

## PROJECT FOR THE ARCHAEOLOGY OF YEMENI TERRACED AGRICULTURE

**Tony J. Wilkinson**

Having conducted five field seasons from 1994 to 1999 the Oriental Institute Dhamar Project has obtained a rather good general impression of the archaeology of the high intermontane plains of Yemen, so that it has now become necessary to shift gears. Consequently, the sixth season, from late January until April 2001, was intended to tackle more specific in-depth problems. This entailed undertaking more excavations, as well as elaborating certain issues that were clearly in need of further research.

Funding for the 2001 field season came from the National Geographic Society, the American Institute for Yemeni Studies, and the Oriental Institute. We are very grateful to all who have contributed support for the project over the years. Because as many as three teams were in the field at any one time, we had three representatives (Ali Sanabani, Ahmed Haidari, and Jamal al-Mukrid), all of whom are to be thanked for contributing enormously to the success of fieldwork. We particularly wish to thank Ali Sanabani, Director of the Dhamar Office of the Department of Antiquities for lending his help and advice at every stage of fieldwork as well as our driver Abdullah Masa'udi who was superb in his capacity as local liaison officer. Considerable gratitude must especially go to officials of the General Organization of Antiquities and Museums, especially Dr. Yusuf Abdullah, and to Ahmed Shemsan, for help and advice before and during the season. Special thanks must also go to my colleague Christopher Edens, Ph.D., who directed the excavations and who provided superb administrative services as director of the American Institute of Yemeni Studies in San'a.



*Figure 1. Water-gathering cistern within major Himyarite site of Masna'at Maryah*

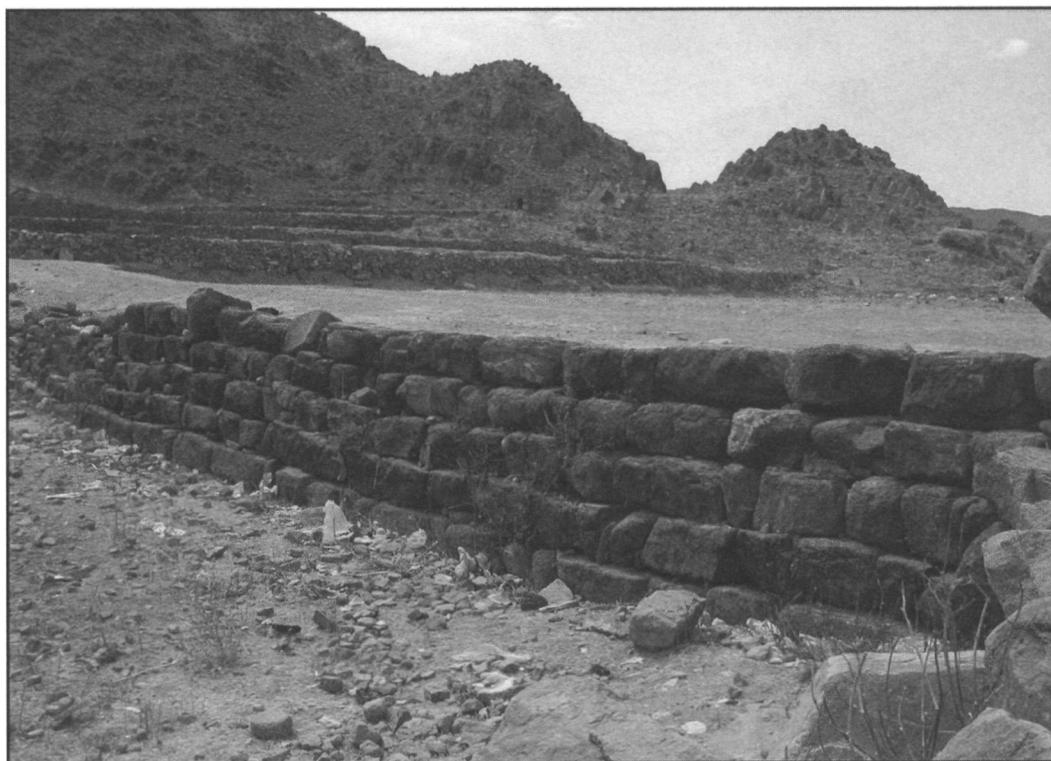


**Figure 2. Aliyah (Site DS 163), Himyarite site developed on rocky slopes overlooking valley of Wadi Shalalah**

This year excavation of key archaeological sites was undertaken by Christopher Edens and Krista Lewis. Krista, an advanced graduate student in the University of Chicago Department of Anthropology, is continuing our program by excavating two Himyarite sites and undertaking archaeological surveys as part of her dissertation on practices of Yemeni food production and consumption. Archaeological survey was also made much more effective by the inclusion of a prehistorian — Bakiye Yukmen — with the 2001 field team. In addition Joseph Daniels, graduate student at the University of Chicago, is advancing our epigraphic knowledge by recording inscriptions and rock art within their landscape context. Too often studies of both rock art and informal inscriptions on rock faces have neglected the landscape context, which is regrettable because it seems that inscriptions, rather than being random jottings or graffiti, often relate to specific sanctified or holy places. Alternatively, others appear to occur on places of special significance, either land boundaries or alongside important routeways. Although this epigraphic work is in its early stages, it promises to provide us with fundamental information on the development of Semitic languages and religion in highland Arabia. Brian Pittman, graduate student at Cambridge University, is also tackling the landscape by attempting to unravel some of the more enigmatic aspects of environmental change, specifically with respect to the history of pastoral cultivation and terraced agriculture.

During the 2001 field season three sites were excavated: first Hammat al-Qa (DS 101) was excavated for three days. Unfortunately, owing to the political situation around the time of the local elections, excavations had to be discontinued. After this, a small part of a large, apparently prehistoric, site (Hayd al-Sawad: DS 324) to the north of Dhamar was excavated under the direction of Christopher Edens with the assistance of Lamya Khalidi and Jamal al-Mukrid. The site, which had been partly destroyed by quarrying, has produced pottery and lithics, as well as a range of ancient plant foods in the form of carbonized plants remains. This large (c. 3 ha) site

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*Figure 3. Cross-valley wall or dam at Qifl al-Shalalah. Photograph by Joseph Daniels*

produced two radiocarbon dates in the range 2500–2870 BC, which makes it the earliest pottery-producing site on the high plains of Yemen. Finally, Jabubat Jaruf (DS 269), a Bronze Age site near Khirbet Afiq to the southeast of Dhamar, a site that has been partly destroyed by bulldozing activity, was excavated. Jabubat al-Jaruf provided an unusually deep sequence of at least 2 m of stratified archaeological deposits. Because these strata appear to form several superimposed phases many of which contain charcoal, they promise to provide us with a much needed radiocarbon-dated stratigraphic sequence for the Bronze Age of highland Yemen.

In 2001 a significant part of the excavation effort was devoted to the retrieval of carbonized plants remains. These are grains of cereals or other plant foods that have been turned to charcoal by burning. They provide evidence of the ancient agricultural economy as well as of the foods that were grown and were eaten by either the inhabitants or their animals. Very little is known about the history of Yemeni food prior to the Islamic period because most evidence of early plants came in the form of seed impressions in pottery. By using a specially constructed machine that processes the soil and allows the charred plant remains to float into a sieve (flotation), it is possible to process large quantities of soil rapidly and to retrieve much larger quantities of plant remains than is possible by hand flotation. This work, undertaken by Heidi Ekstrom, has so far produced large quantities of charred plant remains: Bronze Age Hayd al-Sawad and Jabubat Jaruf have both yielded numerous examples of cereal grains including barley, wheat, as well as large legumes such as lentil, common pea, and possibly chick-pea.

Since its inception a primary aim of the Dhamar Project has been to determine the history of Yemeni terraced agriculture, specifically within the context of changes in the natural environment. It is now well attested that after an intensely cold and dry period known as the Late Glacial Maximum (around 18,000 years BC), atmospheric conditions heated up and the Indian Ocean monsoon strengthened so that more rainfall was precipitated over the southern part of the

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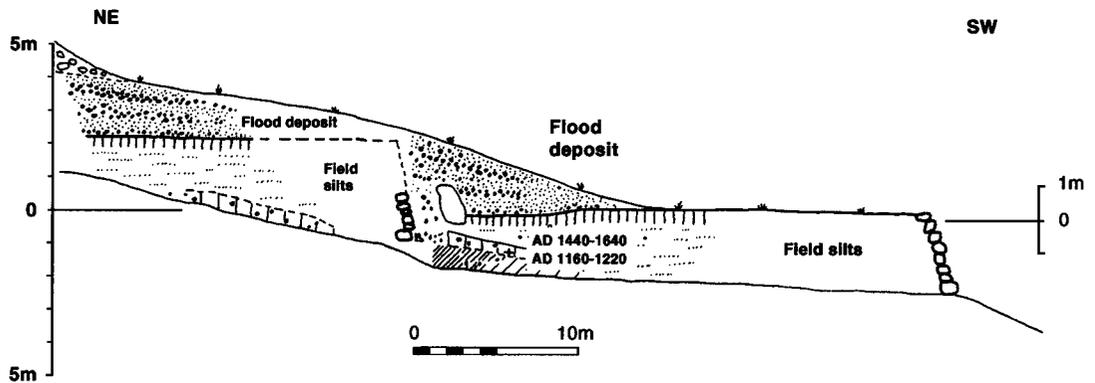


Figure 4. Section of two Islamic period terraced fields near Aliyah. Note massive gravel layer that accumulated after fields upstream collapsed and were eroded away

Arabian Peninsula. The work of the Dhamar Project is now showing that this change in atmospheric circulation resulted in the rapid development of lakes and marshes in areas that are now semiarid valleys. In 2001 we even managed to discover previously unsuspected ancient lake beds. For example, we were fortunate to be visiting a valley near Masna'at Mariyah at the time when an irrigation well was being excavated through a deep sequence of stratified layers. One of these layers was a gray brown silt crammed with the shells of freshwater mollusks that had evidently been living in a freshwater lake or marsh. A radiocarbon date from the mollusks fell in the range 10,150–9330 BC. This adds to the other dated lake sediments from the project that are helping define the early to mid-Holocene wet interval of Arabia.

This year Brian Pittman contributed to our overall environmental project by recording numerous sedimentary sections and by taking samples from the ancient buried soils. These included the now-famous Jahran Palaeosol, which dates back to the moist interval of the Neolithic and Early Bronze Ages. Brian's work should show how the environment has changed, and how humans have contributed to the degradation of the soil over the last 7,000–8,000 years. Major soil sections showing the effects of Neolithic communities on the landscape were recorded and sampled at Ghazwan (between Yarim and Dhamar), in the Qa Jahran near the large Bronze Age site of Hawagir (excavated in 1999), and in the area of Masna'at Mariyah to the west of Dhamar (fig. 1). Another aim of Brian Pittman's work is to show if the basins (*qa'*) remained as extensive areas of pasture after the Neolithic period lakes had dried up. By taking thin slices of artificially hardened chunks of soil (i.e., soil micromorphology), Brian should be able to demonstrate whether the soils had been disturbed by humans, if they formed marshes or pasture, or if they were under cultivation.

The highlands around Dhamar and Yarim are well known for their ancient Himyarite dams. This year, detailed surveys of irrigation systems were undertaken by Tony J. Wilkinson, K. Lewis, Ali Sanabani, Ahmed Haidari, and J. Daniels. The selected systems were located within the upper Wadi Shalalah in the region of the large Himyarite site of Aliyah (DS 163; fig. 2), and also around the Himyarite capital of Zafar. The latter area had been briefly investigated during the first (1994) field season, but it became clear that further studies were needed to enlarge the scope of the landscape context and to make corrections in the naming and location of dams.

In the Wadi Shalalah, the Himyarite irrigation systems are still sufficiently well preserved to be fixed within the memories of local people. Consequently survey in this delightful and verdant valley consisted of a combination of field mapping, collection of artifacts, and conversations

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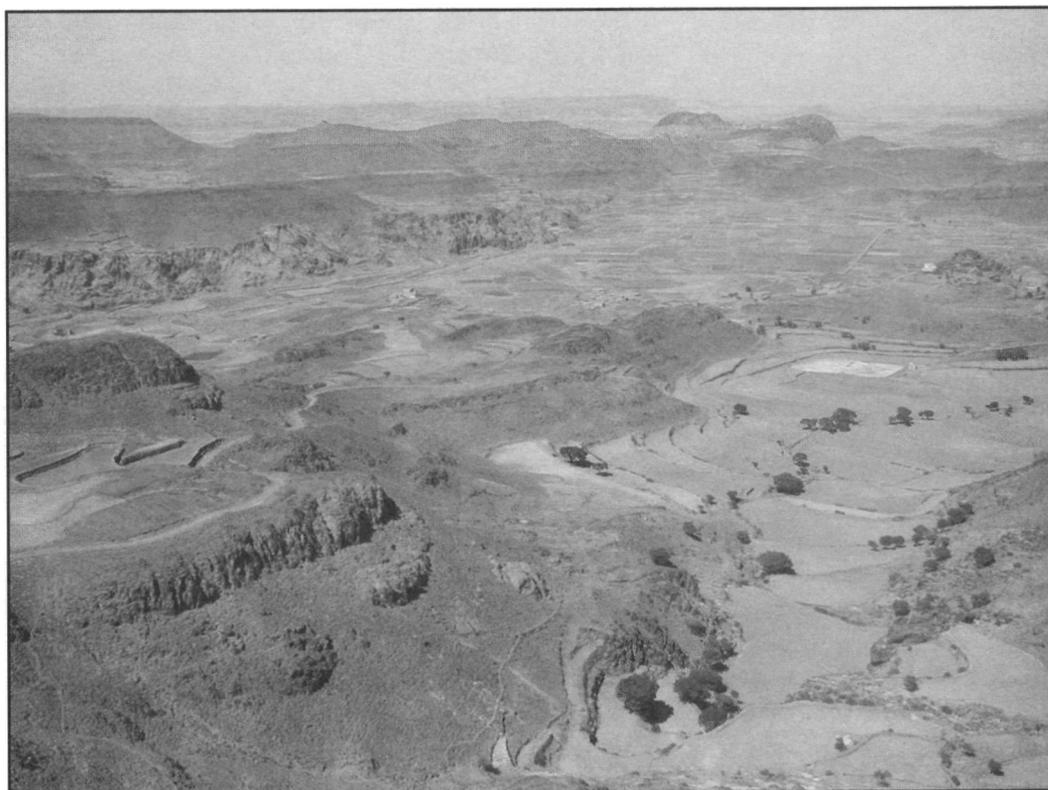


**Figure 5. Ancient stepped road running from Zafar to Marib near to where it crossed Wadi Shalalah. Photograph by Joseph Daniels**

with the inhabitants about their recollections of ancient irrigation features. The Shalalah irrigation systems consisted of three main elements: dams (*sedds*) which trapped and directed the water downstream to the areas to be irrigated; *harrabs*: monumental cross-valley walls that functioned, in part, to control the water and silt (usually) downstream from the dams (fig. 3), and irrigation channels which distributed the water away from the dams and across the irrigated areas. Each component of the irrigation system appears to have been named and many relict irrigation features even appear to retain their original Himyarite names. To the south of the Wadi Shalalah the valleys around the former Himyarite capital of Zafar are almost entirely stabilized by a complex system of dams and monumental terrace walls. We were able to discern the function of at least one monumental terrace because of the fortuitous presence of pits presumably dug by local people into the silts adjacent to the walls. These pits demonstrated that when the walls were constructed in the Himyarite period, they functioned as traps for silt and loam which evidently had accumulated within a relatively tranquil environment. It therefore seems that by constructing numerous large cross-valley walls the Himyarite builders were able to distribute the energies of the monsoonal rains and tame them so that destructive patterns of erosion were minimized. In contrast to the post-Himyarite terrace walls in the Wadi Shalalah (discussed below), these walls held, and therefore contributed, to the maintenance of a remarkably stable environment.

Our studies of terraced agriculture have continued this year and several sections show that when fields are abandoned, massive amounts of soil erosion can occur. A number of years ago the anthropologist Dan Varisco pointed out that the neglect and abandonment of Yemeni terraced fields could be catastrophic for the rural landscape. This is because when fields are aban-

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*Figure 6. Part of route of ancient Marib-Zafar road looking north. Note in distance to right of center the road crossed Wadi Shalalah via major cross-valley wall. Photograph by Joseph Daniels*

done, the field surface becomes impermeable so that rainfall, rather than infiltrating into the plowed soil, runs off rapidly. As a result, runoff generated by storms can rip into the terraced fields, destroy the unmaintained terrace walls, thereby resulting in a cascade of erosion and sedimentation downslope. In 2001, historical examples of this process were recorded in at least two places. The best example was in a side valley of the Wadi Shalalah near the important Himyarite site of Aliyah (DS 163; fig. 2) where a beautiful (to me at least) sedimentary sequence was exposed in a deep gully through two large terraced fields (fig. 4). The fields themselves showed that fine eminently cultivable sediments had built up behind the terrace walls. Then, on top of these fine loams were more than 1 m of cobbles and coarse gravel that had been deposited presumably as a result of major floods coursing down the valley and dumping their debris onto the pre-existing terraced fields. Because radiocarbon dates place the initial phase of the fields within the medieval Islamic period (AD 1160–1220 and AD 1440–1640) it is now possible to discern the entire life cycle of a terraced field.

In the Himyarite period (first century BC to sixth century AD) the series of dams and monumental walls located a short distance up the Wadi Shalalah (discussed above) had supplied water for cultivation in the valley floor rather than in the side valleys. When this system went into terminal decay it seems that terraced fields were then constructed in the side valley under discussion. This appears to have been in the period AD 1160–1640, and slightly earlier. These terrace walls accumulated silt and loam as a result of annual flooding down the wadis. Then at some time in the last century or so terraced fields upstream must have collapsed, thereby unleashing massive inundations of debris onto the fields further downstream (fig. 4). Finally, continued

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*Figure 7. Site of al-Aqirr from east*

high-energy floods resulted in the field terraces being incised down to the level of the present wadi floor.

Epigraphic studies of inscriptions associated with both irrigation systems and natural locations in the landscape are being undertaken by Joseph Daniels. Of particular interest are those inscriptions that have been incised on natural rock faces located on certain hills or mountaintops because these natural places might have had some religious significance during the Himyarite period or perhaps slightly earlier. For many years we have been aware that many important archaeological sites developed along ancient routeways, and in 2001 the survey team surveyed the ancient north-south routes from Yarim or Dhamar to San'a, and also investigated parts of what are thought to have been the Himyarite road between Marib and Zafar (figs. 5–6). The Dhamar-San'a road runs past and immediately east of the isolated hill of Hayd Bayan, which yielded a number of Himyarite inscriptions as well as a single isolated Himyarite building. Together this hill and the accompanying building appear to have had special significance in the landscape, perhaps having some sort of religious function. Similarly, what appears to have been a Qatabanian temple at the site of Miqta' near Shunadhib also lies on this ancient north-south route. A similar hill (Bhothan) near Sanaban had also been incised with numerous inscriptions and at least one of these implies that the hill had a religious function.

Additional important sites along the ancient Dhamar-San'a road include the 3–4 ha Bronze and Iron Age site of Kharabat al-Shani (DS 326) as well as al-Aqirr (DS 342; fig. 7), which lay astride the ancient road to the south of Risabar. The site al-Aqirr includes the remains of a building the plan of which suggests that it might have been a major Bronze Age public building that perhaps had an administrative function. This large building contrasts markedly with the typical Bronze Age buildings of other settlements investigated, which, as described in the 1999/2000 *Annual Report*, were mainly elongate structures of apparently exclusively domestic function. In contrast to the standard Bronze Age house, the al-Aqirr building consisted of a durable double

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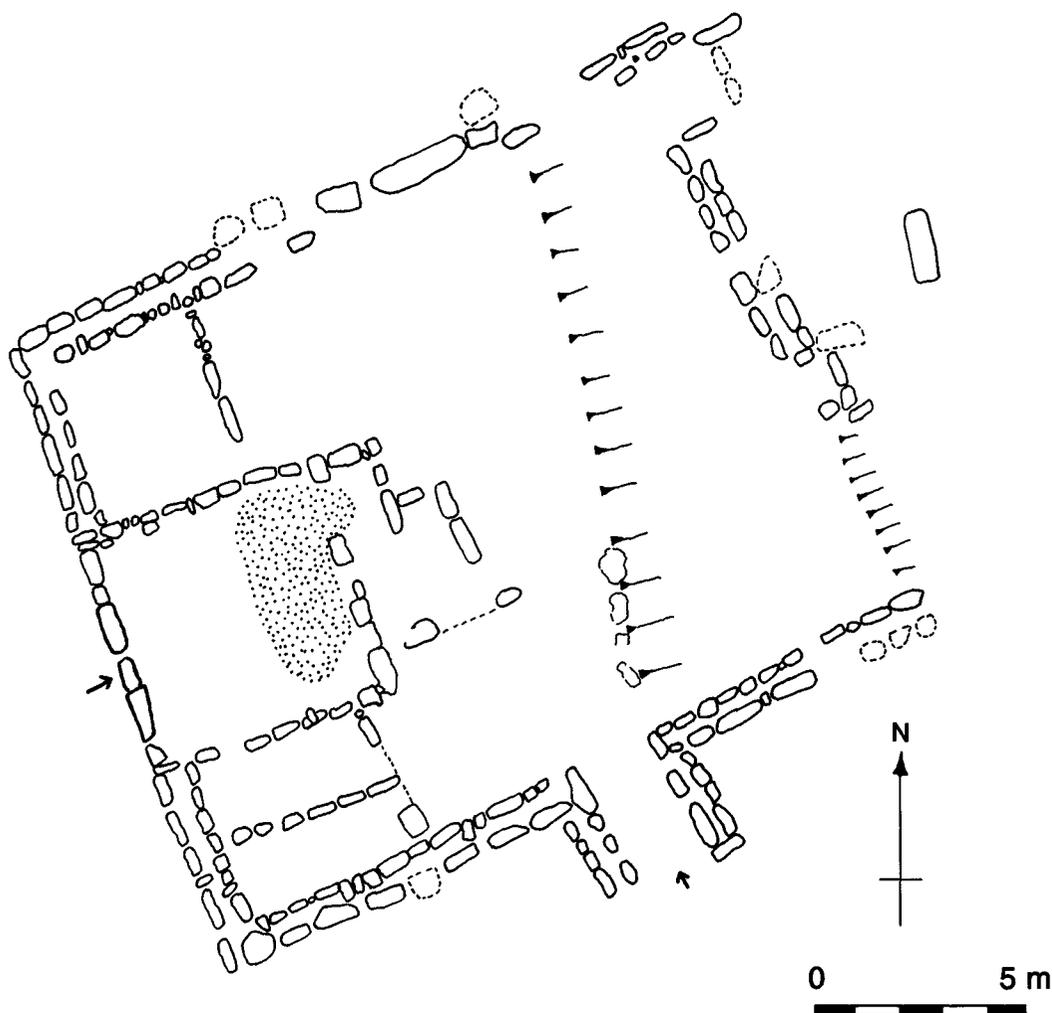


Figure 8. Plan of main building at al-Aqirr

wall 16 m north-south by 19 m east-west, which enclosed an area comprising a forecourt to the east and a group of rooms to the west (fig. 8). Centrally located within the rear range of rooms was a 6 m × 6 m room with smaller abutting chambers to the east as well as a range of other rooms built against the back wall. The enclosure was entered from the south via a monumental entrance or the rooms could be accessed by a second smaller entrance from the west. Pottery found on the surface suggests a Bronze Age date for this building and neighboring structures. Although the function of the main building can only be guessed, it is likely that it was probably used to control or watch over the movement of people and goods traveling along the main north-south route that went past the site.

In addition, the site of al-Aqirr also included the remains of well-constructed houses as well as a single large building constructed with what appears to be a pillared portico to the east. This could be interpreted as a temple, but little more can be said about this intriguing site until more detailed investigations have been carried out.

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**Figure 9. Ancient Himyarite road fossilized within modern landscape to east of Yarim. Photograph by Joseph Daniels**

This year the survey team consisted of the author, Krista Lewis, Ahmed Haidari, and Joseph Daniels, as well as a prehistorian (Bakiye Yukmen). One of our objectives was to trace evidence for Bronze Age sites into the moist highlands in the southern part of our survey region, which is in an area where such sites had been hitherto elusive. Very careful survey of mountain ridges in the Wadi Shalalah and Yarim areas enabled us to recover the remains of more prehistoric sites in this region, although all such sites were consistently small. These discoveries support the earlier observation that in the southern area of higher rainfall, prehistoric sites appear to be smaller and more dispersed than in the drier areas around and north of Dhamar.

In total, the 2001 field season recorded thirty-eight new sites (DS 323–360). The breakdown of sites according to period was as follows:

<u>Period</u>	<u>Number of Sites</u>
Neolithic	0
Bronze Age	9
Iron Age	2
Iron Age/Himyarite*	7
Himyarite	6
Islamic	7

\* Strictly speaking, sites classified thus are Iron Age, but the presence of mainly Iron Age diagnostics, in addition to one or two Himyarite sherds, suggests that these sites may either be Late Iron Age in date or have both Iron Age and Himyarite periods present.