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Palaeolithic chert quarrying and mining in Egypt

Chert mines are among the first structures of prehistoric man's activities to have been observed. The economical changes and the population expansion accompanying the spread of early agriculture in the Near East and Europe constitute a real technical revolution. According to G. Smolla (1987), flint mining could have been an especially important part of this process, and indeed, until

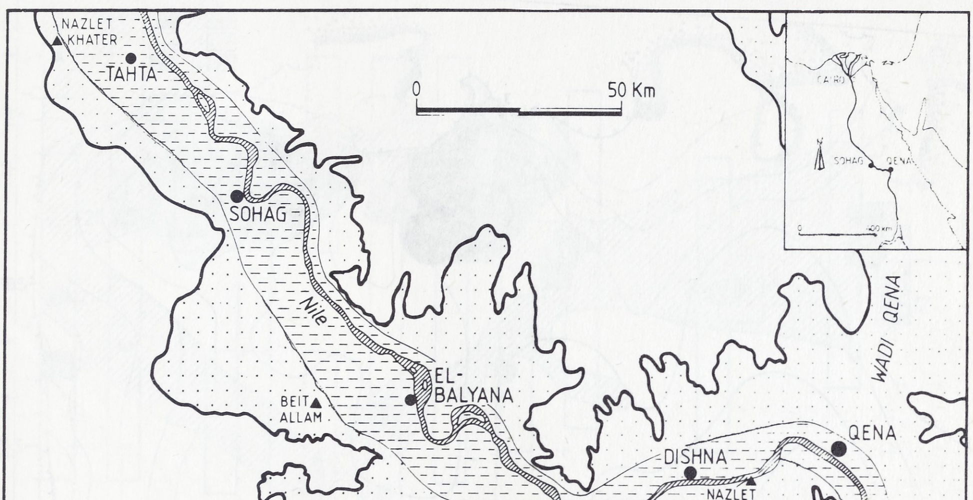

Fig. 1. Situation map of the sites, floodplain (shaded area) and lower desert (dotted area).

some years ago, all chert mining sites reported in the literature, were younger than 12,000 years, most of them being confined to the period of 6,000 to 4,000 years ago (Weisgerber, Slotta and Weiner 1980).

Research by the Belgian Middle Egypt Prehistoric Project of Leuven University since 1980 led to the discovery of two important Palaeolithic chert exploitation areas, one at Nazlet Safaha, near Qena, and another at Nazlet Khater, near Tahta, both in southern Egypt (Fig. 1).

Middle Palaeolithic quarrying

The area of Nazlet Safaha is situated on the west bank of the Nile, downstream of Dandara Temple (Vermeersch *et al.* 1986. In this publication the site has been erroneously named Nazlet Sabaha). It is located near the river Nile, on a Nile cobble terrace remnant, which is still quarried for gravel in many small pits. The bars of the former channel deposits, with their top at about 7 m above the Nile floodplain, are 2 to 3 m thick and rest disconformably on very coarse Nile sands. The terrace deposits contain mainly metamorphous and eruptive, but also quartz and chert cobbles with a diameter of up to 0.2 m. The matrix is composed of pebbles and coarse sands. The chert cobbles are round or ellipsoidal. The cobble deposit is overlain by medium sands of variable thickness (about 0.5 m).

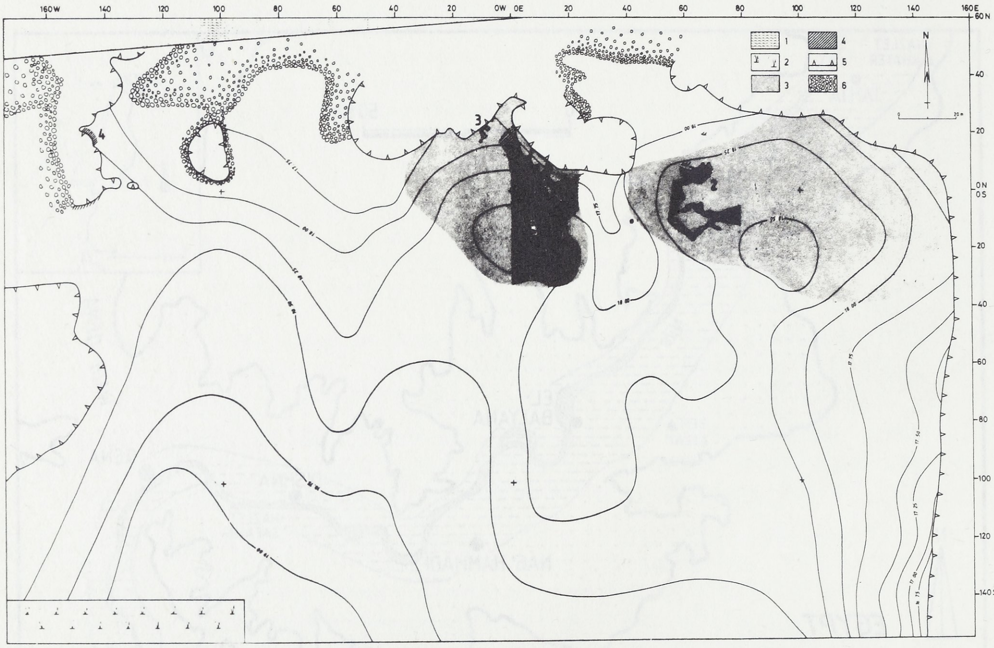

Fig. 2. Map of the Nazlet Safaha region with sites 1, 2, 3 and 4;
1: abandoned Maghar canal; 2: cultivated area; 3: man-made desert pavement; 4: area exploited by Middle Palaeolithic man as reconstructed in our excavations; 5: recent quarry front; 6: recent quarry dump.

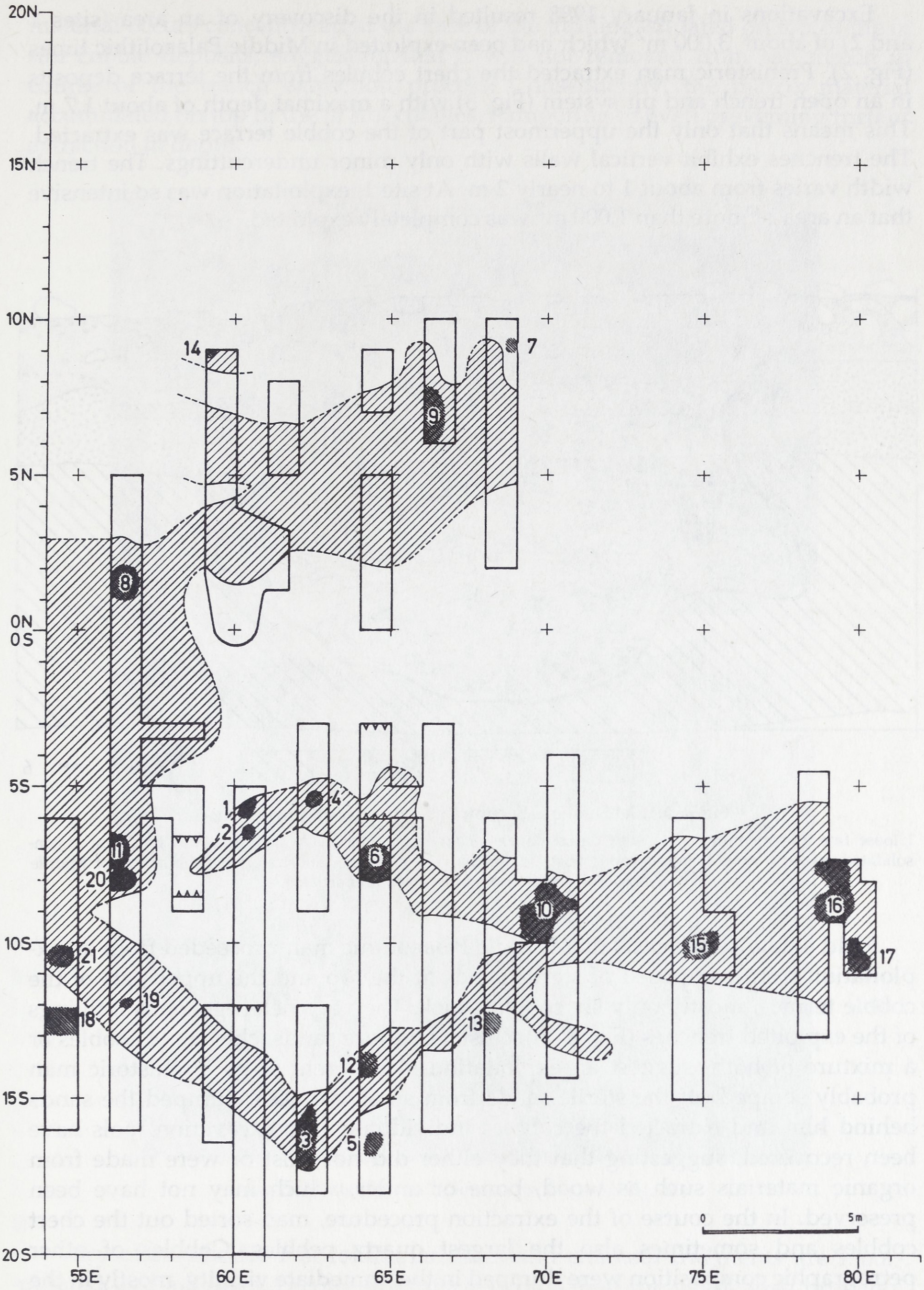

Fig. 3. Nazlet Safaha 2. Middle Palaeolithic chert exploitation trenches (shaded area) with position of chipped chert artifact concentrations (densely shaded area).

Excavations in January 1988 resulted in the discovery of an area (sites 1 and 2) of about 3,000 m^2 which had been exploited in Middle Palaeolithic times (Fig. 2). Prehistoric man extracted the chert cobbles from the terrace deposits in an open trench and pit system (Fig. 3) with a maximal depth of about 1.7 m. This means that only the uppermost part of the cobble terrace was extracted. The trenches exhibit vertical walls with only minor undercuttings. The trench width varies from about 1 to nearly 2 m. At site 1, exploitation was so intensive that an area of more than 1,000 m^2 was completely exploited.

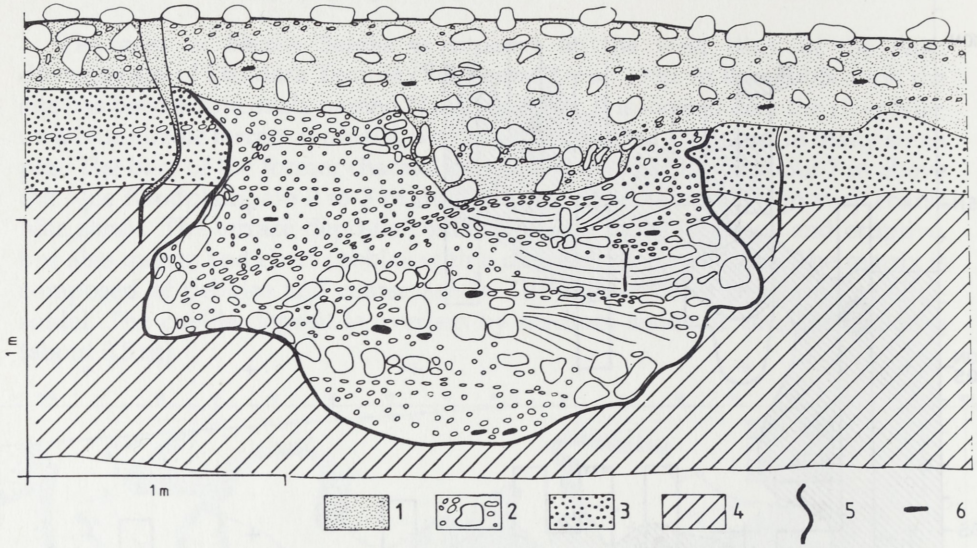

Fig. 4. Nazlet Safaha 2. Section through exploitation trench;

1: loose fine and medium sands with desert pavement on top; 2: man-made heterogeneous infillings; 3: consolidated medium granuliferous sands (substrate); 4: Nile cobble terrace (substrate); 5: delimitation of Middle Palaeolithic trench; 6: Middle Palaeolithic artifacts.

Field evidence suggests that Middle Palaeolithic man proceeded from an exploitation front composed of sterile sands at the top and the upper part of the cobble terrace, mostly only six cobbles thick. The very heterogeneous infillings of the exploited trenches (Fig. 4 - 5), clusters of pure sands, clusters of cobbles or a mixture of both, suggest 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 may not have 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 trench itself. Within the anthropogenic infillings of the prehistoric trenches, pure matrix material from the terrace deposits was rare. It seems that the matrix material occurs concentrated at the base of the infilling, situated on top of the *in situ* cobble deposits, suggesting that it was not removed from the trench in course of the trench extraction process. Consequently, the matrix material accumulated on top of the *in situ* cobbles, hampering or even preventing further extraction in depth.

Fig. 5. Nazlet Safaha 2. Similar profile as in Fig. 4.

Very often Middle Palaeolithic artifacts and charcoal fragments are incorporated in the fillings. During prehistoric exploitation the whole area probably displayed an irregular topography with many pits and low dump-heaps. Some of the excavated pits contained an accumulation of large quantities of chipped chert artifacts. Refitting together many of these artifacts indicates that prehistoric man has transformed the chert cobbles into prehistoric artifacts in or in the vicinity of the quarrying trenches. In the course of the extraction procedure aeolian sand was blown into certain exploitation pits, causing some of the artifact concentrations to be stratified in aeolian deposits. Absence of running water deposits or erosional features in the trench fillings and the aeolian sands suggests that climate during the exploitation periods was hyperarid.

After the abandonment of the area, the exploited surface was littered with cobbles lying in an unnatural position above the sterile sands. Since then the whole surface has been levelled off by denudation and an aeolian cover has filled the pits. Finally, a desert pavement, bearing a dark desert varnish, has developed over the whole surface, covering filled pits, aeolian deposits and dump materials (Fig. 2). This desert pavement is man-made as it is mainly composed of cobbles extracted by prehistoric man and of artifacts. Our excavations at the outer edge of the desert pavement zone indicate that its extension is a very precise indicator of the delimitation of the prehistoric exploitation area.

Living structures or hearths have not been recognized. In some places, however, charcoal could be observed in relation to some of the chert artifact accumulations. As a whole, the quarrying site gives the impression of being rather unstructured, probably as a result of intermittent, non-continuous exploitation.

Original discovery by prehistoric man and access to the cobble deposit is probably due to the fact that the river Nile was already, in those former times, in present nearby position, eroding the terrace deposits. 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.

The lithic artifacts recovered in and outside the prehistoric dump deposits at site 1 and 2 mainly represent a Levallois technology. Retouched tools are nearly absent. As far as we know at present, the Levallois technology belongs to the classic Levallois (K) group as defined by van Peer and Vermeersch (1990). The occurrence of Nubian technique, absent at sites 1 and 2, was observed at site 4. At the latter site, however, excavations have not yet been undertaken. The presence at site 1, 2 and 4, of Levallois or Nubian technology exclusively, points to a Middle Palaeolithic age of the exploitation.

Similar artifacts, belonging to the classical Levallois group, have been recorded at other sites in the Egyptian Nile Valley, such as Nazlet Khater-2 and Beit Allam (Vermeersch, Paulissen and van Peer 1990). These sites are considered older than 60,000 years (Paulissen, Vermeersch 1987; 1989). Taking into account that the site of Nazlet Safaha is coeval with an hyperarid climate, it is probably of somewhat younger age and we estimate that it can be placed around 50,000 years ago. Accelerator datings of the dispersed charcoal in the aeolian sands and in the infillings are in progress.

Chert exploitation, where no chert was visible at the surface, testifies that Middle Palaeolithic man already had the intellectual capacity of geological reasoning. Indeed, he was able to extrapolate what he observed during the initial extraction: the fact that exploitable cobbles were still present under a thin cover of sterile sands. Middle Palaeolithic exploitation techniques were simple but well adapted to the chert occurrence in fluviatile deposits.

A detailed survey of the terrace remnants and along all recent quarry fronts in the Nazlet Safaha area revealed the presence of other exploitation sites. Quarrying activity lasted probably over a long period of time, starting at least in the Middle Palaeolithic but probably continuing over some ten thousands of years into the Upper and Late Palaeolithic periods. Indeed, although we did not perform excavations, surface collection and inspection of prehistoric extraction pits, visible in recent quarries, suggest the presence of younger cobble exploitation sites, utilizing the same quarrying methods as Middle Palaeolithic man. At site 3 (Fig. 5), the extracted chert cobbles have been worked for flake production without the utilization of Levallois technique. Site 5, some 200 m east of site 2, is characterized by numerous double platform cores which, by using a crest preparation technique, have been flaked for blades. Here also, Levallois technique is lacking. Debitage techniques at the latter site are characteristic for the Upper and Late Palaeolithic period.

All these quarrying activities produced a landscape where most of the area with a thin sand cover had been exploited by prehistoric man.

Upper Palaeolithic mining

Some 150 km to the north of Nazlet Safaha, at Nazlet Khater near Tahta (Fig. 1), we excavated a chert mining site with an exploitation system of trenches, vertical shafts and horizontal subterranean galleries, C-14 dated at 33,000 years ago

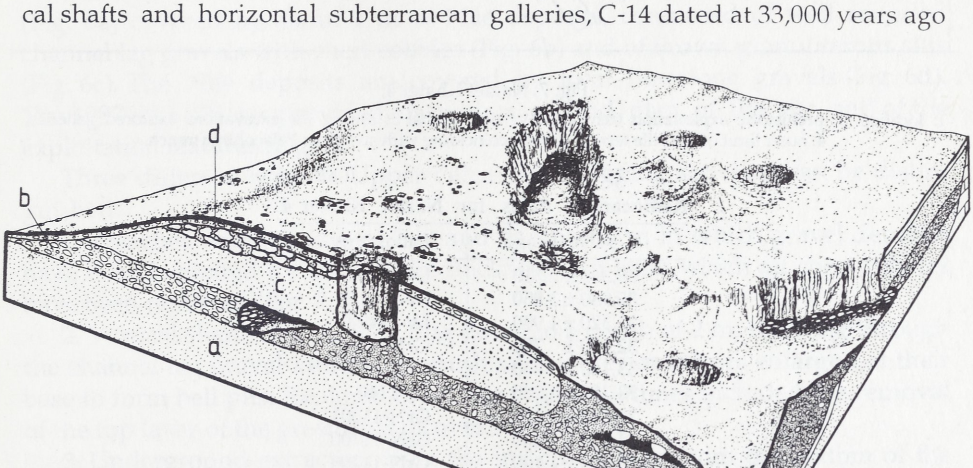

Fig. 6. Nazlet Khater 4. Stratigraphy and extraction systems of the Upper Palaeolithic exploitation; a: greenish silts; b: Nile gravels; c: brown granuliferous silts and fine sands; d: local limestone gravels.

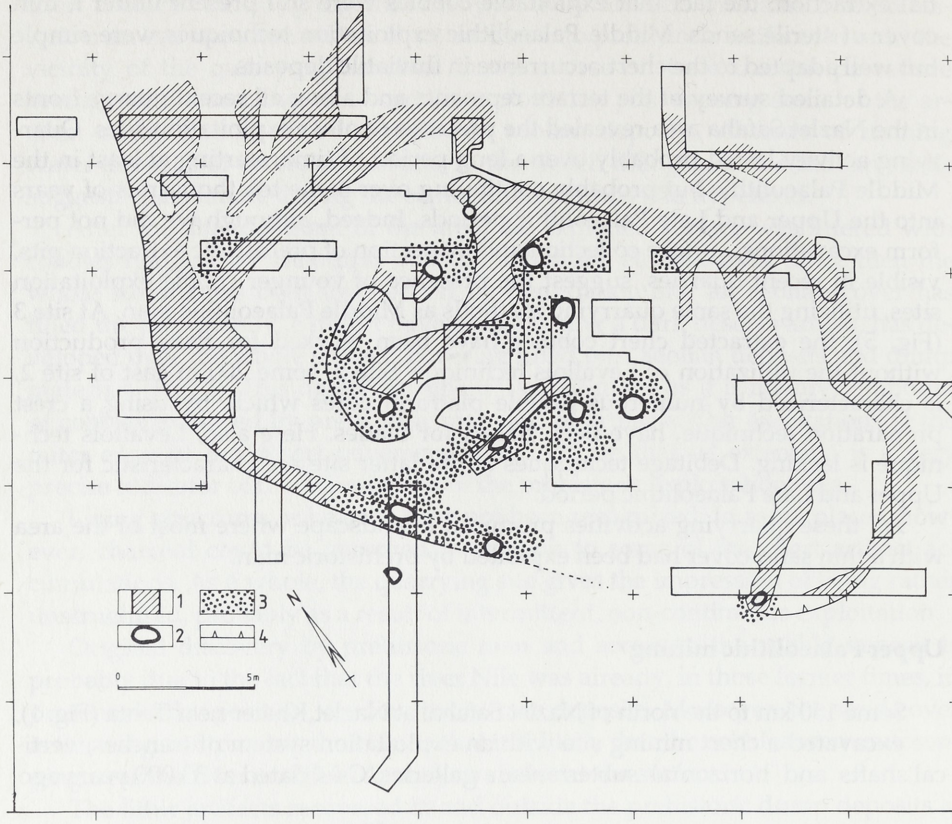

Fig. 7. Nazlet Khater 4;

1: location of prehistoric exploitation trenches; 2: vertical shafts; 3: during the excavations explored galleries; 4: outer limit of the Nile terrace gravels coinciding with an Upper Palaeolithic trench.

Table 1

Radiocarbon dates for Nazlet Khater 4.

C-14 years ago	Laboratory
30,360 ± 2,310	Lv-1139 D
30,980 ± 2,850	Lv-1141 D
31,320 ± 1,990	Lv-1142 D
32,100 ± 700	GrN-11297
33,100 ± 650	GrN-11299
33,280 ± 1,280	Lv-1140
33,650 ± 450	GrN-11301
34,950 ± 600	GrN-11300
35,100 ± 1,100	GrN-11296

All on charcoal.

(Table 1) and accompanied by large quantities of lithic material of early Upper Palaeolithic affinity (Vermeersch *et al.* 1982; 1984; 1990). Like Nazlet Safaha, the site is situated on a low Nile terrace remnant, at the edge of the cultivated plain near the limestone cliffs, bordering the valley.

Fig. 8. Nazlet Khater 4. Shaft orifice.

The base of the Nazlet Khater 4 site consists of greenish silts and fine sands (Fig. 6a) covered by about 1 m of Nile deposits, composed of well rounded channel lag gravels with chert cobbles (Fig. 6b) and of brown granuliferous silts (Fig. 6c). The Nile deposits are covered by local limestone gravels (Fig. 6d). The 1987 excavations provided us with a ground plan of the site and of the exploitation features (Fig. 7).

Three different types of Upper Palaeolithic digging activities can be distinguished:

1. Trenches with a width of 1 m and depth of 2 m in which gravel deposits have been exploited for their entire thickness and from which all chert cobbles have been removed (Fig. 7: 1);
2. Vertical shafts (Fig. 7: 2; 8), dug down to a depth of 2 m, reaching through the channel lag gravel into the greenish silts, were sometimes enlarged at their base to form bell pits. Exploitation of this type sometimes included the removal of the top layer of the greenish silts over some 0.5 m;
3. Underground extraction from the trench walls or from the bottom of the bell pits.

Most gravel deposits between the trenches have been extracted. Proceeding from a central bell pit, the channel lag gravels have been exploited for several meters, creating short horizontal galleries, very often with subterranean connections. The largest galleries (Fig. 7: 3) which could be explored, extend for more

Fig. 9. Nazlet Khater 4. Horn picks of gazelle and hartebeest.

than 10 m^2 under the ground. The horizontal distribution of trenches and bell pits suggests that very large areas of the site are really undermined. Gallery roofs have collapsed here and there.

On the walls of shafts and galleries cutting marks of picks used in gravel extraction can often be observed. Sometimes these cutting marks have been covered with a calcite crust, proving their antiquity. Some picks have been recovered from the horizontal gallery fillings. They consist of gazelle and hartebeest horns of which the extremity is very worn (Fig. 9). Rough extraction activities have been performed by using heavy hammerstones (Fig. 10), of which numerous examples have been found.

The post-exploitation deposits in the trenches, in the bell pits and in the horizontal galleries consist of anthropogenic gravel dumps at the base, covered with yellow fine aeolian sands. The gravel unit, containing Upper Palaeolithic artifacts, is generally heavily encrusted by a thick calcrete. The overlying infillings of loose aeolian sands completely obscure all Upper Palaeolithic diggings. The presence of *in situ* hearths in the aeolian sand unit indicates that the site was occupied during a period of active sand blasting. The post-occupation evolution

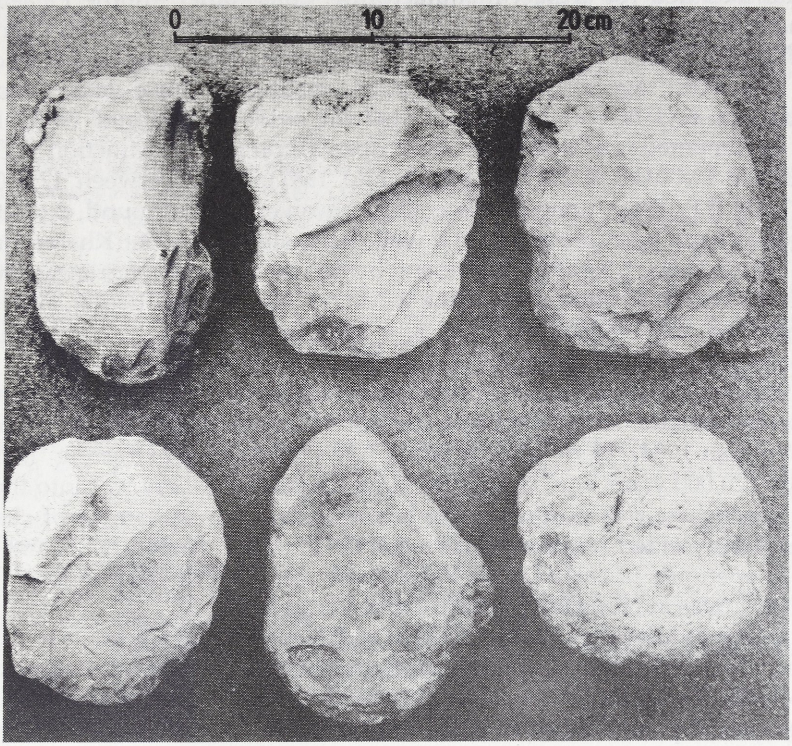

Fig. 10. Nazlet Khater 4. Hammerstones.

of the site consisted of the formation of a salt crust with desiccation of the overall perfect gently eastward dipping slope.

The Upper Palaeolithic diggings were clearly intended for the extraction of chert cobbles from the Nile channel lag deposits. The flat elongated chert cobbles have been utilized as raw material for an intensive debitage activity by early Upper Palaeolithic man. This resulted in the production of large quantities of artifacts, which have been recovered during the excavations. Clearly, the production of blades was the ultimate purpose of the Upper Palaeolithic miners.

Conclusions

Comparison of the Middle Palaeolithic and the Upper Palaeolithic exploitations shows that both systems used trenches. However, the Upper Palaeolithic extraction system differs from the Middle Palaeolithic one in the sense that the exploitation is more regularly planned, involving parallel trenches at fairly constant intervals, enabling a complete exploitation of the cobble deposits. Most evidently, the Nazlet Khater exploitation system is more systematically conceived.

As far as presently known, the quarrying sites of Nazlet Safaha and the mining sites of Nazlet Khater represent the oldest exploitation sites of raw material intended for artifact manufacturing. Some other Middle Palaeolithic sites have been reported from the Suisse Jura (Schmid 1968) and from the north-east Hungary (Siman 1986). At these sites, however, it was impossible to determine the exact age of the exploitation system, because later Neolithic exploitations had thoroughly perturbated the evidence (Schmid 1980). Much better documented is a Final Palaeolithic open air pit for the extraction of chocolate flint at Orońsko II-2 in Poland (Schild 1987), dated between 12,000 B.P. and 11,000 B.P. From none of these sites, however, underground exploitation techniques have been recorded. The well-dated sites of Nazlet Khater 4 and 7 (GrN-14910: 34,900 ± 500 B.P.) represent, by far, the oldest subterranean mining sites in the world. In other parts of the world, in Europe in particular, systematic underground exploitation of chert and flint is known only from the Late Holocene, posterior to 6,000 B.P. (Weisgerber, Slotta and Weiner 1980).

In this context we should mention, however, that very old underground extraction of hematite is reported from the Lion Cavern in Swaziland (Beaumont 1973; Volman 1984). Here, Middle Stone Age people were extracting hematite perhaps 120,000 years ago, utilizing a large horizontal gallery, cut into the side of the specularite rich portion of the hematite cliff face. A sample of charcoal from this site yielded a date of 43,200 + 1,350 – 1,200 B.P. (GrN-5313). Paint quarrying in open pits of early Upper Palaeolithic age has also been reported from sites near Lovas in Hungary (Meszaros and Vertes 1955).

With the evidence of Nazlet Safaha and Nazlet Khater it is clear that organized chert extraction is much older than generally thought. It demonstrates that Middle Palaeolithic man was already well aware of the geological and petrographical potentialities of covered cobble beds and was able to organize their systematic exploitation. Complex subterranean mining, however, involving the construction of shafts or bell-pits, is probably a practice introduced by Upper Palaeolithic man. The development of this type of extraction technology may therefore not be considered strictly related to the economic changes accompanying the introduction of a Neolithic way of live, as was stated by G. Smolla (1987). In Egypt, at least, it is much older.

Acknowledgements

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