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A New Radiocarbon Chronology for Prehistoric Sites in Nubia

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The sequence of prehistoric cultural developments in Nubia has been regarded as one of the best-dated series in North Africa. Eighteen new dates obtained by redating of residues from previously dated samples and the processing of samples held in storage plus a series of recently excavated examples have indicated, however, the need for significant revision of the original chronology. Almost all of the new dates, whether derived from residues or from new samples, were older than the original dates. No adequate explanation is offered for the discrepancies in the two series of dates, although two possibly contributing factors are noted.

Introduction
A series of 18 new radiocarbon dates on charcoal from several prehistoric sites in Nubia (10 from Sudan and eight from Egypt) suggests a significant revision in the basic chronology for that area. Six of these new dates are on the pretreated residues of samples previously dated, and four are on samples that were in storage at Southern Methodist University, but which were not dated originally because of limitations in funds. Two of the new dates refer to the Khormusan industry, two are with the Halfan industry, two are from the Arkinian industry, and four are associated with the Sharmarkian industry. The eight new dates from Egypt all come from a series of Late Paleolithic sites at Wadi Kubbaniya, on the west bank of the Nile just below Aswan.

Previous Chronology
The 1968 Nubian chronology was based on an extensive series of radiocarbon dates closely tied to several stratigraphic sections which were interpreted as recording a complex sequence of Nilotic aggradational and recessional events. On the basis of the then available radiocarbon dates, it was believed that the earliest true Nile sediments (i.e., those containing heavy minerals of Ethiopian origin) were of Late Pleistocene age, and dated after 30,000 years ago. These earliest Nile sediments, named the Dibeira-Jer formation, recorded the first Nilotic aggradational event and reached a maximum elevation of 34 m. above the modern floodplain. The silts contained several sites of the Khormusan industry and yielded two samples of


charcoal that dated 20,900 B.P. ± 280 years (WSU-203, Site 1017), and 18,800 B.P. ± 500 years (WSU-215, Site ANW-3). The Khormusan is primarily a flake industry that places heavy stress on Levallois technology and denticulates, and in these respects closely resembles many Middle Paleolithic complexes elsewhere. It differs from most Middle Paleolithic, however, in having a consistently high frequency of burins, a feature usually associated with post Middle Paleolithic developments. Thus, in spite of the basically primitive nature of the Khormusan, the burins seemed to indicate a Late Paleolithic manifestation, and consequently the two radiocarbon dates were accepted as correct. The Dibeira-Jer formation and its associated Khormusan industry were estimated to date between 27,000 and 18,000 B.P. A discordant date of >36,000 B.P. (GXO-409), obtained from the Khormusan site of G630, excavated by the University of Colorado Expedition, was rejected as too old.

The Dibeira-Jer aggradation was believed to have been followed by a comparatively brief recessional event, the so-called Ballan, when the level of the Nile fell more than 10 m. below the Dibeira-Jer maximum, and dunes and other aeolian sediments were deposited over the eroded surface of the silts. The lithic industry associated with this so-called Ballana recessional event is radically different from the preceding Khormusan. Although traces of Levallois technology remain, the new industry, named the Halfan, is dominated by microlithic blades, many of which have light Ouchtata retouch. There were four radiocarbon dates associated with the Halfan industry: 16,500 B.P. ± 500 years (WSU-201, Site 443); 18,600 B.P. ± 550 years (WSU-318, Site 8859); 19,250 B.P. ± 375 years (WSU-332, Site 2014); and 24,700 B.P. ± 2500 years (GXO-440, Site GB-32, excavated by the University of Colorado Expedition). Again, the discordant early date from Site GB-32 was rejected as too old, and the Halfan (and the so-called Ballana recessional event) were estimated to date from ca. 20,000 to 17,000 B.P. The Halfan thus overlapped in time with the latter part of the Khormusan industry and the final part of the Dibeira-Jer aggradation.

The next aggradational event, the Sahaba, was estimated to date from around 17,000 to 10,000 B.P., on the basis of several radiocarbon dates. This general time frame for the Sahaba is not contested by new radiometric measurements, but its relationship to the immediately preceding aggradation and recession has been revised. The maximum of the Sahaba aggradation was 26 m. above the modern floodplain at Wadi Halfa or 10 m. lower than the preceding Dibeira-Jer aggradation.

The Sahaba was followed by another brief episode of downcutting (the Birbet), and then by a third Nile interval of aggradation, named the Arkin, which reached a maximum some 13 m. above the modern floodplain, and was dated 9390 B.P. ± 180 years (WSU-175, Site DIW-1). A series of recessional features and minor aggradational events within the Arkin were dated as follows: 7700 B.P. ± 120 years (WSU-176, Site DIW-51) for the 9 m. maximum; and 5600 B.P. ± 200 years (WSU-174, Site DIW-50) and 5220 B.P. ± 50 years (WSU-103, Site DIW-4) for the 5 m. maximum. The intervening 6 m. maximum was undated, but was estimated to date between 6000 and 6500 B.P.

It is useful to recall that our knowledge of African prehistory at this stage was such that the entire sequence of dates seemed reasonable and fully comparable with many other dates then available from East Africa. Furthermore, with only two exceptions, the dates were internally consistent and in proper stratigraphic order.

Additional Dates

Shortly after the field work in Nubia was completed and the results published, the Radiocarbon Laboratory in Washington State University, Pullman, Washington, returned several samples which had not been processed because sufficient funds were not then available. At the same time, the pretreated residues from the dated samples were also returned, each in a sealed glass jar. The entire group was placed in storage with the other Nubian collections at Southern Methodist University. They remained undisturbed until late 1975, when the undated samples were evaluated for possible dating.

The first of the undated materials to be processed were three samples of charcoal associated with the latter part of the Arkin aggradation. Two of these were from Site DIW-50, associated with the 5 m. maximum. They gave dates of 5410 B.P. ± 150 years (SMU-1) and 5880 B.P. ± 150 years (SMU-2), both in close agreement with the previous date of 5600 B.P. for that event.

The third sample was from Site DIW-53, associated with the previously undated 6 m. sub-aggradation. It gave a surprisingly old date of 7910 B.P. ± 120 years (SMU-4), which conflicted with the 7700 B.P. ± 120 years (WSU-176) for the stratigraphically older 9 m. event. The conflict was not regarded as serious, however, since the two dates did overlap within one standard deviation.  

Another previously undated specimen was a small sample of fine charcoal dispersed in sandy matrix from a hearth associated with Site 34, Area D, a surface to slightly sub-surface concentration overlying the early Khormusan assemblage of Site 34, Area A. The assemblage from Area D is regarded as typologically the most evolved known for the Khormusan industry, and a date from this hearth should refer to the final part of that development. The sample was given a pretreatment which removed both the fine charcoal and the humates at once from the matrix, and resulted in a silt-free concentrate of the organic fractions which were then dated. It yielded an age of $>41,490$ B.P. (SMU-107), clearly much older than the time range previously assigned to the Khormusan and the Dibeira-Jer formation. It did, however, agree with the previously rejected date of $>36,000$ B.P. (GKO-409) from the Khormusan Site of 6G30. An attempt to date the silt fraction as well failed because not enough carbon was left in it.

The residue from the charcoal sample of WSU-203 (from Site 1017, previously dated 20,900 B.P. ± 280 years) was then redated. Although the sample had already been pretreated at the Washington State University Laboratory, the process was repeated. It was noted, however, that weak solutions of NaOH (0.2 percent) caused the charcoal residue to pass through a glass fiber filter, thus the completion of the humate extraction could not be attempted. With pretreatment possibly not completed, the process was terminated. The residue gave a date of $>36,750$ B.P. (SMU-245). Presumably, if pretreatment could have been carried to completion, the sample would have yielded a date close to or beyond the limits of the SMU Laboratory, i.e., about 45,000 B.P. This date is, therefore, seen as in close agreement with SMU-107 and GKO-409. Unfortunately, there is no residue available for the other Khormusan date, WSU-215, but in the light of the redating of WSU-203, the WSU-215 date must be regarded as suspect.

The first revised chronology for the Nubian sequence was published shortly after this series of new dates became available. The major changes at that time were: 1) to date the Dibeira-Jer formation to before 40,000 years ago, and its associated Khormusan industry as the latest of three Middle Paleolithic manifestations in the Nile Valley; 2) to suggest a synchrony of the Ballana dune episode and Nile silts of the Masmas formation at Kom Ombo, dated at several localities between 17,000 and 19,000 B.P.; and 3) to correlate the Sahaba formation with a similar episode of siltation at Kom Ombo, known as the Darau formation. This episode was referred to as the Sahaba-Darau aggradation.

The redating of WSU-203 led to further questioning of the Nubian dates from the Washington State Laboratory, and it was decided that all previously dated samples for which adequate residue remained and all undated samples in storage were to be dated. There were only three datable residues on file: one from the Halfan site of 443 (previously dated 16,500 B.P. ± 500 years, (WSU-201), one from the oldest Arkinian site, DIW-1 (previously dated 9390 B.P. ± 180 years, WSU-175), and one from the Sharmarkian site DIW-51 (previously dated 7700 B.P. ± 120 years, WSU-176). Sample WSU-201 was marginal in size and, like some of the others, tended to pass into solution when subjected to weak NaOH. Also, there was evidence of remaining carbonate in the charcoal of this sample, shown by a weak but persistent reaction to an HCl solution. Thus, the pretreatment process can not be regarded as having been completed and some humates and carbonates may have remained. This residue of WSU-201 gave dates of 17,620 B.P. ± 410 years, and 17,200 B.P. ± 330 years (SMU-576; two counts), or some 1000 years older than the previous date from the same sample.

Similarly, a new date on the returned spare sample from WSU-175, from DIW-1, was run. Again the pretreatment process was repeated. Thereby it was noted that the material reacted like and had the appearance of almost pure humates. This new date (SMU-600) yields an age of 10,580 B.P. ± 150 years which is nearly 1200 years older than the Washington State measurement.

A previously undated charcoal sample from the same site, but from a separate area (Locality J), was also submitted for dating to the SMU Laboratory. Pretreatment procedures revealed the very delicate nature of this sample, which contained secondary carbonates. One weak (0.1 percent) NaOH treatment was given to remove the most soluble humates. A stronger treatment would have entirely dissolved the sample. We therefore conclude that the DIW-1 sample was of similar condition to the Locality J sample. The latter yielded a date of 10,670 B.P. ± 110 years (SMU-581), essentially the same age given by the SMU date which was rerun on WSU-175.

Finally, sample WSU-176, from Site DIW-51 and the 9 m. maximum of the Arkin formation, was redated and gave an age of 8860 B.P. ± 90 years (SMU-582). This new age is 1160 years older than the previous determination, and removes the conflict previously noted between the dates from DIW-51 and DIW-53.

More recently, excavations at a series of Late Paleolithic sites at Wadi Kubbaniya on the west bank of the Nile just north of Aswan have yielded significant

5. Ibid. 231-72.
new information on the Ballana-Masmas and the Sahaba-Darau aggradational events, as well as a series of eight new radiocarbon determinations, as follows:

<table>
<thead>
<tr>
<th>EVENT</th>
<th>AGE B.P.</th>
<th>EVENT</th>
<th>AGE B.P.</th>
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<tbody>
<tr>
<td>18,250 B.P. ± 290 years (SMU-591), charcoal</td>
<td>5600</td>
<td>5 m</td>
<td>5600</td>
</tr>
<tr>
<td>16,960 B.P. ± 210 years (SMU-599), charcoal</td>
<td>9 m</td>
<td>7710</td>
<td></td>
</tr>
<tr>
<td>17,920 B.P. ± 380 years (SMU-596), charcoal</td>
<td>9 m</td>
<td>8860</td>
<td></td>
</tr>
<tr>
<td>17,670 B.P. ± 250 years (SMU-616), charcoal</td>
<td>13 m</td>
<td>10,600</td>
<td></td>
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<tr>
<td>Same sample</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17,380 B.P. ± 340 years (SMU-617), humates</td>
<td>Bibefer(R)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>17,100 B.P. ± 540 years (SMU-623), charcoal</td>
<td>Sahaba(A)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>17,850 B.P. ± 200 years (SMU-592), charcoal</td>
<td>Bibefer(R)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>17,130 B.P. ± 210 years (SMU-595), charcoal</td>
<td>Sahaba and</td>
<td>12,000</td>
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<td></td>
<td>Ballono</td>
<td>17,000</td>
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<td></td>
<td>DuneSil/Aggradation</td>
<td>13,200</td>
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<td>Long Recession</td>
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<td></td>
<td>Dibeira-Jer(A)</td>
<td>20,000+</td>
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<td></td>
<td></td>
<td>Dibeira-Jer(A)</td>
<td>&gt;40,000</td>
</tr>
</tbody>
</table>

Table 1. Comparison of old and new chronologies for Nubia.

The pair of dates SMU-616 and SMU-617 on the same sample demonstrate that charcoal and extracted soluble fraction (humates) yield the same date within statistical probability, therefore humate contamination does not seem to pose a problem at this site.

All of these dates are associated with interfingering silts and dunes assigned to an early phase of aggradation subsequent to the Dibeira-Jer. The accompanying stratigraphic studies indicate continuous Nile aggradation occurred in Wadi Kubbaniya from slightly before 18,000 B.P. until around 12,000 B.P. and failed to confirm the presence of a recessional event between the Ballana-Masmas and Sahaba-Darau aggregations. The evidence clearly indicates only a single, prolonged episode of aggradation. The as yet unnamed recessional event must be placed during the 20,000+ years long period between that aggradation and the much earlier Dibeira-Jer.

Discussion

It may not be possible to arrive at an adequate explanation for the discrepancies between the Washington State University and the Southern Methodist University dates. Part of the problem must be attributed to the incomplete pretreatment of many of the samples before they were dated by Washington State University. Undoubtedly, many of these samples are contaminated by later humates or carbonates. In addition, there may have been a calibration error of the WSU equipment involving the estimation of background or counting efficiency at the time the measurements put in question here were made. Whatever the cause, however, it is evident that the Nubian absolute chronology needs significant revision at several points.

The Khormusan is clearly much older than previously believed, and quite possibly dates prior to 40,000 years ago. In this light, the Middle Paleolithic features of the Khormusan are more understandable, and the Dibeira-Jer aggradation must now be seen as an early Late Pleistocene event. Furthermore, some of the occurrences which were so perplexing in 1968, such as Site 440, which always seemed Middle Paleolithic in both typology and technology, can now be better evaluated. The date of 15,340 B.P. ± 500 years (WSU-290) associated with Site 440 can probably be discarded as much too recent, although the residue from the sample was not sufficient to permit redating.

With the Dibeira-Jer silts placed further back in time, the recession separating that event from the succeeding aggradation takes on new perspective. There are no archaeological complexes or Nile sediments known that can be placed with any confidence within this long interval. For most of this period, the Nile must have been confined to a channel now buried well below the modern floodplain. The data from the adjacent Western Desert of Egypt indicate that the area was hyper-arid and unoccupied from the end of the Aterian, dated before 45,000 years ago and possibly dating before or in the early part of the Dibeira-Jer aggradation, until the first wet phase of the early Holocene, around 9500 years ago.7

The first Nile aggradation after the Dibeira-Jer appears to be recorded in Nubia at those sites with the Halfan industry, and in upper Egypt at Deir el Fakhuri.4

and at Wadi Kubbaniya. In all of these, the occupations occur associated with interfingering Nile and aeolian sediments, and have radiocarbon dates (as revised here) between slightly before 18,000 and 17,000 B.P. The lithic assemblages from these sites show many similarities in both typology and technology. The Wadi Kubbaniya evidence indicates a long unbroken interval of Nile aggradation and simultaneous dune accumulation (the latter on the west bank only), of which the latter part was previously known as the Sahaba-Darau aggradation. This ended at about 12,000 B.P. when the level of the Nile apparently fell abruptly to below the level of the modern floodplain.

The next aggradation in Nubia is the Arkin, of which the maximum (at 13 m. above the modern floodplain) is now dated at 10,600 years ago. The subsequent series of minor recessions and sub-aggradations are dated as 8860 B.P. for the 9 m. maximum; 7710 B.P. for the 6 m. maximum and 5700-5400 B.P. for the 5 m. maximum. The original and revised chronologies are compared in Table 1.

It is perhaps fruitless to speculate on the impact the original erroneous dates had on our perceptions of Nubian prehistory. Clearly they encouraged the survival of the still not fully discredited concept of general African cultural conservatism and backwardness, that Middle Paleolithic technologies somehow survived there far later than elsewhere. They undoubtedly were a major factor in the development of the model by de Heijnzelin of a relatively recent Nile; and they contributed to our view that the Nilotic microenvironment was somehow simultaneously shared by groups whose lithic technologies were radically different. These new dates, together with the recent stratigraphic observations, provide a framework in which the cultural developments in the Nile Valley are clearly more comparable to those elsewhere in North Africa and the Near East.

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