a dominant scientific position in the world until about the middle of the 19th century. The nonresilient French social structure, with which the scientific establishment has always been integral, did not permit the state to meet new challenges to that position. Then it felt the impact of the emergence, after World War II, of two dominant scientific states, and de Gaulle regained national leadership. Gilpin gives the history of the social, economic, and political interaction of science and the state, pausing midway to devote a chapter to the "American model of the scientific state." By then he has taken us into the period of French preoccupation with planning. At first almost a fetish—planning was to enable France magically to regain her grandeur among states—it gradually acquired substantial meaning. But planning itself could not produce results quickly enough, and its orderly process was perturbed by the *force de frappe,* seemingly petulant policies toward NATO and the Common Market, and other manifestations of impatience. Planning has produced no instant miracles anywhere; their failure to appear has perhaps been most obvious in France, as the events of 1968 have demonstrated. But the process of planning and testing its various methodologies has been in effect in France probably longer than anywhere else, and it is difficult to believe that this growing body of knowledge, experience, and planning personnel (especially as they infuse industry) will not eventually give France advantages over nations that are less experienced and less educated in the process.

Gilpin believes that France must follow one of three paths to achieve the status of a scientific state. She can follow the "Swedish" path by focusing her technological efforts in a few areas of concentration, or the "Japanese" way through heavy utilization of foreign licensing agreements; or she can emulate the two dominant scientific states in all activities across a broad front. Clearly, to do the last requires the resources and markets of states of continental dimensions; if this route is the most attractive for France and for other European nations, the logical conclusion, which Gilpin pursues, is more intensive scientific and technological collaboration on a truly European scale.

This is the obvious conclusion for which many have argued, but there are still few signs of its coming about. The difficulty is that technology is not the sole driving force in economic and political consolidation. If even the Czech crisis did not impart an immediate, salutary push toward European unity, it is difficult to envison the "American challenge" as a quick catalyst, although over a period of a great many years it may prove to have been such. The ultimate solution for Europe will probably turn out to be a melange of the three analyzed by Gilpin, coupled with the advantages derived from newly developed, long-term planning methodologies. Whatever solution arises, it will be a solution essentially derived by Europeans themselves. And not many years hence it would not be surprising to see the "European challenge" become a most fashionable subject.

Political vicissitudes will determine how the pendulum of challenge swings between the developed and the undeveloped nations; but most studies, examinations, and so on will borrow from such as de Tocqueville, confident in his expectation that social benefit would of its own accord spill over from "high scientific vocation." He was wrong in that, but who can challenge his thesis that some sort of scientific "aristocracy" must be maintained?

On the other hand, can we fully accept Servan-Schreiber's dictum that "politics, the interplay between Right and Left, is increasingly the irreplaceable source of creativity"? But for the moment, Gilpin gives us a fine summation of the problem for France, and for a great many other nations: "The term 'technology gap' is really a symbolic representation of the whole spectrum of challenges posed by a dynamic, expanding, and socially democratic society for conservative societies ruled by traditional elites wanting the power that science and technology can bring, but unwilling to pay the price of a profound social-economic transformation."

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Last Looks at a Pleistocene Record

Desert and River in Nubia. Geomorphology and Prehistoric Environments at the Aswan Reservoir. KARL W. BUTZER and CARL L. HANSEN, with contributions by Egbert G. Leigh, Jr., Madeleine Van Campo, and Bruce G. Gladfelter. University of Wisconsin Press, Madison, 1968. xxii + 562 pp., illus. $17.50. Set of 15 maps from the book, drawn to a larger scale, $10.

The Prehistory of Nubia. Final Reports of Research Conducted by the Combined Prehistoric Expedition to Nubia. FRED WENDORF, Ed. Fort Burgwin Research Center and Southern Methodist University Press, Dallas, Texas, 1968. 2 vols., xiv + 1084 pp., illus., boxed with 38 loose figures and tables. $37.50.

"Nubia, a part of the Nile Valley, is a land of river, rock, and sand that winds its way upstream of Aswan into the distance of the Sudan." This is the only statement in these two works that even approximates a definition of the area of their concern, and it appears only on page 196 of the Butzer and Hansen volume. Admittedly, Nubia is vaguely delineated, being a region of northeastern Africa, between upper Egypt, the Red Sea, and the Libyan Desert and extending south indefinitely to about Khartoum. It includes that part of the Nile Valley from Aswan, near the First Cataract, to the confluence of the White and Blue Niles, at Khartoum, thus extending about 900 kilometers north-south. "Nubia . . . has no strictly defined limits and is little more than a geographical expression" (*Encyclopaedia Britannica,* 1956). The work reported in these two books concerns in actuality only Lower Nubia, that area north of the large S-bend of the Nile in northern Sudan.

The impetus for the intensive but short-lived efforts reported by these authors came from the construction of the new High Dam at Aswan that is bringing into existence Lake Nasser. This lake will inundate nearly 500 kilometers of the Nile Valley; the surface area of the reservoir will be about 6500 square kilometers when it is full in 1975; and the water volume will be 125 billion cubic meters, or five times the capacity of the former dam at Aswan. The economic implications for Egypt are certainly great, but the con-

sequences for students of prehistory and the early history of the middle Nile Valley are devastating. When Lake Nasser is full, "all the Pleistocene record of Lower Nubia will be under water" (Butzer and Hansen, p. 200). Some of the early historic monuments of the area, such as the great temple of Ramses at Abu Simbel, could be cut into pieces and removed to higher ground, but this would hardly be feasible for Pleistocene gravel terraces of the Nile and their enclosed prehistoric sites.

The volumes reviewed here represent the major part of the scientific efforts supported by many countries to record the prehistory of the Nubian Nile before it was inundated by Lake Nasser. Butzer and Hansen's book reports the geomorphological investigations of the Yale Prehistoric Nubia Expedition, supported by several National Science Foundation grants and U.S. State Department grants to Charles A. Reed of Yale University and to Butzer, then of the University of Wisconsin. The "Yale Expedition" was joined in its efforts by a team from the National Museum of Canada, and the Yale-Canadian work was concentrated in the area of upper Egypt from Kom Ombo to the Sudan border. Archeological and other studies associated with this expedition will be published independently.

The two volumes edited by Fred Wendorf report essentially all the work of the Combined Prehistoric Expedition, similarly supported by the U.S. State Department and the National Science Foundation, as well as by the Fort Burgwin Research Center, Inc., and the Smithsonian Institution. This expedition is called "Combined" since it united under the leadership of Wendorf not only a large number of American scholars from several organizations (notably Southern Methodist and Columbia universities, the Museum of New Mexico, and others) but also various European scientists from Belgium, France, and Poland, as well as Egyptians. The "Combined Expedition" concentrated its studies in the area of northernmost Sudan between the Egyptian border and the Second Cataract near Wadi Halfa. The concession granted them by the Egyptian and Sudanese governments extended considerably farther south, but little of interest was found south of the Second Cataract.

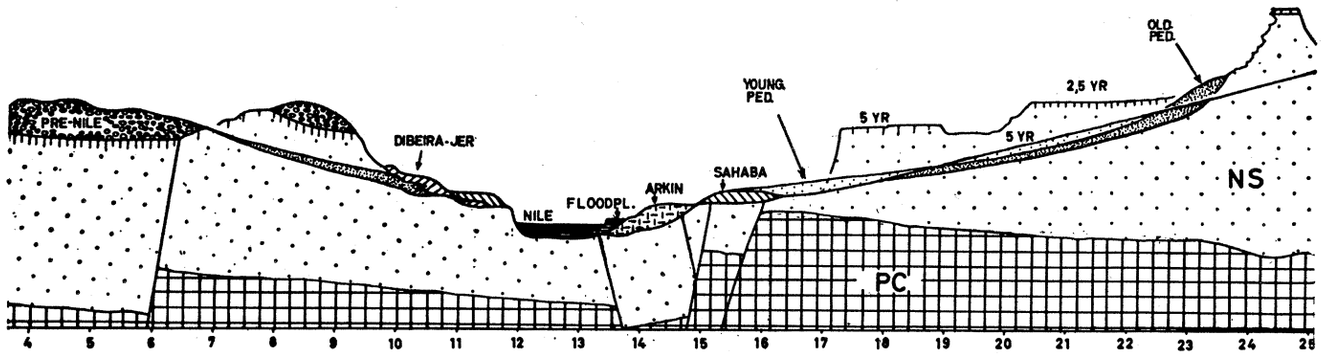
Many other expeditions—from India, the Soviet Union, Scandinavia, and the University of Colorado—were simultaneously working in these same areas in what must have been the largest salvage archeology effort ever. However, these other groups concentrated principally on the archeology of monuments of the early historic period.

The importance of the Nile Valley in the study of the ice ages (the Pleistocene Epoch) is that it stretches longitudinally from intertropical areas into the mid-latitude Mediterranean basin, thus providing a means of physically linking climatic events (pluvial episodes) of the monsoonal tropics with those of the zone of westerly cyclonic storms. There has been much speculation about the phasing of intertropical and mid-latitude pluvials, and here is a region where hypotheses may be tested. The geologic and geomorphologic work reported here is the first intensive modern attempt to understand the area; decent topographic maps, aerial photographs, and even Gemini 4 photography are now available, and the work accomplished in such a short time by Butzer and Hansen and by de Heinzelin (in Wendorf) would have been impossible without these tools.

Although both these books cover much of the same type of materials and subjects, the balance is quite different. Butzer and Hansen concentrate on the paleogeography of Egyptian Nubia, but they bring in enough archeological information to show the temporal position and environmental conditions of the early habitants of Lower Nubia. Wendorf's volumes are largely archeological reports, although de Heinzelin's chapter and fragments of geological information in certain other chapters provide the natural and chronological framework that is important to the prehistorians. The Atlas that accompanies the two volumes of text is made up mostly of numerous geologic sections drawn by de Heinzelin.

Butzer is by self-declaration a Pleistocene geographer, and in his book he illustrates very well just how he applies this approach. *Desert and River in Nubia* is a very well written account of the bedrock framework, the geomorphologic and sedimentary history, the prehistoric populations, and the flora and fauna of the Nile Valley in Lower Nubia, of the Kurkur Oasis 55 kilometers west of the Nile in the Libyan Desert, and of the Red Sea littoral near Mersa Alam. Several sections are devoted to present-day geomorphic processes (or lack thereof) that can be observed in the area, and there are good summaries of climatic and historic information. The book is well illustrated with photographs, line drawings, and tables presenting quantitative data on heavy minerals, clay minerals, quartz-grain morphoscopy, and pebble shapes, and there are appendices describing the fossil pollen (rare) and fossil mollusks (abundant). One cannot help being impressed by the vast amount of information synthesized herein, especially since it was gathered essentially during one four-month field season (1962–63). The book has a very authoritarian tone, and many suggested interpretations are stated rather categorically in places, although the authors admit a few paragraphs or pages farther on that such interpretations are tentative, reasonable but unproven. The rapidity with which this rather extensive area was studied can only elicit caution in accepting all the fine details of interpretation. Only a person with Butzer's extensive experience in similar areas could possibly have pulled together this information in such a short time. Nevertheless, one has reason to be prudent. All the evidence now is, or very soon will be, under water.

Of the myriad of details presented by Butzer and Hansen, only a few can be mentioned here: the question of the Proto-Nile, the age of the modern Nile system, and the correlation of pluvials. The term "Proto-Nile" has been variously used and misused, and Butzer and Hansen wisely define exactly what they mean by it—a stream system occupying the Proto-Nile basin stretching along the axis of the present Nile Valley north from the Third Cataract. They recognize this fluvial network as far back in time as the Miocene Epoch; it is evidenced by high-level pediment surfaces flanking the present Nile. Its age is determined by reference to bedrock faulting and marine incursions of the Tertiary Mediterranean Sea, which reached as far as Aswan during Late Tertiary time (Pliocene). In contrast, de Heinzelin (in Wendorf) recognizes three stages in the development of the Nile: a Pre-Nile stage, a Proto-Nile stage, and the modern Nile. His Pre-Nile Dabarosa Formation, some 60 meters above the present Nile, is certainly equivalent to one of Butzer and Hansen's early Pleistocene Nile terraces, perhaps their Gallaba gravels near Kom Ombo. However, de Heinzelin is unwilling to attach an age to his Dabarosa Formation. His next stage is called "Proto-Nile" and is dated by him as Upper and Middle



Schematic cross section of Nile Valley just north of Second Cataract at Wadi Halfa, showing the major fluvial deposits. East is to the right. "Pre-Nile" gravels predate the incorporation of Ethiopian drainage into the Nile system; "Dibeira-Jer," "Sahaba," and "Arkin" sediments were deposited by three successive aggradations of the Nile since about 25,000 years ago—they are separated from each other by periods of downcutting and by subaerial deposits, mostly eolian (not shown); "Young Ped." and "Old Ped." are aggradations of gravels in wadis tributary to the Nile in Nubia, contemporary with the pluvial aggradations of the Nile itself; "5 YR" and "2.5 YR" indicate the Munsell color of paleosols developed on older, higher erosion surfaces; "NS"—Nubia Sandstone; "PC"—Precambrian basement rocks. The horizontal scale is in kilometers; vertical exaggeration, about × 25. [Reproduced from de Heinzelin, Atlas fig. 81, in *The Prehistory of Nubia*]

Pleistocene, during which time he visualizes the Proto-Nile system being limited to the area north of the Second Cataract, not the Third Cataract as is believed by Butzer and Hansen. Thus, there is considerable disagreement on both the age and the extent of the Proto-Nile system. A part of this discrepancy is surely a result of difference in terminology.

From this point on, however, the interpretations of the history of the Nile by the two groups of authors are nearly identical, although they use different sets of stratigraphic names. Both agree that a very important change took place in Upper Pleistocene time, no more than 50,000 years ago and possibly somewhat less. Then, for the first time, river gravels in Lower Nubia (north of the Second Cataract at Wadi Halfa) include exotic pebbles and heavy minerals that indicate the first arrival of sediments from an Ethiopian source. This means that the large Precambrian massif just south of the Second Cataract was breached by fluvial erosion and joined to the Egyptian Nile, thus forming the Nile system essentially as we know it.

The Nile River in upper Egypt and Nubia runs through one of the driest regions on earth; Aswan receives on the average 3 millimeters of rain a year. With the present hydrography no water is added to the Nile throughout this part of its trajectory. Yet during the pluvial episodes of Pleistocene time a considerable amount of sediment was eroded, transported, and deposited by wadis tributary to the Nile. Prior to the incorporation of the Ethiopian Nile in late Pleistocene time, this fluvial activity can be ascribed only to a significant increase in local precipitation, mainly in the Red Sea Hills that form the upper reaches of the now-dry tributaries. This would have been brought about when the Mediterranean winter-rainfall belt shifted southward in response to continental glaciation in northern latitudes. At least half a dozen pluvials of this sort are postulated by Butzer and Hansen for the earlier part of the Pleistocene.

Of even greater interest for pluvial chronologies is the Upper Pleistocene record. Radiocarbon dating assures us that the last major pluvial of Lower Nubia was indeed contemporary with the last major glaciation of Europe and North America (between about 70,000 and 10,000 years ago). With the appearance of Ethiopian sediments in the Nubian Nile there is evidence for at least three main inputs ("pluvial substages") due to a summer flood regime like that today, dependent on tropical monsoonal precipitation. Those summer flood deposits spread over a much larger part of the Nile valley bottom than modern summer floods do. Furthermore, they interfinger with wadi alluvia, which were dependent on increased winter rains in the Red Sea Hills. Thus the evidence is very clear, for the Upper Pleistocene at least, that intertropical pluvials were indeed contemporary with Mediterranean-type pluvials, as well as contemporary with continental glaciation.

Pluvial episodes in the area of the Nubian Nile were by no means characterized by a superabundance of rainfall and lush vegetation. Butzer and Hansen suggest an increase of precipitation to no more than 50 to 100 millimeters a year, in other words, a change from extreme aridity to a subarid or semiarid climate. During these pluvials the human inhabitants stayed close to the Nile, the surrounding deserts remaining inhospitable. However, the banks of the Nile must have been considerably more comfortable without irrigation than would be the case today. Grassy vegetation was abundant, large game animals (hippopotamus, wild cattle, buffalo, warthog, gazelles, wild ass, and others) frequented the area, and fish were probably always an important element of the food supply.

Turning our attention then to the prehistoric archeology and the Wendorf volumes, we find confirmation that this area which is so inhospitable at present was not always so. In the planning of this salvage operation much more emphasis was given to the remains of the historic period because prehistoric Nubia was considered "culturally conservative and almost unchanging from the Middle Paleolithic until just before the beginning of the Neolithic" (Wendorf, p. 5). Upper Paleolithic evolution and the beginnings of food production seemed to have bypassed this area. However, as a result of the work reported by the various colleagues of Wendorf, it now appears that Nubia was not a cultural backwater; rather, it was a major crossroads, especially in Late Paleolithic and Epi-Paleolithic times. The prehistory of Nubia has been completely rewritten.

Leaving aside for lack of space the Early Stone Age Acheulean industries, reported by Waldemar Chmielewski, and the controversy between the Guichards and Anthony Marks concerning the relationships of the "Nubian

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