PROJECT FOR THE ARCHAEOLOGY OF YEMENI TERRACED AGRICULTURE

Tony J. Wilkinson

Since our last field season in February and March 2001, a number of sister projects have developed in order to focus upon several specific problems. These subprojects, which continue to be part of the Oriental Institute Project for the Archaeology of Yemeni Terraced Agriculture, are providing valuable new information on the antiquity of human occupation in the Yemen highlands. Considerable progress has been made on the analysis of materials collected during earlier field seasons, and because Chris Edens and Krista Lewis have been resident full time in Yemen since the 2001 field season, we are able to report the results of both additional fieldwork and analysis of data.

A major new exhibition on the *Land of Sheba* (i.e., Yemen) is currently on view at the British Museum. This exhibition, which continues for the remainder of 2002, features a spectacular range of epigraphy, funerary goods, fine bronze statues, and decorative sculptures of international importance. Although no finds from the project are on display, the results of the Dhamar Project figure prominently in the museum catalog. Notably the major third- and second-millennium hilltop town of Hammat al-Qa (reported in the *1990–2000 Annual Report*) can now be referred to as forming a type site for Bronze Age Yemen. These results are of more than local Yemeni interest because the verdant Yemen highlands must have formed a core area around which the incense trading states of Saba'a and Ma'in developed during the first millennium BC.

Since its inception a primary focus of the project has been the investigation of the role that environmental change has played in the development of human settlement and the agricultural landscapes of southern Arabia. We have gradually built up a valuable database concerning fluctuating phases of wetter and drier climate from the deposits of marshes and lakes in the area of Dhamar. This record is now starting to complement those records

Figure 1. View of al-Adhla well during excavation. Brian Pittman taking samples, bottom left. Yemen

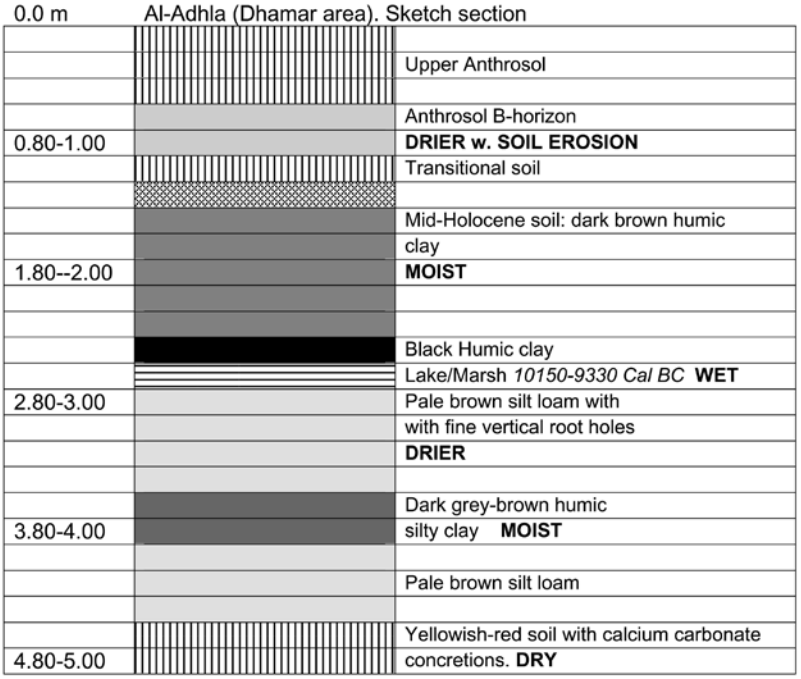

Figure 2. Sketch diagram of sequence exposed in al-Adhla well with major climatic phases indicated in bold letters

provided by deep cores drilled in the bed of the Indian Ocean. One problem with environmental records from the land is that lakes and marshes have an annoying habit of drying up. Although this may, of course, indicate that conditions became drier, when lakes dry out their mud can either blow away or become transformed into soils. As a result, our indicators of past climate, such as the microfossils that lived in the lakes or chemical traces that indicate the nature of the rainfall, can be blown away also or will be transformed and mixed into the soil profile. However, by the judicious use of deep sections exposed in the shafts of wells (fig. 1) we can recognize sediments from relict lakes and marshes. Thanks to the good nature of the Yemenis who dig these wells we have been able to get virtually unlimited access to the exposed sections in order to take sediment samples for analysis.

In 2001 Brian Pittman of Cambridge University meticulously recorded the al-Adhla section and took samples from throughout the five meter deep cut. This new well exposed alternating strata of dryland soils (indicating semiarid environmental conditions) and shelly mud and organic rich sediments (lakes and marshes relating to wet climatic phases) overlain by loams deposited during historical period agriculture (i.e., last 2,000 years or so; fig. 2). Shelly clays at almost three meter depth (nine feet) yielded our earliest dated lake or marsh at between ca. 10,000 and 9,300 BC. This deposit, as with other lake and marsh deposits recorded on the plateau, relates to a period of wet conditions that prevailed after the so-called Late Glacial Maximum (i.e., the time when the high latitude ice sheets were at their maximum extent). At this time the cold dry conditions of the Late Glacial were giving way to much warmer post-glacial conditions, with the result that the Indian Ocean monsoon (together with its associated rain) started rapidly to gain strength. This increased atmospheric moisture, which is reflected

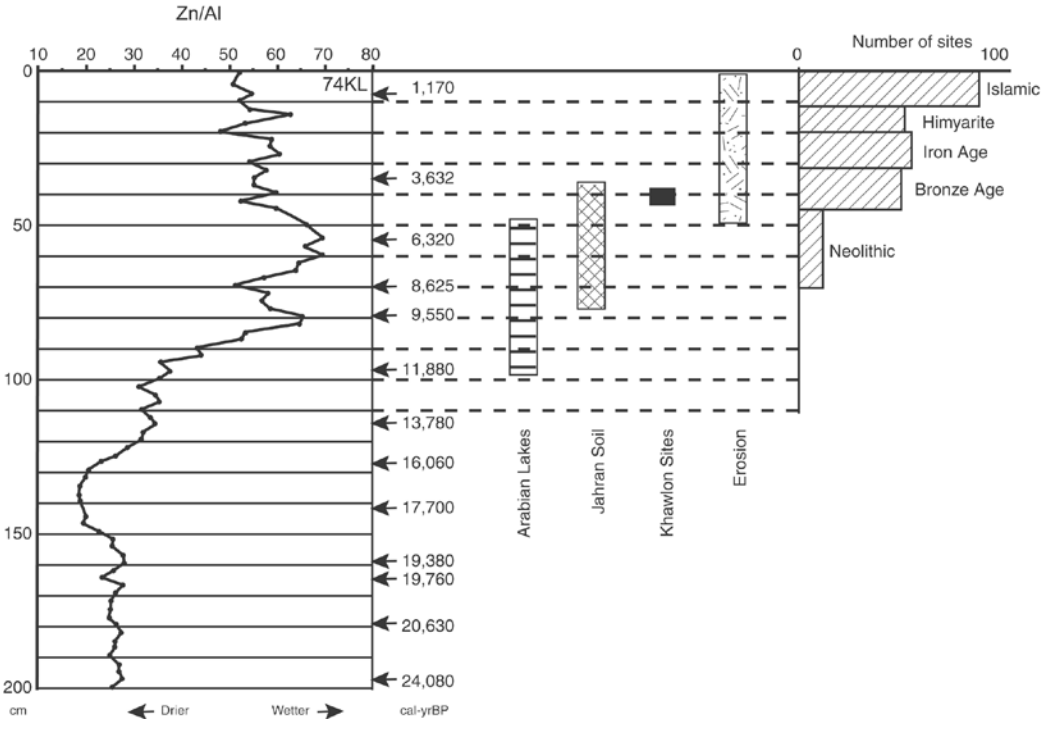

Figure 3. Climatic curve for Indian Ocean near Yemen alongside dates for lakes and ancient soils indicative of moister climatic conditions. Graph to left provides indication of wetter (to right) and drier monsoon conditions (to left). Note how dates for Arabian lakes and "Jahran soil" correspond closely to peak in wetness as indicated by climate curve

Figure 4. Hait al-Sawad excavations during final stage of excavations, with Lamya Khalidi doing last minute recording. Yemen

in other dated lake deposits from Arabia, appears to have continued to around 5,200 years ago (i.e., ca. 3100 BC), after which the monsoon weakened and rainfall decreased somewhat. As indicated on figure 3, these data from the Dhamar area coincide rather well with those from Indian Ocean cores.

It seems to be counter-intuitive that just as climatic conditions were becoming drier (that is during the third millennium BC), the Yemen highlands were being settled by a large number of communities living in villages and small towns. This suggests that human populations were in fact increasing in the face of a drying climate. However, the latest results from the sites excavated in 2001 demonstrate that the earlier stages of this phase of settlement in the Yemen highlands indeed took place during the late fourth and early third millennium, that is, when climatic conditions were still apparently moister than today. Because these sites are yielding abundant carbonized plant remains we are now able to interpret the range of domesticated plants that were in use as food. This is important because the Yemen highlands may have played a key role in the transmission of domesticated food plants, such as African sorghum, to India. Palaeobotanical analysis of the carbonized plant remains should therefore indicate whether the early inhabitants of the highlands received their food plants in the form of domestic wheat, barley, and legumes from the northern fertile crescent or whether the "package" included the plants such as sorghum, which is currently a staple of the modern inhabitants of the highlands.

We have now put soundings in a number of Bronze Age sites in the highlands, including the site of Kharraib in 1998 (see *1997–1998 Annual Report*) and Hammat al-Qa in 1996, 1999, and 2000 (see *1999–2000 Annual Report*). Although these excavations have proven extremely valuable by supplying ceramic sequences and charcoal for radiocarbon dates, the actual se-

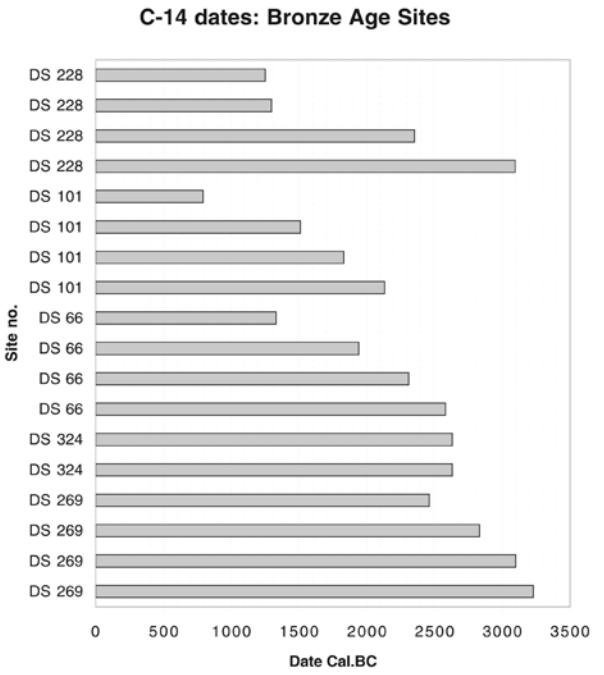

Figure 5. Chart of radiocarbon dates for Bronze Age sites excavated in Yemen Highlands

quences have been disappointingly shallow. In other words they failed to supply us with the requisite layer cake of strata that could be used to develop a superimposed stratigraphic sequence. Fortunately, two sites briefly investigated in 2001 provided just the deep sequence that is needed to solve some of the thornier issues of chronology that confront us. One of these sites, first discovered by the team in 1998, was Jububat al-Juruf (DS 269). This was revisited in 2001 in order to determine whether recent expansion of fields in the area had started to destroy the distinctive pattern of stone building foundations that had been recorded in 1998. We were fortunate to visit the site before too much damage had been done, but the site was indeed threatened. Consequently Christopher Edens, with the assistance of Lamya Khalidi (University of Chicago), took on the task of excavating part of the site, so that if it was destroyed, we would have some record of what had been lost. Chris chose to excavate in the east end of an approximately three meter wide by fourteen meter long stone-built building. The deepest sounding penetrated to a depth of some two meters without completely exposing bedrock. Chris's preliminary interpretation is that the accumulated debris of the site extends over a long period of time, a suspicion well confirmed by the radiocarbon dates for the lower pottery-yielding horizons which fall in the range 3350 and 3010 BC! The associated ground stone artifacts and abundant carbonized plant remains makes this a very important archaeological horizon indeed and it now appears to be the earliest ceramic-yielding horizon in southwestern Arabia. Consequently analysis of the carbonized plant remains by Heidi Ekstrom of Minnesota should tell us whether the food plants in use were primarily derived from the northern fertile crescent as seems to be the case from mid-third millennium BC Hait al-Sawad, or whether sorghum or other African-derived plant foods were in use. To date, the charred seeds from Hait al-Sawad are proving to be of considerable value because formerly our only knowledge of food plants has come from seed impressions embedded in sherds of pottery. Analyses by Heidi Ekstrom demonstrate that common food waste included barley, chick-pea, lentils, plus a single wheat grain; there were also seeds of fourteen wild plants which included wild legumes and grasses as well as various fruits and nuts.

Figure 6. Massive Himyarite dam of Sedd al-Ajmar to west of Dhamar, with local onlookers. Yemen

Because Jububat Juruf is our first deep stratigraphic sequence for the prehistoric

highlands, it will complement the sequence excavated from the other early settlement of Hait al-Sawad, excavated by Chris Edens, Lamya Khalidi, and Jamal Mukrid earlier in the 2001 field season (fig. 4). Altogether we now have some eighteen radiocarbon determinations from Bronze Age sites in the Dhamar area (fig. 5). This is a significant development because it is important to remember that until Alessandro De Maigret recognized in the early 1980s that a number of sites in the semi-arid Khawlan area near Marib were of the third millennium BC, southwestern Arabia was virtually without evidence for Bronze Age occupation.

Figure 7. Site of Miqta', Yemen, excavated by Krista Lewis and Ali Sanabani, with Bakiye Yükmen (left) and Krista Lewis (right) discussing points of architectural detail

On the other hand, Yemen has long been known as the home of the incense kingdoms of the Sabaeans and the Himyarites, and Krista Lewis (University of Chicago, Department of Anthropology) has been examining this later part of the historical spectrum which dates from a century or two BC to the sixth century AD. As part of her dissertation research on systems of food production in ancient Yemen, Krista (with the assistance of Lamya Khalidi) has been extending and enhancing our earlier reconnaissance surveys. In 2001/2002 these surveys resulted in the discovery of twenty-three new sites of which one had Bronze Age occupation, six were of Himyarite date and eleven showed evidence for Islamic occupation.

In addition to the settlement and landscape survey, Krista has excavated two small settlements dating to the late first millennium BC or slightly later (i.e., the Himyarite period). Her chosen site for 2001 (Kharabet al-'Adhla: DS 20) was found in our first field season in 1994. The site has always interested us because it is located only a short distance downstream from one of the major dams of the region (Sedd al-Ajmar: fig. 6). It is therefore reasonable to speculate that because its fields must have benefited from irrigation water channeled from the dam, this settlement was in use at the same time as the dam.

The excavations were co-directed with our long-term colleague from the Dhamar Department of Antiquities, Ali Sanabani. Excavations focused upon part of one house, namely a single room, together with a midden located immediately outside the building. Owing to the considerable quantities of collapsed rubble generated when these substantial buildings collapse, it was necessary for the team to dig through some 1.2–1.5 meters (four–five feet) of deposits down to the paved floor of the room. The lowest fill contained a range of artifacts that hinted that the room may have originally functioned as a kitchen (or at least received abundant kitchen waste). In addition to including a number of grinding stones and a circular millstone, the ashy deposits in the room yielded large quantities of carbonized plant remains that should help Krista reconstruct the diet of the ancient Himyarites. In addition to the artifacts

Figure 8. Project team in 2001. Photograph by Tony J. Wilkinson

that relate to simple functions of domestic tasks, there were a number of stone objects of religious paraphernalia, which included a fragment of a bull's head altar stone and a carved incense burner. In contrast to the rather sparse range of artifacts found within the building, the exterior was blessed with a huge midden crammed with pottery. In the words of the excavator: "This extraordinary midden provides an unparalleled opportunity for documenting a coherent assemblage of early Himyarite ceramics." This is magnificent because it means that we have a good range of diagnostic pottery types to compare with materials collected from the surface of other sites in the region. Such studies are crucial to archaeological surveys because they make our diagnosis of the age of archaeological sites from surface remains much more accurate than before. This is particularly important because the 2002 survey in the area of al-Adhla showed that there were six Himyarite sites recorded, but none of the Iron Age. Does this mean, therefore, that the huge Himyarite hilltop city of Masna'at Maryah located a short distance to the west resulted in the development of a large number of subsidiary sites in the area? If this proves to be the case it could lead us to a much deeper understanding of the political landscape of the region.

Also contributing to our knowledge of the political development of the highlands is a study of Himyaritic texts incised formally on buildings and more casually as graffiti into natural rock faces. This study, which is being undertaken by graduate student Joseph Daniels (University of Chicago), should provide fundamental insights into the early development of written language in the highlands.

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