Mousterian" and the "Nubian Middle Paleolithic," we can look briefly at the numerous Upper and Final Stone Age industries mostly described here for the first time.

The Khormusan industry introduces the Upper Stone Age around 25,000 B.C. and dominates the Nubian scene for some 8000 years. This is a Levallois flake industry showing no close connections to the preceding Nubia Middle Paleolithic or Mousterian groups. Wendorf (p. 1045) suggests that a considerable gap of time separates the Middle Stone Age groups from the Khormusan, placing the origin of the latter industry within that gap. A striking adaptation of the Khormusan people to their environment is shown by Anthony E. Marks, who defines and describes this industry. The earliest Khormusan sites are found in the first Nile deposits of Ethiopian origin. The stratigraphically oldest Khormusan sites are dominated by stone tools made of the local "ferrocrete sandstone," a relatively poor material that was utilized by all the earlier inhabitants. Now one can follow a definite progressive change in preference for new raw materials that are now being introduced into Lower Nubia, namely chert, agate, quartz, and other Precambrian rocks that are more amenable to the production of chipped stone tools. This is vividly shown in a series of histograms (p. 326).

Before the Khormusan industry disappears from Nubia (around 17,000 B.C.) other industries (and presumably other peoples) appear in the area, namely the Halfan industry, "an exceedingly early microlithic industry which seems to document an indigenous transition from a highly specialized Levallois flake technology. . ." (Wendorf, p. 1049), and the Gemaian industry, a non-Levallois flake industry. Although these three industries are found in the same stratigraphic interval, the sites are hardly numerous, and there is no indication that these people were in fact living side by side; their stone technologies show no signs of interchange of ideas between the groups. The Khormusan and the Halfan peoples disappear from Nubia leaving no trace, according to Marks, but the Gemaian industry does seem to be the forerunner of the next important innovation of this area, the Qadan industry.

The Qadan industry dominated the Nubian Nile from about 12,500 to about 5000 B.C. and is characterized by a marked increase in the number of sites. This expansion is related to the appearance of grinding stones indicative of part of what Wendorf calls the "Nilotic Adjustment." The Qadan peoples, who like their predecessors were taking advantage of the fish and wildlife that were abundant along the Nile during pluvial times, apparently discovered for themselves means of utilizing wild grain as a food supply. The kind of grain is a big question; no plant fossils are preserved except for cemented root channels in the sands of the former river bank. However, this discovery was the basis for a considerable expansion in population and a long-lived cultural tradition, which apparently finds its continuation in the Abkan industry of the early historic period. But, perplexingly enough, this very early, if not earliest, utilization of grinding techniques for the preparation of grains did not lead to the establishment of village life in Nubia as it did in the Near East about 8000 B.C. Apparently the Qadans did not learn how to domesticate the grains or to establish a system of irrigation before the wild grain disappeared from Nubia in face of the oncoming drought of post-pluvial times.

No account of the prehistory of Nubia would be complete without mention of the Sebilian industry. The Sebilian was the only prehistoric industry that had received much attention in this area prior to the work reported here, and it has involved many problems. It was the only industry of note in the long time span between the Middle Paleolithic and full-blown Neolithic cultures. Being rather crude of technology, the Sebilian was proposed to have been the immediate successor of the Nilotic Levalloiso-Mousterian peoples, thus dating from the height of the Last Pluvial. However, comparison of the Sebilian with other industries of Nubia and knowledge of its stratigraphic position in the Nile sediment sequence show that the Sebilian industry is neither very old nor very dominant in the prehistory of the Nile. The Sebilians appear to have been an intrusive group in part contemporary with the grain-grinding Qadan people, around 12,000 to 10,000 B.C. Their stone technology was crude relative to that of their contemporaries, and they used only ferrocrete sandstone for raw material, although more desirable chert was available in the Nile gravels at their feet. Marks argues strongly, but hypothetically, that the Sebilians were an offshoot from central African forest peoples who wandered into the Nile Valley from the southwest.

These volumes by Butzer and Hansen and by Wendorf and his colleagues will certainly replace the works of Caton-Thompson and Gardner and of Sandford and Arkell as standard references for the prehistory of the Nile. There can be no comparison between the older works and these reports. The typological collections of the 1920's and 1930's are statistically inadequate for modern archeologists, and the older geological studies made without modern aids such as decent maps, air photos, and radiocarbon dating were only first approximations. A tremendous step forward has been made, even though it was forced upon prehistorians by the construction of the High Dam. Fortunately, national governments responded financially to this crisis and capable scientists were available to carry out the cooperative effort. They are to be complimented on their rapid publication of their results.

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A Key Site on the Mediterranean

The Haua Fteah (Cyrenaica) and the Stone Age of the South-East Mediterranean. C. B. M. MCBURNEY. Cambridge University Press, New York, 1967. xvi + 387 pp., illus. $37.50.

Along the southern littoral of the Mediterranean between Tunisia and Israel only one key prehistoric site is known. This is the cave of Haua Fteah in eastern Libya, situated in the Gebel el Akhdar or Green Mountain of Cyrenaica, which is the only relatively well-watered upland zone between the North African Maghreb and the Levant area of southwestern Asia. In the hope that the archeological sites in the Gebel el Akhdar would provide cultural linkages between the two widely separated regions and that certain paleoecological problems would also be resolved, McBurney has since the Second World War conducted a number of expeditions here. Haua Fteah was investigated in three seasons between 1951 and 1955, and the results are now presented in this large, handsomely produced, and expensive volume.

Haua Fteah (a translation of the

local Arabic name is not given) is an enormous cave near the coast and measures about 120 meters long and 70 meters wide. A deep sounding near the entrance did not reach bedrock but revealed at least 35 archeological layers dispersed through some 14 meters of deposits. In relation to the immense size of the site the excavation really amounts to a large test-pit, which I calculate to have sampled less than 2 percent of the cave's deposits. The cultural sequence, believed to extend from Last Interglacial times through Middle and Upper Paleolithic, Neolithic, and historic occupations, is found in a complex stratigraphic context. Separate living floors were often telescoped together, and excavation was apparently carried out in more or less arbitrary levels or "spits" which usually did not correspond to occupation levels.

At the base of the excavation McBurney found an important group of artifacts, including many coarse blade tools, which he has named the Libyan Pre-Aurignacian. It is claimed to date to the Last Interglacial, perhaps between 80,000 and 65,000 years ago, and to be related to the controversial Pre-Aurignacian (or, as it is now usually called, Amudian) of the Levant. This is followed stratigraphically by assemblages McBurney terms Middle Paleolithic, including a "Devolved Pre-Aurignacian," a "Hybrid Mousterian," possibly some Aterian, and, most important, several meters of what he calls Typical Levalloiso-Mousterian. These latter deposits yielded two human mandibular fragments of Neanderthaloid form, the subjects of a special appendix by P. V. Tobias. The industry apparently shows no continuity from the Pre-Aurignacian and dates from final Last Interglacial or early Last Glacial times until about 40,000 years ago. It was then replaced, again without indications of a local transition, by 7 meters of deposits containing the first true Upper Paleolithic in the region, the Dabban (earlier identified by McBurney at the nearby site Hagfet ed Dabba). This is characterized by burins, backed blades, end-scrapers, and curious chamfered blades; it is estimated to have existed here from about 38,000 B.C. to about 15,000 B.C., thus representing one of the oldest and longest-lived Upper Paleolithic cultures known. From about 12,000 B.C. until the 9th millennium the cave was occupied by groups using a microlithic industry, named the Eastern Oranian by McBurney, which shows no signs of origin in the Dabban and which, like the Dabban, may have resulted from movements out of southwestern Asia. Sometime after 8000 B.C., during a shift to warmer conditions, the Eastern Oranian was replaced by what McBurney terms the Libyco-Capsian, which is considered the contemporary and partial equivalent of the Capsian of Tunisia and Algeria. By about 5000 B.C. this Libyco-Capsian was being infiltrated by elements from the food-producing groups that were already well developed elsewhere, particularly in southwestern Asia, and domesticated animals (goats or sheep) were present at Haua Fteah. This may represent the earliest dated "Neolithic" on the African continent, although recent reports from Algeria and the Sahara suggest that Neolithic groupings may have been present there at about the same time. The deposits of the cave pass into the historical range about 2500 B.C. with occupation by the Early Historic Libyans, pastoralists known from dynastic Egyptian records who were apparently descended from the Neolithic peoples and who survived in the area until Classical times.

Obviously the data McBurney and his colleagues present here have the greatest significance for all prehistorians working in northern Africa and western Asia. To insert a personal note, some of the Paleolithic materials I excavated in Upper Egypt a few years ago come into better focus now that the long Libyan sequence is described in detail. Similarly, the interpretations offered of Upper Pleistocene and early Holocene climates and environments provide a great deal of new information for specialists interested in the paleoecology of the Mediterranean basin and its hinterlands. McBurney's description of the curious Libyan Pre-Aurignacian should help illuminate the thorny problem of the Levant Pre-Aurignacian, which has such interesting implications for cultural and biological evolution and whose very existence as a separate cultural entity is currently being questioned by some investigators. His Dabban culture offers the best evidence yet known that the Upper Paleolithic was installed early in Libya and should finally dispose of the myth that North Africa at this time was significantly retarded in relation to Europe and western Asia. For all these and other reasons this is an important publication.

But the book, like the curate's celebrated egg, has its dubious parts. It is consistent with the tradition in much of Stone Age archeology in the Old World of discussing only briefly, or not at all, the methodology used and the theoretical assumptions underlying analysis and interpretation. Although there are signs that this "commonsensical" attitude is changing as archeological systematics becomes more explicitly examined, McBurney offers few concessions to the reader in this respect. Although such expressions as "culture," "tradition," "industry," "assemblage," "phase," and "complex" occur frequently throughout the book, there is no indication at all of how the author envisages the concepts in each particular context. One gathers, judging by the vague, almost mystical references to "sudden outbursts or mutations" and "decay and atrophy" (p. 14), that his model of internal cultural change through time is based on analogy with biological evolution, while migrations and undefined "influences" seem to be his principal mechanisms for explaining shifts from one cultural stage to another. There is little evidence that the author has profited from the considerable theoretical advances made, in his own country and elsewhere, in the last 30 years.

The quantitative analysis of some 50,000 stone tools is presented in more elaborate fashion than has been the rule in most publications, by means of a large number of graphs and tables. For legitimate reasons McBurney has chosen to compare the Haua Fteah artifacts with each other, and with those from other sites, not simply by the classic method hitherto used in North Africa of distinguishing a large number of discrete tool-types, but by calculating within a restricted number of tool classes "the true modal values of the measurable characters of a type" (p. 13). Comparisons are nearly all made on the basis of absolute dimensions of artifacts (length, breadth, thickness, or ratios between these dimensions). When the observed frequencies do not approximate normal curves of distribution attempts are made to fit the deviation to log-normal curves. Now, no one will deny that these measurements may be useful, and indeed for many purposes (for example, the study of fine-grained cultural changes) such characters or modes are probably superior to types. But it is never made clear just why certain metrical attributes are chosen while other measurable and quite possibly relevant ones—scraper-head arcs, burin angles, extent and positioning of retouch, for example—are virtually ignored. The problem of deciding whether to use large and inclusive classes with fewer diagnostic attributes

or many more classes with less variation in each and therefore more diagnostic attributes is of course a familiar one to archeological taxonomists. Those prehistorians who work with ceramics, particularly in the New World, have been far more consciously aware of the theoretical implications of the choice and have devised methods to meet the problem which are, up to now, more sophisticated than those usually adopted for studying stone artifacts. I think that McBurney has sacrificed some of the advantage inherent in a more orthodox classification (with all its obvious faults) without gaining adequate compensation. In addition, even within the simplified type-classes he has adopted there is sometimes at least terminological confusion; thus the same artifacts are referred to as backed blades on page 138 and as backed bladelets in fig. VI.2. At times, too, the author does not seem, in evaluating the changes in his modal values, to have allowed sufficiently for skewing due to the very small sampling the excavation represents in a huge site where activities on the part of the occupants may often have been quite varied and spatially distinct.

The chronological correlations within the Upper Pleistocene are based on Emiliani's rather than Zeuner's glacial succession. Emiliani's O^{16}/O^{18} analyses of paleotemperatures from marine food shells have been correlated with temperatures derived from deep-sea core Foraminifera in the Mediterranean and other seas; these are then integrated with radiocarbon dates from the cave, with E. S. Higgs's study of the mammalian fauna, and with C. G. Sampson's granulometric analyses to yield an impressive synthesis that is certain to evoke valuable discussion. Whatever the eventual fate of this synthesis, however, I think it is probably premature to attempt such long-range correlations as that offered here between Libya and the postulated climatic sequence from Shanidar Cave in Iraq, particularly in view of Wright's recent criticism of certain conclusions reached in this last site [*Science* **161**, 334 (1968)]. Higgs's study of the 12,000 identifiable animal bones is a fine example of a study of faunal fluctuations as linked to changing environments at Haua Fteah and other important circum-Mediterranean sites. He argues that the variations in frequency of remains are due only to climatic-environmental factors and that cultural factors such as selective hunting practices are not significant since the variations observable in the remains do not coincide with the cultural changes in the site. I do not think this last part of the argument is conclusive.

A series of 18 radiocarbon dates was obtained from the upper half of the sequence, from the later Levalloiso-Mousterian onward. It is unfortunate that these dates are not evaluated at greater length, since they are not always in agreement and pose certain problems. Such discussion would have been particularly useful for the claim of a very early date (about 38,000 B.C.) for the earliest Dabban, for this date is not clearly demonstrated by the Haua Fteah radiocarbon results and is only partially supported by two dates from soil samples obtained at the Hagfet ed Dabba site. Therefore, one can reasonably remain unpersuaded that the Dabban really began much, if at all, before about 32,000 B.C. at Haua Fteah—that is, the Upper Paleolithic of Cyrenaica may after all be no earlier than that of Western Europe. McBurney's technique of dating the events beyond the radiocarbon range by extrapolating from the known dates to estimate the average rate of deposition in the cave (claimed to be of the order of 20 to 30 centimeters a millennium), and also of interpolating to estimate the duration of individual archeological layers, is ingenious; however, so many variables are involved that most readers will probably remain unconvinced by the results offered except in a very broad sense.

From a strictly terminological viewpoint there are some legitimate criticisms. The expression Levalloiso-Mousterian has an anachronistic ring today, and McBurney's definition of the Levallois technique emphasizes too heavily the presence of faceted striking platforms. Certain of his constructs, such as "Hybrid Mousterian" and "Devolved Pre-Aurignacian," should be regarded with skepticism until they have been found in contexts in which there is no possibility of contamination between layers. The term Libyco-Capsian is an unhappy choice, as are all politico-ethnic names applied to prehistoric units.

Finally, this memoir is carelessly organized. Data on a given topic are often scattered piecemeal through the book. There are inexplicable omissions and confusing inconsistencies. Better editing might have eliminated many of these faults, which are frustrating to the reader who has to depend on the published material alone for information. A full listing of the minor lapses and contradictions would be picayune in a review of this type, as would a catalog of the many errors in the bibliography, where too often titles referred to in the text are missing. But there are more serious omissions. Although one must sympathize with any archeologist faced with a half million pieces of stone waste, it is disappointing that this waste is almost completely ignored in the study. The information on the variations in lithic raw materials employed is also very skimpy. Perhaps as a corollary of his zeal for linear measurements, McBurney is remarkably parsimonious with the illustrations of stone tools, considering that this is a final site report. Thus, for the Libyco-Capsian only one example is illustrated from a category (backed blades) which constitutes over half the inventory. This is surely taking too literally the currently popular adage "when you've seen one you've seen them all." The photograph of the interesting but indistinct engraved stone in plate IX.11 ought to be accompanied by a line drawing to aid in reading it. Although McBurney attempts to correlate the cultures of Haua Fteah with other sites around the Mediterranean and as far away as Iraq, there is, inexplicably, no chronological table for the various archeological phases to guide the reader through the author's often circuitous prose style. Another oddity: the site itself is not precisely located on the rather unsatisfactory map of the Gebel el Akhdar region (p. 34). A further confusing aspect is that linear measurements of the excavations are sometimes given in English and at other times in metric units. The French résumé thoughtfully provided should have been more carefully vetted for spelling, structure, and grammar; it is badly fractured and contains some howlers (such as *coquillages marinés* for marine shells), and, more important, its statements are not always consistent with those of the main text. The final summary (pp. 324–28) is too superficial and fails to synthesize adequately the masses of archeological, environmental, and other data distributed through the book by the various contributors.

Nevertheless, this memoir, though often unsatisfying, is far from unrewarding. It may not qualify as a breakthrough in archeological methodology, and many of its assumptions and conclusions are questionable. But the contents and geographical location of the cave—it is probably the most important Upper Pleistocene site known in North

Africa—are such that the report represents a most valuable, even essential, reference for all interested in the prehistory and paleoecology of this and adjoining regions.

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Origins of Agriculture

The Prehistory of the Tehuacan Valley. DOUGLAS S. BYERS, Ed. Vol. 1, Environment and Subsistence (viii + 331 pp., illus. $15); vol. 2, The Non-Ceramic Artifacts (xiv + 258 pp., illus. $12.50). Published for the Robert S. Peabody Foundation by the University of Texas Press, Austin, 1968.

In the New World, at the time of discovery, civilizations were found in two areas, Mesoamerica and the central Andes. A major debate in New World archeology has been carried on over the question whether the native population had independently evolved food production or whether domestic plants were introduced by migrants from the Old World. Between 1960 and 1964, under the direction of Richard MacNeish, a multidisciplinary team of researchers conducted an archeological research program in the Tehuacan Valley in central Mexico with the major objective of discovering the early phases of plant domestication in Mesoamerica. The project was spectacularly successful and has recovered an enormous body of data pertaining to the objective. The results are to be published in six volumes, of which the first two, the subject of this review, have appeared.

Volume 1 is entitled "Environment and Subsistence" and consists of a series of chapters by 14 authors, including, besides the introductory statements and the summary (written by MacNeish), a description of the contemporary settlement of the valley, geological and geographic descriptions of the valley, analyses of human skeletal remains, an analysis of vertebrate remains and aboriginal hunting patterns, and finally a series of detailed analyses of botanical remains, particularly of cultigens. There are also a study of human coprolites and a special chapter comparing the stylistic characteristics of the Codex Borgia to the ceramics of the final prehistoric phase in the history of the valley. Volume 2, "The Non-Ceramic Artifacts," is a detailed analysis of artifacts made of stone, bone, antler, shell, copper, wood, bark, and fiber. From a technical point of view, the Tehuacan Valley project was a monumental effort, and the two published volumes are models of archeological reporting.

This is the only project in all of Mesoamerica which provides us with a detailed history of technology, subsistence, and settlement patterns from the beginnings of human occupation to the present. The picture is particularly complete with respect to subsistence. The Tehuacan Valley was selected for intensive study because of its low rainfall and the presence of dry caves, and hence the high probability that perishable remains would be preserved there. Approximately 100,000 plant remains, 11,000 zoological specimens, and over 100 samples of human coprolites were collected. The project demonstrated conclusively that the food-producing revolution was indeed a native development, based on native flora, and that it was initiated perhaps as early as 7000 B.C., certainly by 5000 B.C. Particularly important was the finding of evidence of wild maize, the staple crop of the ancient population of Mesoamerica, and of an early domestic variety that dates at least as far back as 4000 B.C. A major methodological achievement of the project was an attempt to calculate, by percentages, the amounts of food of various kinds consumed by the ancient population. The Tehuacan data also present a picture of an almost imperceptible evolution of food production, related primarily to the evolution of the plants themselves, rather than an abrupt revolution. Even though the initial attempt at plant domestication may date back as far as 7000 B.C., it was not until 1500 B.C. that cultigens made up the majority of the diet of the population of Tehuacan. The entire process of development of food production, on the basis of the Tehuacan data, can be visualized as gradual evolution that involved an increasingly more effective adaptation to the food resources of the valley.

This reviewer does have a number of reservations about some of the conclusions of volume 1. First, there seems to be among many of the scholars in American archeology today a simplistic and naive assumption that the fact that cultural traits appear in an archeological sequence in one area earlier than in another automatically proves cultural diffusion. In a number of places in this monograph, for example, the simple fact that several of the pre-Hispanic crops appear earlier in Mexico than in Peru is used to prove that the crops were diffused from the former to the latter area. In fact, much of the Peruvian evidence for early plant domestication comes from the coastal desert, and we know virtually nothing about the agricultural history of the neighboring highlands. Coastal desert is an unlikely place for the origin of domestic plants, and it seems just as reasonable to assume that the coastal crops represent an introduction from the nearby highlands, where they may well have been cultivated earlier, as that they were brought in from places as far distant as Mexico. We cannot with certainty say, from the botanical side, that the wild ancestors of the specific plants in question were not native to both the central Andes and Mesoamerica, and there is a strong probability that domestication came about independently in several places.

Second, the data on the post-Conquest and contemporary population are rather thin and could stand considerable amplification. Particularly, I found the discussion of contemporary techniques of farming and irrigation inadequate. The project was, of course, concerned primarily with the prehistory of the valley, but data on more recent conditions and practices would seem to be of critical importance for the understanding of the earlier ones.

Third, although I heartily support the idea expressed by MacNeish of professional freedom of expression in the preparation of a report of this type, it seems to me that the project should have had a little more anthropological monitoring of the nonanthropological professionals involved. It would have avoided such incredible reconstructions of Classic and post-Classic society as that presented by Callen, who, on the basis of coprolite analysis, believes that there was a slave class that worked as agricultural laborers but was not provided with agricultural produce to subsist and was required to scrounge in the neighboring hills for wild foods. I also refer to the constant misuse of the word "urban" in various places in the report.

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