mounds. Mounds might form over basement faults, supplying an increased flow of warm water rich in Fe^{2+} and Mn^{2+}. The nontronite gravel formed by these solutions reduces the resistance to flow, thus reinforcing the rapid flow of water through the sediment and possibly facilitating the formation of mounds.

The Ca^{2+} and Mg^{2+} profiles in the Galápagos Hydrothermal Mounds Field provide evidence for convection in sediments independent of heat flow measurements. The nonlinear gradients can be used to calculate upward advection rates of about 1 cm/year through pelagic sediments around mounds. The advection rates calculated from [Ca^{2+}] in mound cores, about 20 to 30 cm/year, are in good agreement with the rates calculated for other mounds from temperature profiles. The data and gradients provide important new information about the extent and importance of ridge flank convection; information on such convection up to now has been confined to geophysical studies. Future work should be directed toward further characterizing the composition of the hydrothermal fluid entering the sediments in this area.

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Blade Technology in the Egyptian Nile Valley: Some New Evidence

Abstract. *An Upper Paleolithic site with blade technology was excavated at Nazlet Khater, Egypt. Radiocarbon dates center around 31,500 years ago, indicating that the Egyptian Nile Valley was not an isolated enclave where blade technology appeared late in comparison with other eastern Mediterranean areas. This site fills a gap in the record of human history in Egypt between 40,000 and 20,000 years ago.*

In the Egyptian Nile Valley, blade industries of Upper Paleolithic style are known from many sites that were excavated by the Combined Prehistoric Expedition (*1, 2*). The investigators correlated these industries with a period of Nile aggradation that, on the basis of numerous radiocarbon dates, occurred less than 19,000 years ago. With the reassessment of the Nubian chronology (*3, 4*), the Khormusan industry, originally estimated to date between 27,000 and 18,000 years ago, is now considered to be much older, possibly dating back more than 40,000 years. This is more consistent with the Middle Paleolithic features of the Khormusan industry, but the new chronology implies that there is a gap of more than 20,000 years in our knowledge of the record of human history in the lower Nile Valley. Indeed, no archeological complexes or Nile sediments have been placed with any confidence within this interval (*2*). The excavations of the Belgian Middle Egypt Prehistoric Project at Nazlet Khater near Tahta in Upper Egypt (*5, 6*) have now provided evidence of the presence of blade-producing communities within this interval along the Nile.

During the past 4 years four sites were excavated in the lower desert of Nazlet Khater (Fig. 1). This lower desert is that part of the desert which belongs to the Nile Valley. Nazlet Khater 1 is situated on a small elevation adjacent to the edge of the cultivated zone. Nile sediments—gravels, silts, and clays—form the core of this elevation. The uppermost gravel deposit, of Nilotic origin, which is 5 m above the alluvial plain and partially covered by Nile silts, contains numerous Middle Paleolithic artifacts. The upper part of the elevation, consisting of local wadi-slope deposits, is rich in artifacts (more than 1000 per square meter) that are also of Middle Paleolithic age. The differences between the industries repre-

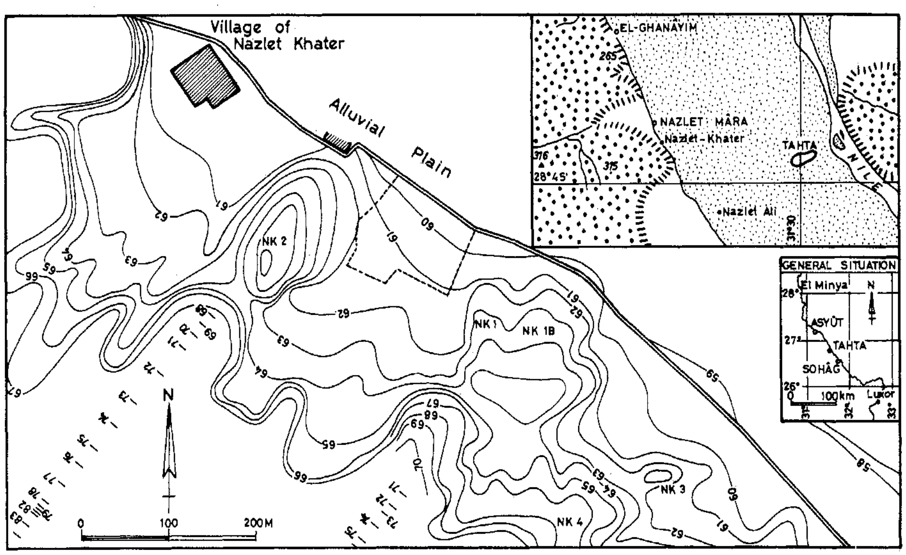

Fig. 1. Topographic map of the area in the vicinity of the modern village of Nazlet Khater and the Paleolithic sites of Nazlet Khater (*NK*) 1, 1B, 2, 3, and 4. The contour lines are in meters.

sented by the artifacts appear to be only minor. As a whole, the material of Nazler Khater 1 can be described as representative of predominantly Levallois technology with a clear predilection for the use of Nubian style debitage (*7*). Tools are rare and mostly restricted to some denticulates. The Middle Paleolithic artifacts from Nazlet Khater 2 and 3 have similar characteristics.

Nazlet Khater 4 is situated about 10 m above the Nile floodplain on a small remnant of sands and gravels adjacent to the limestone substrate. This remnant is composed of core gravels with rare limestone elements, coarse sands, and clay of Nilotic origin. This core is truncated and eroded by wadi sediments, which contain well-rounded limestone blocks and some artifacts of Levallois technology. On top of the stratigraphic sequence there is a blade industry and charcoal covered by a crust of salt with desiccation wedges, loose eolian sand, and a desert pavement. The excavation is situated on the border of a depression that is filled mostly with loose eolian sand. The depression border contained four layers with prehistoric artifacts which, however, seem to have been derived from a single occupation floor. The salt crust was formed after the human occupation. The occupation floor contained remnants of hearths, and numerous fractured calcinated hearthstones and large pieces of charcoal were collected. The upper three artifact-bearing layers above the occupation floor are separated by deposits of eolian sand that do not contain artifacts. In the archeological layers many thousands of artifacts were collected. Faunal remains are absent.

Samples of charcoal from the four different layers from top to bottom yielded the following radiocarbon dates (with sample numbers in parentheses): 31,320 ± 2310 years (Lv-1142 D), 30,980 ± 2850 years (Lv-1141 D), 30,360 ± 2310 years (Lv-1139 D), and 33,280 ± 1280 years (Lv-1140). We have not yet dated with confidence the Middle Paleolithic artifacts from Nazlet Khater 1, 2, and 3. It appears, however, that the blade industry is much younger than Middle Paleolithic.

Because the Nile deposits that contain Middle Paleolithic artifacts are at a lower level than the blade-industry artifacts and were covered by wadi deposits that contain important Middle Paleolithic concentrations, up to more than 1000 artifacts per square meter, nearly archeologically in situ, we conclude that in this area during the late Pleistocene no Nile aggradations reached a level of 5 m above the floodplain. The site of Nazlet Khater 4 is thus situated beyond influence of the Nile, and the Nile evolution during the late Pleistocene in this area is therefore quite different from that in southern Egypt, where, according to Wendorf and Schild (*2*) and Butzer (*3*), it is characterized by high levels.

The most striking characteristic of the industry of Nazlet Khater 4 is the presence of blades (artifacts 1, 5, and 9 to 13 in Fig. 2) typical of Upper Paleolithic tradition. In some square meters these comprise up to 15 percent of the total artifact composition, including chips and cores. To produce the blades, egg-shaped cobbles of Nile chert, which is abundant in the vicinity, were used. A primary flake perpendicular to the elongated edge of the cobble was removed to make a flat striking platform. Before the blade was struck, a crest (artifact 2 in Fig. 2) was frequently prepared on one edge, and cores with one striking platform (artifacts 3 and 4 in Fig. 2) were obtained. Cores with two striking platforms are present but not numerous. Levallois cores are lacking. Since the cobbles from which the blades were

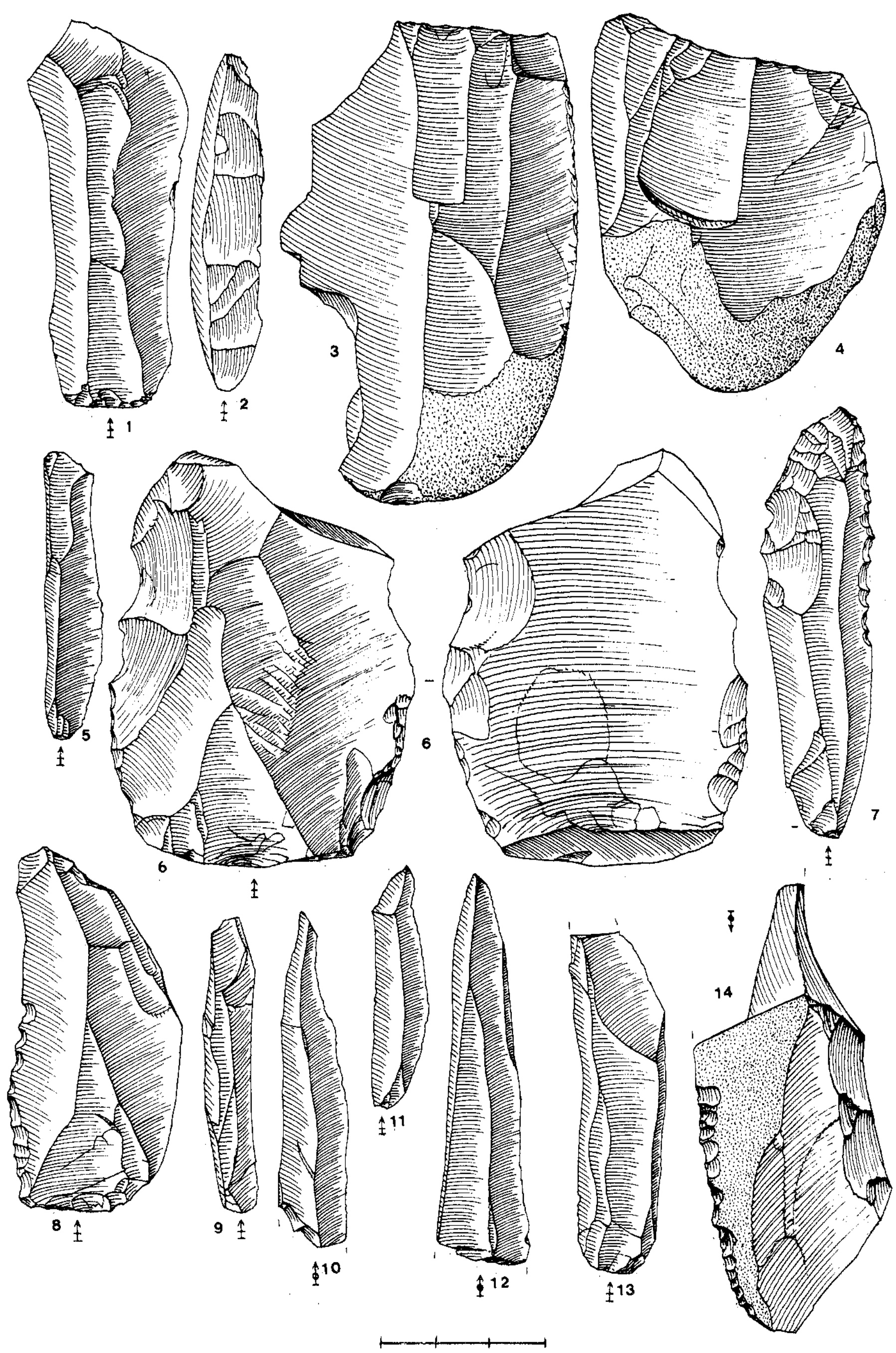

Fig. 2. Artifacts from Nazlet Khater 4: crest (2), cores with one striking platform (3 and 4), blades (1, 5, and 9 to 13), and denticulates (6 to 8 and 14). Scale bar is 3 cm. The direction of the arrow indicates the direction of percussion. Arrow with line: striking platform is present. Arrow with circle: striking platform is absent.

struck were not large, the length range of the blades is limited. The length to width ratio, however, often exceeds 3:1. The butt is generally flat, sometimes punctiform, but rarely dihedral. Most of the blades do not have parallel sides. Except for a few denticulates (artifacts 6 to 8 and 14 in Fig. 2), tools are absent.

The blade industry of Nazlet Khater 4 dates to the period between the Middle Paleolithic with Levallois technology and the much later diversified Upper Paleolithic industries (*2*). Since Levallois technology is present in some Upper Paleolithic industries of Upper Egypt, such as the Idfuan and the Sebilian, it seems that this technology was continually in use in the Egyptian Nile Valley for a long time. Earlier views on the Nile Valley provided a picture of an isolated enclave where the old techniques of the Middle Paleolithic continued to be pursued with few modifications. Even when these views were amended because of the excavation of sites with blade technology (*8*), the fact remained that until now all the blade-bearing sites were late when compared to the Levant area. The excavation of the site of Nazlet Khater 4 provides evidence that blade industries without use of Levallois technology were present along the Egyptian Nile as early as 31,500 years ago, which is in good agreement with the Levant evidence.

In North Africa very little information is available concerning human presence between 40,000 and 20,000 years ago. If eventually some of the Aterian industry occurrences can be placed in this period (*9*), which is not at all evident (*10*), it is clear that no technological affinities exist between the Aterian and the industry of Nazlet Khater 4. In the Sahara and the Maghreb (*11*) human occupations during this period are conspicuously lacking. Only in Cyrenaica, Libya, is this period documented by the Dabban industry from the caves of Ed Dabba (*12*) and Haua Fteah (*13*). The duration of the Dabban industry may be placed between about 40,000 to 38,000 years ago and about 15,000 years ago. Like the industry of Nazlet Khater 4, the Dabban industry shows no signs of Levallois technology but exhibits a fully developed blade technology. The evidence from Nazlet Khater 4 does not add new facts to the discussion of the origin of the Upper Paleolithic tradition in the large region of the eastern Mediterranean, but it is clear that in North Africa this tradition is present not only in Cyrenaica but also along the Egyptian Nile about 31,500 years ago. Whether the blade industries of Egypt from 20,000 years ago and later can be related to the Nazlet Khater 4 material is not yet clear (*14*).

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The Mount St. Helens Volcanic Eruption of 18 May 1980: Large Short-Term Surface Temperature Effects

Abstract. *The surface temperature effects of the 18 May 1980 eruption of Mount St. Helens Volcano were examined for 1 day immediately after the eruption; 24-hour temperature differences and Model Output Statistics errors as well as the detailed temporal evolution of surface temperature at selected stations were used. During the daytime hours immediately after the eruption, the temperature was suppressed by the volcanic plume by as much as 8°C. That night, low-level volcanic dust produced temperature enhancements of up to 8°C. These effects quickly diminished the next day as the volcanic dust cloud dissipated and moved toward the east. The net local effect of the eruption appears to be warming, in contrast to cooling which might be expected over climatic time scales.*

A violent eruption of Mount St. Helens Volcano began on 18 May 1980 at 1532 GMT (0732 PST), which devastated hundreds of square kilometers and sent large amounts of dust and volcanic ash into the atmosphere. The plume spread quickly to the east, bringing darkness and reduced visibility.

Although there have been many studies of the effects of volcanic eruptions on climate (*1, 2*), as far as we know there has never been a study of the local, short-term effects of a volcanic eruption on surface temperature. In this case, the Mount St. Helens eruption occurred upwind of a relatively dense network of National Weather Service, Federal Aviation Administration, and military hourly surface observation stations. We have taken advantage of this fact to establish a mesoscale network of over 90 stations in the states of Washington, Oregon, Idaho, Wyoming, and Montana to study the surface temperature effects during the first 24 hours after the eruption. We present here preliminary results of a more detailed study (*3*).

It is fortunate for the purposes of this study that, before the eruption and during the subsequent 24 hours, there was little synoptic-scale weather activity over the Pacific Northwest. The mean sea-level pressure field just prior to the eruption was dominated by high pressure over Idaho and Colorado, and this pattern remained nearly unchanged during most of the next day. (As the high slowly drifted eastward, there was some weak

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