DHAMAR PROJECT

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This report should be detailing the results of the 1998 field season conducted in February and March 1999. Unfortunately, owing to circumstances following the kidnapping of tourists in late 1998, and a United States government travel advisory notice against visiting Yemen, the winter 1999 season was postponed until fall 1999. However, we were able to take advantage of the available time to prepare for publication some of the materials recovered from earlier field seasons. Consequently, just as the results from the 1998 field season were appearing in the journal *Arabian Archaeology and Epigraphy,* major articles synthesizing our knowledge on the Bronze Age pottery from highland Yemen and the Iron Age and Himyarite architecture were being prepared respectively by Christopher Edens and Eleanor Barbanes. In addition senior graduate students Joseph Daniels and Colleen Coyle were able to critically examine inscriptional evidence (Daniels) and obsidian sourcing (Coyle) from the Dhamar area.

Since our return from the field, results of the geoarchaeological analyses are starting to appear. This is enabling us to make more sense of the sequence of environmental change as well as interactions between early highland communities and the environment. The extraordinary length and scale of the Yemeni sedimentary sequences is well illustrated by figure 1, which shows an expanded diagrammatic view of the stratigraphic succession behind the destroyed Himyarite dam of Sedd adh-Dhra'ah II (for a photograph, see *1995/96 Annual Report*, p. 75, fig. 4). This sequence, which represents virtually the entire sweep of the Holocene (i.e., the last

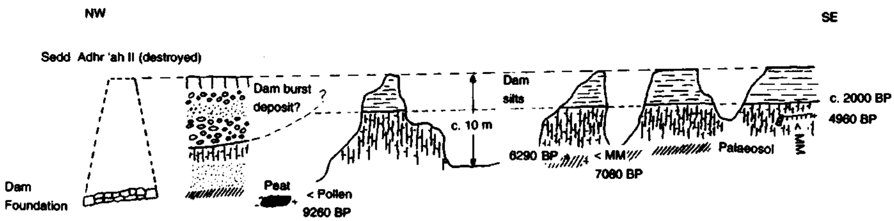

Figure 1. Diagrammatic section behind the broken 2,000 year old dam of Sedd adh-Dhra'ah showing sedimentary stratigraphy from the last 10,000 years

10,000 years), commences with thick deposits of peat at the base that have been dated by radiocarbon to 9,260 years before present. These peats are now being analyzed for their contained pollen by Caroline Davies at Arizona State University. The peats being black and humus-rich appear to have accumulated in a verdant environment during which conditions were favorable for the accumulation of organic matter. Similar conditions, albeit perhaps somewhat less verdant, continued into the period between 6,000 and 7,000 years ago when the characteristic humus-rich (but not peaty!) palaeosol must have accumulated in a rather plant-rich valley floor environment. After this, conditions in the valley changed so that they were less favorable for the accumulation of organic material and humus so that silts and clays started to fill up the valley floor. As discussed below, this sedimentation probably results from a combination of increased atmospheric drying and increased human activity. It was during the later stages of the so-called Neolithic moist interval that a small valley floor terrace, already mentioned in the *1997/98 Annual Report*, must have been built. This low wall, dated by radiocarbon to around 3735 BC (4900 BP, fig.1) represents one of the earliest dated terraced fields in Arabia, but unfortunately, owing to its great age, the soil that accumulated behind the terrace wall has some of the characteristics of a natural soil. This information comes from the soil micromorphological studies of Charly French, a geoarchaeologist from Cambridge University, who has examined selected soils from the project under the microscope to obtain a worm's-eye view of their structure and history. The accumulation of silt and clay in the valley floor continued after the terraced field had been covered. Then, during Himyarite times (roughly contemporary with the Roman period), a major dam was built, behind which accumulated a few meters of silts and sands. Finally, a major catastrophic flood appears to have swept away the dam down to its foundations and left in its wake massive boulder and cobble beds (dam burst deposit in fig. 1).

There now seems little doubt that in southern Arabia the middle Holocene, that is from about 10,000 to 5,000 years ago, was significantly moister than today. However, our research is showing quite clearly how atmospheric processes and human activity interacted. The humus-rich buried soils (palaeosols) are proving to be particularly interesting because on face value they appear to have been formed during a moister climate that encouraged the growth of more vegetation than is possible today. The soils did not, however, simply accumulate in a pristine environment bereft of human activity. Instead, soil micromorphological studies by Charly French demonstrate that some of these soils show signs of considerable reworking in the presence of human activity, a point which is confirmed by the frequent presence, during

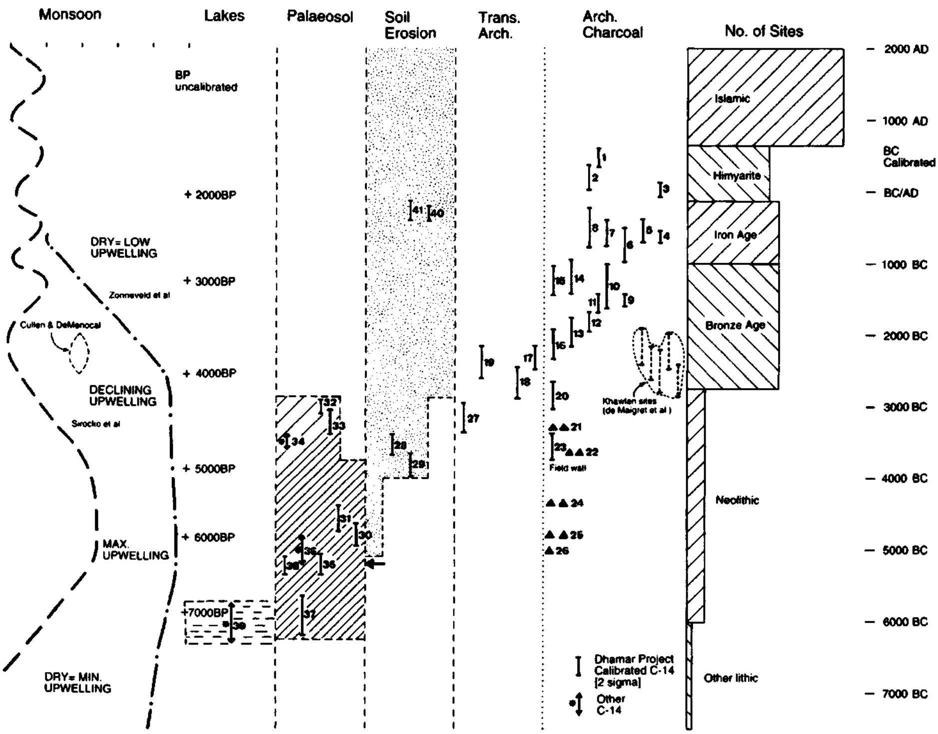

Figure 2. Settlement and environment in highland Yemen: Climate to the left, settlement periods to the right, sedimentary stratigraphy and radiocarbon-dated archaeological horizons in the central columns (drawn by Eleanor Barbanes)

field inspection, of obsidian artifacts, flecks of charcoal, and even food waste in the form of animal bones. Thus, these buried soils that developed in the apparently pristine environment of highland Yemen during the Neolithic were often intimately associated with human activity.

Figure 2 illustrates the ambiguity of interpreting the combined effects of human activity and environmental change, the interpretation of which is seemingly tinged with politics. On the left-hand side of the diagram we can see increased atmospheric moisture as recorded in cores in the bed of the Indian Ocean, whereas to the right is illustrated the increasing number of archaeological sites through time. The second column (Palaeosol: hatched) indicates the dates obtained by radiocarbon of the ancient dark humus-rich soils, while the third column (soil erosion: stipple) indicates the silty and sandy soils that accumulated usually on top of and after the old soils, frequently behind the walls of field terraces. In addition, archaeological horizons dated by radiocarbon are shown by the vertical lines in the column designated: Arch. Charcoal. Looking from the left, the buried soil (palaeosol) clearly accumulated when conditions were wetter, and the distinctive interface between the buried soils and the overlying soil erosion occurs at a time when, according to the ocean cores, conditions were getting drier. This therefore dates from a little before or after 4,000 years ago in radiocarbon years. In other words with drier conditions there was

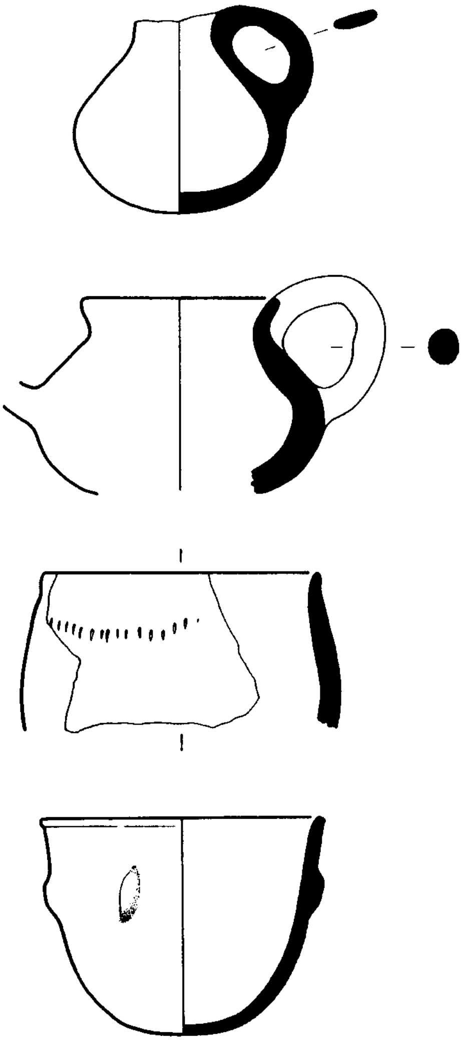

Figure 3. Some of the smaller late Bronze Age vessels from Kharraib (DS 228; drawn by Eleanor Barbanes)

less vegetation to retain soil on slopes and soil erosion resulted. On the other hand, looking from the right of the diagram we see that the same horizon is "explained" by the abrupt increase of human occupation in the Bronze Age, as indicated by the number of sites with the characteristic Bronze Age pottery. Such human activity, by disturbing soils on slopes and physically removing vegetation, would have encouraged soil erosion. Taking a more magisterial overview, we are therefore forced to conclude that neither human activities nor climate were the sole determinant of the change from humus-rich soil to accumulation of silts and loams. Rather it seems that the increase in human population and activity in the face of a drying climate might have resulted in this major sedimentary transition.

Owing to the still preliminary nature of our ceramic chronology, however, the graphical representation of sites in figure 2 is still oversimplified. Because all sites of the rather lengthy Bronze Age, which extends from the early third millennium BC to the late second millennium, are combined together, we get an overly steep increase in site numbers in the Bronze Age. However, recent analysis of the ceramic sequence by Christopher Edens suggests that there are probably three phases of the Bronze Age in the Dhamar area (albeit with a significant amount of spatial variability). The earliest phase, belonging to the later part of the third millennium is represented by the site of al-Sibal, excavated by McGuire Gibson in 1995; the second phase by Hammat al-Qa, excavated by Christopher Edens; and the third phase by Kharraib, again excavated by McGuire Gibson and reported in the previous *Annual Report*. Examples of the rather distinctive later Bronze Age ceramics are indicated in figure 3. The full late second millennium BC assemblage, although still distinctively "Bronze Age" in its types, is starting to exhibit some of the characteristics of the Iron Age pottery of the region. Although we are still some way off from having a full ceramic record, we are now reaching the point where the known ceramic horizons are starting to exceed the gaps in the sequence.

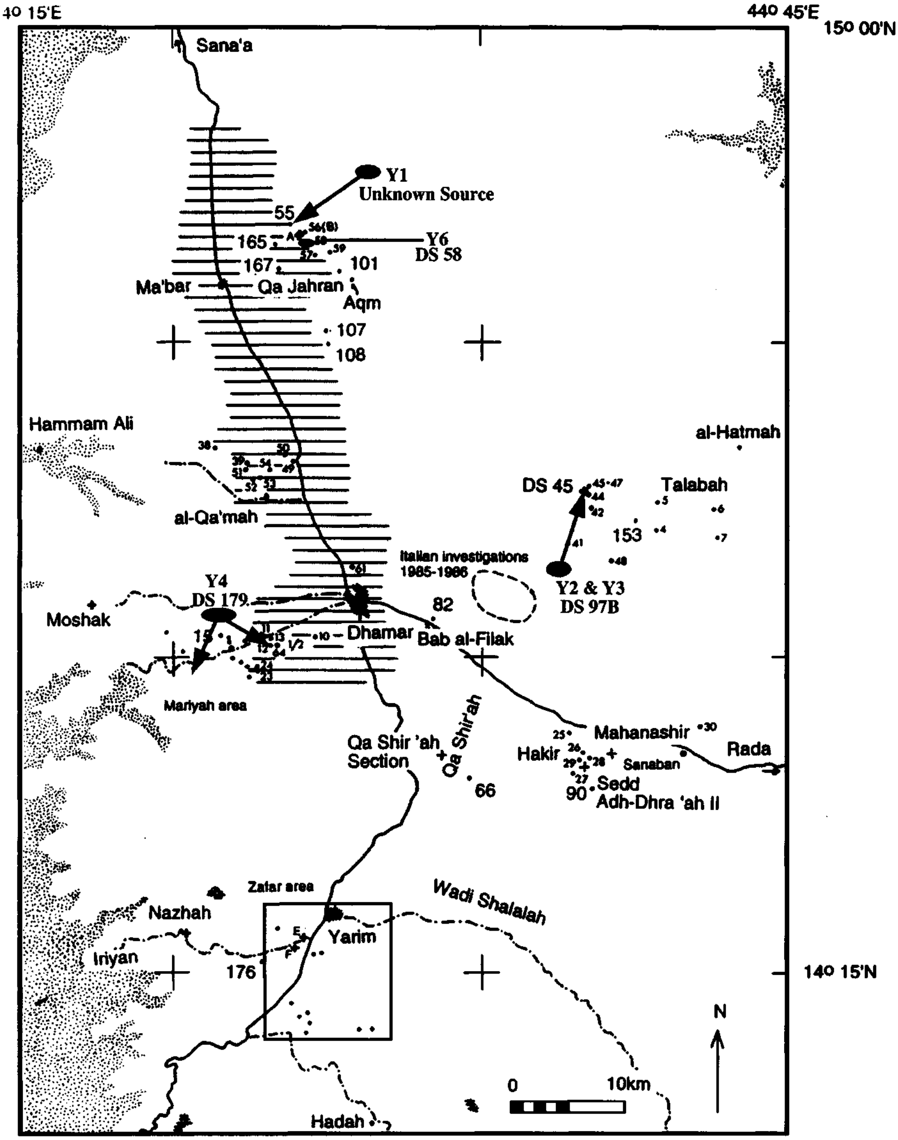

Figure 4. Preliminary map of obsidian trade and sources (data from J. Blackman, compiled by C. Coyle)

One of the few natural resources in the Yemen highlands around Dhamar, apart from soil and rainfall, is obsidian. This form of volcanic glass, because it can be chipped into a sharp concoidal fracture, is ideal for the manufacture of chipped stone implements. Even more attractive to archaeologists, the volcanic flows or plugs that yield the obsidian usually have distinctive chemical signatures that can be measured by techniques such as instrumental neutron activation analysis. As a result of the application of these sourcing techniques it is possible to trace artifacts to specific sources of obsidian. At present, we are in the initial stages of a study of obsidian sourcing in the Dhamar area, but some preliminary results are starting to appear. Analysis, undertaken by Jim Blackman of the Smithsonian Center for Materials Research and Education, Washington, DC is beginning to demonstrate that individual obsidian artifacts from specific sites can now be traced to specific outcrops or obsidian sources. In figure 4, compiled by Colleen Coyle, the sources are shown as solid ellipses, whereas arrows lead away from the sources to nearby sites that received obsidian from those same sources. For example, the Bronze Age site of DS 45 appears to have received at least some of its obsidian from the nearby volcanic mountain of Jebel al-Lisi (source Y2/Y3), while the Iron Age site of DS 15/17 received its obsidian from a much more dispersed source a few kilometers to the north (source Y4). More significantly in terms of interregional exchange, sites well outside the region, in the Wadi al-Jubah some 110 km to the northeast, received at least some of their obsidian from sources in the Dhamar area. Thus source Y2/Y3 contributed a single artifact to the site of Hajar ar-Rayhan I (in Wadi al-Jubah) and also site DS 55 shown in the northern part of figure 4, shared the same (but unknown) source as artifacts from Hajar ar-Rayhani. It is very likely that this source is also in the Dhamar area.

The archaeology of the Dhamar region therefore continues to take shape, both as a result of traditional modes of fieldwork, and by scientific analysis. Future work will therefore attempt not only to elaborate the archaeological and environmental chronology, but also to extend the record back into the early third, fourth, and fifth millennium BC, a period of which we still have only a very vague impression. Specifically, in the forthcoming season scheduled for October and November 1999, we will continue to map details of buildings within the Bronze Age sites, the scope of the obsidian analysis program will be extended, we will attempt to obtain further details on the date of initial construction of terraced fields, and finally, more time will be expended recording inscriptions, both monumental and informal, in order to build up the historical database for the region during the Himyarite period.