecting, systematic quarrying and underground mining. For the Taramsa Hill there is no evidence for underground mining.

Systematic quarrying

Evidences for systematic quarrying have been found for the activity phases 2, 4 and 5.

On the hill top, systematic quarrying is made clear from Sector 91/01 during the activity phase 2. Here, the extraction activity proceeds from the floor of undeep pits, with some kind of a horizontal extraction front. It seems that no light yellowish brown aeolian sand is associated with this phase. Artifacts seems to be related to rubified dump deposits. Suitable cobbles have been extracted whereas the matrix sand has been left at the bottom of the pits.

Another extraction strategy has been utilized in Sector 89/03, 91/01 (activity phase 5), 91/02 (activity phase 4 and 5) and 91/06. The areas of cobble extraction from the activity phases 4 and 5 are easily recognizable as the pits are always filled with dump and with light yellowish brown aeolian sands. During the activity phase 4, the extractors apparently worked on the hill top, such as in Sector 91/02 and Sector 89/01.

During the activity phase 5, several extraction strategies have been utilized such as trenching from the eastern hillslope upwards. These trenches (Sector 91/03) have an irregular lay out and can be compared with the trenches at Nazlet Safaha (Vermeersch *et alii* 1990). Artifact production is in close areal relationship with the cobble extraction.

The different systematic quarrying activities on the hill have several common characteristics. The extraction approach consisted in making pits and trenches. Several pits or trenches can coalesce to form larger pit systems (Sector 91/01 and 91/03). These exploitation systems were simple but well adapted to the natural chert occurrences. As the chert cobbles were not consolidated, extraction tools could be simple, such as gazelle horns, shovels and baskets. As no organic material has been preserved, no such tools have been recovered. It is striking that not a single stone hammer has been recovered, a fact probably also related to the unconsolidated nature of the cobble deposit. At least during the activity phases 4 and 5, extraction dump has been deposited in already exploited pits and debitage activity has been performed nearby the active extraction area. As far as we can understand, very large areas of the hill have been exploited.

Incidental and intensive collecting

As no extraction structures could be connected with the artifacts recovered from Sector 91/02, 91/03 (activity phase 1) and Sector 91/05, we might presume that the chert has been collected unsystematically from the hill surface or that the extraction structures were destroyed by later prehistoric activity or have not yet been recovered by our excavations.

Middle Palaeolithic artifact production

It is obvious that all the different artifact concentrations recovered from Nazlet Safaha and Taramsa Hill so far belong to the Middle Palaeolithic (Van Peer and Vermeersch 1990). The Levallois or Levallois-related technological characteristics of the lithics show this clearly.

Early Middle Palaeolithic

As far as we know for the moment, activity phases 1 and 2 are the oldest represented at Taramsa Hill. Similar material is absent from Nazlet Safaha. Most of this lithic material consists of waste material, *i.e.* cores and flakes, but some tools were present. Among these were handaxes and foliates. Reduction techniques includes the Nubian method for activity phase 1 but is not yet known for activity phase 2. In general, the lithics of these phases seem to be rather similar to the Nubian Middle Palaeolithic which is known from Nubia (Guichard and Guichard 1965 and 1968).

Mid-Middle Palaeolithic

Activity phases 3 and 4 from Taramsa Hill belong to the Mid-Middle Palaeolithic. In the Mid-Middle Palaeolithic two technological groups have been differentiated, the first one (N-group) showing an extensive use of the Nubian 1 method alongside the classic Levallois method, the second one (K-group) almost completely lacking this Nubian 1 method (Van Peer 1991). Activity phase 3 from Taramsa Hill can be attributed to the K-group. Activity phase 4 from Taramsa Hill can be attributed the N-group.

Late Middle Palaeolithic

Nazlet Safaha 1 and 2 and most of the excavated flint concentrations at Taramsa Hill, those from activity phase 5, belong to the Late Middle Palaeolithic. Indeed, some formal traits of Levallois flakes at Nazlet Safaha, notably the intensive distal preparation and the butt preparation en chapeau de gendarme suggest an evolved stage. The presence of an evolved Levallois-related technology for the production of elongated flakes and blades (Van Peer 1992) at Taramsa Hill suggest evolutionary trends in the technological characteristics which may foreshadow Upper Palaeolithic techniques.

Upper Palaeolithic Mining

In order to position the Middle Paleolithic extraction sites, it is of interest to compare them with the Upper Palaeolithic mining site at Nazlet Khater 4 (Vermeersch *et alii* 1990). At this site near Tahta, the gravel deposit mined by prehistoric man is intercalated between an upper layer of coarse sand and silt and a lower layer of greenish silt. Three types of Upper Palaeolithic features are distinguished: 1) Ditches with a width of *ca.* 1 m and a depth of *ca.* 2 m. All original gravel deposits from these ditches were removed. 2) Vertical shafts, dug down to a depth of 2 m through the whole sequence and ending on top of the greenish silts. Sometimes the shafts were enlarged at their base to form bell pits. Exploitation of this type sometimes involved the removal of the top layer of the greenish silts over some 0.5 m. 3) Underground galleries were cut from the ditch walls or from the bottom of the bell pits. Proceeding from a central bell pit, the gravels were exploited over several metres, in often interconnected horizontal subterranean galleries. The largest galleries extend for more than 10 m^2. Some picks have been recovered from the horizontal gallery fillings. They are gazelle and hartebeest horns of which the distal extremity is worn. Rough extraction activities were performed with heavy hammerstones, of which numerous examples have been found. The extracted flat elongated chert cobbles were used to produce large quantities of artifacts.

Reduction strategies are fully Upper Palaeolithic, no Levallois technology being present. The best represented core type is the single platform core for blade production.

Chronology

The Nazlet Safaha site is situated in the downslope area of a large drainage basin. Nazlet Khater is in a similar geomorphic position but the basin is much more restricted. The absence in the prehistoric ditch fillings of waterlaid deposits or erosional features, in addition to the evidence of aeolian activity, suggests that climate during the exploitation periods at both sites was very arid with very few high amplitude events due to running water. Such climate could have been present in the Nile valley at least since 60,000 years ago (Paulissen and Vermeersch 1989).

We have attempted to constrain the absolute chronolgy of the excavations by dating both the available charcoal fragments and aeolian sand infills using the radiocarbon and optical dating methods, respectively. Each are briefly discussed separately below.

Radiocarbon Dating

In relation with the Middle Palaeolithic industries from our sites we have, till now, four radiocarbon dates, one traditional and three AMS [3]. Others are in progress.

At Nazlet Khater 2 (Vermeersch *et alii* 1990) charcoal associated with the material from the K-group industry of the Mid-Middle Palaeolithic provided a 14C-date of more than 35,700 (GrN-10578) radiocarbon years.

A 14C-date on charcoal from sector 89/03 at Taramsa Hill provided following result: 38,100 ± 1,400 radiocarbon years BP (OxA-2602). It is associated with material attributed to the evolved Levallois-related technology for elongated flakes and blades from the Late Middle Palaeolithic.

A charcoal sample collected from a depth of 0.50 m in the prehistoric infillings at Nazlet Safaha 1 was 14C-dated to 37,200 ± 1,300 radiocarbon years BP (OxA-2601). It is associated with an evolved stage of the Late Middle Palaeolithic.

Another sample, collected from a depth of 0.45 m in the prehistoric infillings at the same sector, provided a 14C-date of 6,680 ± 80 BP radiocarbon years (OxA-1901). It appears that this latter sample was intrusive as it clearly refers to the Holocene wet period. Indeed, we were able to locate several root fragments which all belong to the Holocene wet period (Vermeersch *et alii* 1992).

In relation with the Upper Palaeolithic period at Nazlet Khater 4, nine 14C-dates on charcoal suggest that the mining activities can be dated somewhere between 35,000 and 30,000 radiocarbon years BP (table 1). An additional date at Nazlet Khater 7 gave a similar result.

Optical Dating

Optical dating is a recently developed radiation exposure based luminescence dating method which allows the dating of the time which has elapsed since a sediment was last

[3] We like to thank Rupert A. Housley from the Research Laboratory for Archaeology and the History of Art, Accelerator Unit, Oxford, for his collaboration.

exposed to daylight (Huntley *et alii* 1985, Smith *et alii* 1986 and 1991). Details of the technique and its application to Middle Palaeolithic chert mining sites in the Nile Valley will be discussed in a forthcoming article (Stokes *et alii* in prep.). The key factors which make the techniques applicable relate both to the aeolian nature of the infill materials and the inferred rapid (effectively instantaneous) infilling of the excavation trenches. The method has been demonstrated to produce last interglacial and younger ages in good agreement with high precision uranium series and amino acid racemisation age estimates in arid areas in the adjacent Western Desert (*e.g.* Stokes in press).

Table 1.—Radiocarbon Dates for Middle and Early Upper Palaeolithic Occurrences.

Site	*Period*	*Dating*		
NK 4	Early Upper Palaeo	14C	30,360 ± 2310	Lv-1139D
NK 4	Early Upper Palaeo	14C	31,980 ± 2850	Lv-1141D
NK 4	Early Upper Palaeo	14C	31,320 ± 1990	Lv-1142)
NK 4	Early Upper Palaeo	14C	32,100 ± 700	GrN-11297
NK 4	Early Upper Palaeo	14C	33,100 ± 650	GrN-11299
NK 4	Early Upper Palaeo	14C	33,280 ± 1280	Lv-1140
NK 4	Early Upper Palaeo	14C	33,650 ± 450	GrN-11301
NK 7	Early Upper Palaeo	14C	34,900 ± 500	GrN-14910
NK 4	Early Upper Palaeo	14C	34,950 ± 600	GrN-1300
NK 4	Early Upper Palaeo	14C	35,100 ± 1100	GrN-11296
NK 2	Mid-Mid. Pal., K-group	14C	>35,700	GrN-10578
SAFAHA 1	Late Mid. Pal., evolv. Lev.	AMS	37,200 ± 1300	OxA-2601
TARAMSA	Late Mid Pal., Lev.-rel.	AMS	38,100 ± 1400	OxA-2602

At the time of writing 3 dates were finalised on samples extracted from Taramsa Hill sector 89/02 (sample 1 and 2) and sector 89/01 (sample 3). The samples 1 and 2 were associated with the evolved Levallois-related technology for elongated flakes and blades, whereas sample 3 was associated with an N-group industry.

Two methods of optical date assesment (table 2) and the good agreement between the optical dates of sample 1 and 2, originating from a single infill, suggest a considerable degree of internal consistency and reliability for the samples dated thus far. Given the luminescence characterstics and relative age of the samples we favour the age estimates calculated using the regeneration method. The dates suggest timing of trench excavation at approximately 27 ka for sector 89/02 and 42 ka for sector 89/01.

For the moment it remains difficult to relate our ideas on the technological evolution of the Middle Palaeolithic with the available chronological data. But we hope that the optical dates, together with the conventional 14C and the AMS dates, will be enhanced with other

Table 2.—Provisional Optical Dates for aeolian sand infills from Taramsa Hill.

	Age (ka)[4]	
Sample	*Additive Dose Method*	*Regeneration Method*
ME 40/1 (89/02)	24.4 ± 3.9	26.0 ± 2.6
ME 40/2 (89/02)	23.7 ± 3.1	28.7 ± 4.2
ME 40/3 (89/03)	31.8 ± 4.4	42.1 ± 3.5

[4] For details of age assessment techniques see Aitken (1985).

dates, optical and AMS. Especially for the understanding of the Late Middle Palaeolithic, we need more dates to assess or reject the rather late chronological position (24-28 ka) for some of these industries. We hope to finally arrive at a better understanding of the chronological position of the Middle Palaeolithic phases and the related extraction technologies.

Conclusions

Beside the Upper Palaeolithic mining site at Nazlet Khater, also Middle Palaeolithic mining sites occur in the Nile valley. This conclusion is based on the evidences found at Nazlet Safaha and Taramsa Hill. It is clear that chert extraction in an organized way is much older than generally thought. Extraction features can be associated with the Early, the Mid-Middle, the Late Middle Palaeolithic and the early Upper Palaeolithic. Unfortunately a good chronology is still missing but there is no doubt that at least some of the features are older than 38,000 radiocarbon years. The recognition and location of such deposits by Middle Palaeolithic man suggests that he had some experience in raw material surveys. He was, indeed, already well aware of the lithological and petrographical potentialities of buried cobble beds and was able to organize a systematic, albeit irregular, exploitation. The sites have been utilized only for chert procurement and blank production. Sites to where the blanks have been exported are not yet discovered but are presumably located in the Nile valley and may have been eroded or covered by recent alluvium.

The Upper Palaeolithic open air extraction system differs from the Middle Palaeolithic one in that the former was more regularly planned. The Upper Palaeolithic underground mining system with bell pits and subterranean galleries represents a total new strategy.

References

Aitken, M. J. (1985). *Thermoluminescence Dating.* Academic Press.

Guichard, J. and Guichard, G. (1965). The Early and Middle Palaeolithic of Nubia: A preliminary report. In Wendorf, F. (ed.): *Contributions to the prehistory of Nubia*, Dallas, 57-116.

Guichard, J. and Guichard, G. (1968). Contributions to the study of the Early and Middle Paleolithic of Nubia. In Wendorf, F. (ed.): *The Prehistory of Nubia*, Dallas, 57-166.

Huntley, D. J., Godfrey-Smith, D. I. and Thewalf, M. L. W. (1985). Optical Dating of Sediments. *Nature* 313, 105-107.

Paulissen, E. and Vermeersch, P. M. (1987). Earth, man and climate in the Egyptian Nile Valley during the Pleistocene. In Close, A. E. (ed.): *Prehistory of arid North Africa*, Dallas, 29-68.

Smith, B. W., Aitken, M. J., Rhodes, E. J., Robinson, P. D. and Geldard, D. M. (1986). Optical Dating: Methodological Aspects. *Radiation Protection Dosimetry* 17, 229-233.

Smith, B. W., Rhodes, E. J., Stokes, S. and Spoorer, N. A. (1991). Optical Dating of Quartz. *Radiation Protection Dosimetry* 34 (1/4), 75-78.

Stokes, S. (in press). Optical Dating of Sediment Samples from Bir Tarfawi and Bir Sahara: An initial Report. In Wendorf, F., Schild, R. and Close, A. E. (eds.): *The Middle Palaeolithic in the Egyptian Sahara during the Last Interglacial*, S.M.U. Press, Dallas.

Stokes, S., Vermeersch, P. M., Paulisssen, E. and Van Peer, P. (in preparation). Chronology of Middle Palaeolithic Chert Extraction in the Nile Valley.

Van Peer, P. (1991). Interassemblage Variability and Levallois Styles: The Case of the Northern African Middle Palaeolithic. *Journal of Anthropological Archaeology* 10, 107-151.

Van Peer, P. (1992). *The Levallois reduction strategy.* Prehistory Press, Madison.

Van Peer, P. and Vermeersch, P. M. (1990). Middle to Upper Palaeolithic transition: The evidence for the Nile

Valley. In Mellars, P. M. and Stringer, C. (ed.): *The emergence of modern humans: An archaeological perspective*, Edinburgh, 139-159.

Vermeersch, P. M., Paulissen, E., Gijselings, G. and Jansen, J. (1986). Middle Palaeolithic chert exploitation pits near Qena (Upper Egypt). *Paleorient* 12, 61-65.

Vermeersch, P. M., Paulissen, E., and Van Peer, P. (1990). Palaeolithic chert exploitation in the limestone stretch of the Egyptian Nile Valley. *The African Archaeological Review* 8, 77-102.

Vermeersch, P. M., Paulissen E., Huyge, D., Neumann, K., Van Neer, W. and Van Peer, P. (1992). Predynastic Hearths in Upper Egypt. In Friedman, R. and Adams, B. (eds.): *The Followers of Horus,* Oxbow Monograph 20, Oxford, 163-172.