# ARCHAEOLOGY AND ENVIRONMENT IN THE YEMEN HIGHLANDS. THE ORIENTAL INSTITUTE DHAMAR PROJECT

# INTRODUCTION

By virtue of its position in the southwestern corner of Arabia, the highlands of Yemen receive substantially higher rainfall than the rest of the peninsula. By providing conditions suitable for rainfed agriculture, this rainfall has enabled much of the region to support a remarkably dense population, which now can be traced back to the 3rd millennium BC. Here we summarize the results of an archaeological and environment project conducted by the Oriental Institute of the University of Chicago since spring 1994<sup>1</sup>. Such work could not have been conducted without the full consent and encouragement of the officials of the General Organization of Antiquities and Museums, especially Dr. Yusuf Abdullah and his colleagues. Following four years of fieldwork in which 299 sites have been recorded it is now possible to make some broad generalizations about the distribution of sites in the Dhamar region through the last 5000 or so years. We emphasize that the periodization of sites is based upon very coarse chronological divisions – usually some 1000 years duration per period or even more. However, results of test excavation in key sites allow us to subdivide the cultural sequence into shorter periods than was previous possible.

### ENVIRONMENTAL CHANGE

The rainfall in southwestern Arabia, which arrives in spring and summer as a result of the Indian Ocean monsoon, was even higher in the early to mid Holocene (between about 10,000 and 5500 bp) according to ocean cores. Such increased rainfall has now been recorded on land in the form of palaeosols in the arid lowlands of Wadi Beihan, in the region of Marib and more recently in the Yemen highlands. In the highlands there are two indicators of increased mid-Holocene rainfall: first the sediments of occasional lakes that developed in the high intermontane basins, and second, dark humus-rich palaeosols that are usually buried beneath the deposits of terraced fields or archeological sites<sup>2</sup>. Ranging in thickness from 10 to 70 cm, these soils accumulated when slopes were relatively stable, and vegetation cover was considerable as a result of the relatively high rainfall at the time. Radiocarbon dates from charcoal contained within the soils suggests that they were developed during precisely the period that the ocean cores indicate that the monsoon was at its maximum strength. Interestingly, this period of verdant environment pre-dates the main increase of settlement that took place during the Bronze Age, and it now appears that settlement growth occurred during a period when climate was drying, and when food production systems would have been most stressed.

As a result of the combined effect of increasing population, climatic drying, and probably slope disturbance resulting from the construction of terraced fields, the palaeosol then became buried by thick accumulation of sandy loam deposits that can be up to 10 m in depth. The best examples of such deposits occur behind terrace walls, but in some places, such as near the major Himyarite dam of Sedd adh Dhra'ah, some 6 m of sediment accumulated prior to the construction of the dam.

## THE DEVELOPMENT OF TERRACE AGRICULTURE

Terraced fields have enabled the large populations of highland Yemen productively to farm the steep narrow rocky valleys, but the origins of such fields' systems remains uncertain. Work

<sup>&</sup>lt;sup>C</sup>Gibson M., Wilkinson T.J. The Dhamar Plain, Yemen: a Preliminary Study of the Archaeological Landscape // PSAS. 1995. 25. L., P. 159–183; Wilkinson T.J., Edens C., Gibson M. The archaeology of the Yemen High Plains: a Preliminary Chronology // AAE 1997. 8. P. 99–142; Wilkinson T.J., Edens C. Survey and Excavation in the Central Highlands of Yemen: Results of the Dhamar Survey Project, 1996 and 1998 // AAE. 1999. 9.

<sup>&</sup>lt;sup>2</sup> Wilkinson T.J. Holocene Environments of the High Plateau, Yemen. Recent geoarchaeological investigations // Geoarchaeology. 1997. 12(8). P. 833-864.



Fig. 1. Deep sounding sequence behind the dam of Sedd adh-Dhra'ah II showing the mid-Holocene soil and a small Neolithic period wall of a valley-floor terrace

by the Oriental Institute Dhamar Project has now demonstrated that heavily eroded lines of large stones parallel to the contour lines of slopes appear to be the terrace walls of relict fields that were once associated with adjacent Bronze Age settlements. These relict terraces are recorded on slopes that are not suitable for terraced agriculture today, either because rainfall is too low, or the soils are too thin (or nonexistent); later intensive terracing now obscures any terraces of a comparable age in wetter portions of the highlands. Usually these terraced fields consist only of a single line of heavily weathered and desert varnished stones, with no definite associated archaeological material except for the presence of Bronze Age sites nearby. However, because there are no signs of sites of any other period in the neighborhood, it seems likely that the fields were also of Bronze Age date, that is from around 2000 BC or a little earlier or later.

Even more compelling evidence of early terracing appears in a narrow valley, where a field terrace lies encased within a 10 m thick sequence of valley floor deposits and fill that accumulated behind a Himyarite dam (the dam dating roughly to the 1st centuries BC or AD). Buried beneath some 6 m of fine valley fill, the valley floor terrace appears to have been in use during the 4th millennium, i.e. even before the main period of Bronze Age settlement in the region, on the basis of a radiocarbon determination on charcoal from the soil associated with the terrace.

Terraced fields are not only important for the extension of the agricultural area; they also absorb much of the rainfall that falls during the monsoon season. Where such protective staircases are in use, the landscape is remarkably stable, and as a result the area can support very high populations, despite the low agricultural potential of the natural soils.

#### BRONZE AGE SETTLEMENT

Occupation before the Bronze Age has proven elusive in the Dhamar region. Several dense lithic scatters occur overlooking a dried lakebed in the Sanaban area, the industry including a number of stemmed bifacial points and debitage in obsidian. At several other places chipped stone is associate with the mid-Holocene palaeosol, but such localities have not yet produced evidence for structures of kind reported elsewhere in the Yemen highlands. The typological evidence places the bifacial industry in the 6–5th millennium BC range, at the late end in the range of dates for palaeosols (the mid-Holocene moist phase) across the region. Since the Bronze Ages sites are currently dated no earlier than around 2800 BC, the 4th millennium habitation that existed in the region remains basically undocumented – the survey has not found occupation sites to accompany the above-mentioned valley floor terrace. The 4th millennium was a critical time, in which food production probably took hold in the highlands, pottery production started, and the formation of Bronze Age cultures took root<sup>3</sup>.

<sup>&</sup>lt;sup>3</sup> Edens C., Wilkinson T.J. Southwest Arabia during the Holocene: Recent Archaeological Developments // Journal of World Prehistory, 1998. 12(1). P. 55–119.



Fig. 2. Site plan of buildings within central part of Bronze Age site Hammat al-Qa (by C. Edens and J. Pearce). Note the areas to north and south of this area have not been mapped

The Bronze Age of the Dhamar area is now fairly well documented, making this area one of only two in the western highlands of Yemen where the Bronze Age is commonly reported. The Oriental Institute regional survey project has so far identified 51 Bronze Age settlements in Dhamar and made test excavations in three of these sites. These results are roughly comparable to those of Alessandro de Maigret, who first reported Yemen's Bronze Age in the 1980s. De Maigret's results for the Khawlan region (southeast of Sana'a and northeast of Dhamar) serves as an important baseline for assessing the Dhamar Bronze Age settlements<sup>4</sup>. The Khawlan sites are relatively small (the largest covers a hectare), and are normally composed of one or more circular compounds of curvilinear architecture arranged around a central space. The animal bones and seed impressions in pottery reflect a food producing economy that relied on domesticates like sheep/goat with some cattle and hunted animal, and wheat and barley, and possibly sorghum grown in fields. The radiocarbon evidence places this culture in the 3rd millennium BC<sup>5</sup>.

<sup>&</sup>lt;sup>4</sup> Maigret A. de. The Bronze Age Culture of Hawlan al Tiyal and al-Hada. Rome, 1990.

<sup>&</sup>lt;sup>5</sup> Fedele F. Radiocarbon Dates // A. de Maigret. The Bronze Age Culture of Hawlan al Tiyal and al-Hada. Rome, 1990. P. 205-212.



Fig. 3. Later Bronze Age house at Kharraib (DS 228) (by G. Barratt and E. Barbanes)

The Bronze Age sites of Dhamar share a basic ceramic tradition with Khawlan, but tempered with certain important differences. More striking, fundamental differences appear in settlement characteristics. Like the Khawlan sites, those of the Dhamar area are situated on low hills at the edges of intermontane plains or smaller valleys. Also like Khawlan, settlements in the Dhamar area are essentially surface sites, with architecture highly visible on the surface but possessing little depth (nevertheless, multi-period use and remodeling of buildings does occur). But some Dhamar sites are significantly larger than the largest reported Khawlan site – eight Dhamar sites cover at least 2 ha and several others exceed 1 ha in size, while most places fall within the size range normal for Khawlan. Walls with one or more gates surround some of the larger places. Residential structures inside the settlements usually are free-standing rectilinear buildings, up to 10-12 m long and 4-5 m wide, with one or several rooms. The stone walls of houses may be laid in irregular courses (especially for exterior walls) or may be flat slabs set on edge (especially for internal divisions). Floors are simple surfaces marked only by accumulation of ashy domestic debris. The entrances, often framed with large orthostats, may be placed at one end of the house (a long room house plan) or in one of the long walls (a broad room plan). In excavated examples, the houses are set as much as half a meter into the ground.

The test excavations conducted by M. Gibson, C.L. Schilmoeller and the authors at the sites of Sibal, Hammat al Qa', and Kharayb had the goal of finding ceramics and other materials in architectural contexts that could be radiocarbon dated. The results identify a Bronze Age sequence for the Dhamar area. Sibal, in the Qa' Shir'ah southeast of Dhamar, dates to ca. 2600–1900 BC, and is contemporaneous with the Khawlan sites. Hammat at Qa', at the edge of a small plain in the hills east of Mabar, falls in the ca. 2100–1500 BC range. And Kharayb, overlooking a narrow valley southeast of Dhamar, belongs to ca. 1300–1200 BC (all calibrated dates). The pottery that accompanies these sites presents many similarities with Khawlan ceramics, but the Dhamar assemblages also express regional differences and changes through time in many details. Like Khawlan, the Dhamar Bronze Age pottery assemblages includes numerous large platters and shallow bowls, hole-mouth jars and necked jars, the latter two forms sometimes bearing dentate impressed or incised curvilinear decoration and/or impressed or incised ribs, knobs, and handles. The Dhamar pottery commonly includes several forms that



Fig. 4. Wall foundations of a major Himyarite building at Ribat 'Amran (DS 226) cutting through the mid-Holocene soil and associated Neolithic deposits

are rare of absent in Khawlan, such as hemispherical bowls, heavy storage jars, and jugs. Moreover, a significant proportion of the Dhamar hemispherical bowls and jars has a burnished black or dark gray slip, and a small number also bear a burnished red slip finish. These surface treatments do not appear among the Khawlan assemblages.

The radiocarbon-dated pottery assemblages from the three sites provide the outlines of a ceramic chronology for the Bronze Age of the Dhamar area. This chronology is still coarsegrained, since many of the most common forms (e.g. the platters and hole-mouth jars) appear throughout the Bronze Age sequence with very little change, and the more sensitive diagnostics involve relatively rare forms and surface treatment that weathering often removes from surface materials. Nevertheless the present ceramic chronology permit a preliminary ordering of the survey results.

Sites with Sibal-related pottery are rare, and a 3rd millennium settlement pattern remains. elusive. Several small sites that probably belong to this period contain curvilinear architecture quite like the Khawlan sites. Sibal itself is a 1–2 ha walled town with fairly dense single room and multi-room buildings. These characteristics distinguish Sibal sharply from Khawlan patterns, suggesting a more nucleated and perhaps hierarchical settlement system, and probably also a somewhat more complex social organization, in the Dhamar area than in Khawlan during the 3rd millennium. Excavated fauna from Sibal includes a relatively high proportion of cattle (25%), another sharp contrast with Khawlan (where cattle make up 1–5% of faunal samples) that points to a greater investment in agriculture in Dhamar.

By the end of the 3rd millennium, settlements formed a marked two-tiered hierarchy of villages and walled towns distributed around intermontane plains and valleys. Hammat al Qa', one of the best preserved of the Dhamar Bronze Age towns, gives a clear picture of these 2nd millennium settlement systems. The town sits on a flat-topped hill, or mesa, at one end of a narrow plain. The town wall of massive stones runs around the edge of the mesa and then across

its center to enclose 4 ha. At least three gates give entrance through the wall to an irregular network of streets and houses. The houses, both single room (often with small annexes) and multi-room structures, lie in blocks framed by streets across two-thirds of the site, with fairly open spaces taking up the remaining area. About one quarter of the town interior has been mapped; extrapolating from this sample, Hammat al Qa' held around 60–75 houses. Several villages of the same ceramic period lie on hilltops within several kilometers of Hammat al Qa', these outlying places identifying the two-tiered settlement hierarchy. Relict agricultural terraces are still faintly visible on the slopes below Hammat al Qa' and on the slopes of adjacent hills. Excavation has not yet recovered botanical evidence for the crops that farmers grew on these terraces. The excavated animal bones are almost all sheep (goat is not definitely present) and cattle, the latter accounting for 10% of the total. If the plain was not heavily cultivated, the natural vegetation in the plain probably provided the main pasturelands for these animals.

The two-tiered settlement system of towns and villages continued through the 2nd millennium, with Kharayb representing a late 2nd millennium town of 3 ha. However, several features distinguish the late 2nd millennium from the earlier 2nd millennium period. Fewer sites can be placed in the later period than before. This drop in numbers partly reflects the coarse chronological framework and equivocal nature of most ceramic diagnostics. But important settlement shifts also seem to be underway. The site of Hawagir represents a significant departure from earlier towns in two respects: it covers an unprecedented 12–15 ha, and it sits in an intermontane plain rather than on a hill above. The surface pottery from Hawagir suggests that is slightly younger than Kharayb, at the very end of the 2nd millennium.

Bronze Age sites in the Dhamar area of the Yemen highlands trace the autonomous development of town life in this part of Arabia during the 3rd and 2nd millennium BC. Parallel developments in the Persian Gulf (the Barbar culture) and southeastern Arabia (the Umm an-Nar and Wadi Suq cultures) unfolded at the same time in the context of interregional exchange. In contrast, the western highlands seem to have been largely isolated from wider exchange networks beyond the region itself. The fieldwork accomplished so far in the Yemen highlands, Dhamar or Khawlan, has not yet produced enough information to understand the origin and dynamics of town life in southwestern Arabia. The most obvious gaps include the 4th millennium antecedents of Bronze Age town, a finer-grained chronological control, broad exposures in different architectural sectors of towns, and substantial subsistence and other economic data.

An additional glaring uncertainty is the relationship between Dhamar and Khawlan settlements during the 3rd millennium. The economic orientation of the Khawlan region probably involved a mix of pastoralism and opportunistic agriculture in the drier eastern margin of the highlands, while that of the moister Dhamar region was more intensively agricultural in character. The ceramic differences that distinguish Sibal from the Khawlan sites imply that each region contained a different group. But these differences do not preclude exchanges of complementary subsistence products (agricultural and pastoralist) that might amount to symbiotic sectors of a regional economy. Moreover, the abandonment of the Khawlan eastern highlands at the beginning of the 2nd millennium coincides with the significant increase of site numbers and town size in Dhamar, perhaps indicating transfers of population that accentuated the growth of towns and settlement hierarchy in Dhamar at this time. Both of these possibilities remain to be worked out and tested.

The current radiocarbon evidence leaves a four-century gap between Kharayb and the earliest dated Iron Age sites of the region. This gap wills almost certainly narrow when additional radiocarbon dates are obtained from late Bronze Age and early Iron Age sites. The cultural transition across this gap pertains largely to pottery: a few formal elements continue across the transition, but the Iron Age pottery in general is quite distinct in fabrics and forms from its Bronze Age antecedents. Large, walled early Iron Age sites continue the previously established Bronze Age settlement patterns, although houses within the large sites now regularly possess multiple rooms. The social changes that accompanied this mix of continuity and change in material patterns remain uncertain.

By the late 2nd millennium BC, the Dhamar area appears to have been densely settled with numerous small, medium and large sites up to 10–15 ha. In the 1st millennium BC, although there is a significant change in the ceramic styles, the pattern of settlement continues to be quite dense. Settlements are located both on hills and on low valley side slopes, and it is during this phase that we see some of the highest significant sites yet recorded, either in Yemen or in the entire Arabian peninsula. The best examples of these sites are three related settlements recorded in 1998 to the east of the Himyarite capital of Zafar at an altitude of around 3000 m above sea level (al Qatan and related sites). Settlement sizes continue to fall in the same range as the Bronze Age sites. Sites on hilltops are often naturally defended, but formal defenses with rectangular bastions have been recorded at the sites of Khirbet al Hussayn and Madinet al Khasha'.

The Iron Age part of the cultural sequence was primarily established by the excavation of small soundings by Prof. McGuire Gibson within buildings on known Iron Age sites. These brief investigations not only provided further details on building styles and architecture, but also most importantly supplied enlarged assemblages of pottery together with sufficient charcoal to provide radiocarbon determinations.

In addition Iron Age levels are starting to appear within stratified sequences below modern villages that also feature the remains of Himyarite buildings. Thus it appears that there is some degree of settlement continuity between settlements of the Iron Age (contemporaneous with the Sabaean state further north) and those of the Himyarite period.

Although terrace walls had probably been in use since the 3rd or 4th millennia BC, there is no evidence for large formally constructed dams until the Himyarite period (i.e. 1st century BC to 6th century AD), or perhaps slightly before. Large formally constructed dams appear to be approximately contemporaneous with the rise of the Himyarite state. Dams such as Sedd Ajmar and Sedd adh Dhra'ah were constructed in the distinctive well-dressed style of Himyarite masonry, but the best examples have been destroyed as a result of dam bursts resulting from major floods in antiquity. On the other hand many smaller dams remain as part of the landscape, especially in the region of the Himyarite capital of Zafar. Such dams presumably originally formed part of the Himyarite agricultural economy, but now simply remain incorporated within the modern day field pattern.

With the rise of the Himyarite state the area also witnesses the first clear apprearance of monumental inscriptions. Most are dated by paleography, but occasional examples can be dated by reference to the Himyarite calendar. The northern part of the Dhamar survey area falls within the bounds of the Sabaean state and it is within this area that occasional inscriptions would appear to be stylistically Sabaean, some of which are probably pre-Himyarite in date.

Just as there appears to have been considerable continuity between Iron Age and Himyarite settlements, there is also continuity at the end of the Himyarite into the Islamic period. Unfortunately the rarity of good imported diagnostic Islamic ceramics has inhibited the detailed subdivision of this phase. Furthermore, because many modern villages have probably been occupied for many centuries we must assume that many settlements are buried below modern villages. Nevertheless, despite our inability to subdivide the Islamic record it is clear that Islamic settlement is very common so that by the Islamic period most of the area, with the exception of the drier parts of Hada to the northeast were densely occupied.

#### CONCLUSIONS

It is therefore now evident that the highlands of Yemen were quite densely occupied from the 3rd millennium BC, and that population continued to rise, although details remain hazy, through the 2nd and 1st millennia BC. Therefore by the time the Himyarite state came into being in the 1st century BC some degree of social complexity and a moderately dense network of settlements had been in existence for two or three millennia. Interestingly the growth of settlement in the 3rd millennium BC took place in the face of a significant trend of climatic drying which occurred as the Indian Ocean monsoon weakened in strength. Although the decline of settlements in the Khawlan area to the north of Dhamar may have been influenced by the later stages of this phase of desiccation, a causal relationship has not yet been convincingly demonstrated. However the rise in population in the highlands, in the face of climatic drying must have exerted significant stresses on the local communities especially in the drier parts of the region.

Curiously, with the exception of a change in pottery style between the late 2nd millennium and the early 1st millennium BC, there is little evidence of the wealth generated by the incense trade, and according to present evidence it seems likely that the Dhamar highlands were effectively by-passed by such trade, and remained minimally integrated with broader patterns of world trade.

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# АРХЕОЛОГИЯ И ДРЕВНЯЯ ОКРУЖАЮЩАЯ СРЕДА ЙЕМЕНСКОГО НАГОРЬЯ, ЗАМАРСКИЙ ПРОЕКТ ВОСТОЧНОГО ИНСТИТУТА ЧИКАГО

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В статье суммированы результаты работ, проводившихся экспедицией чикагского Восточного института в Республике Йемен в течение четырех полевых сезонов. Всего было исследовано 299 памятников, относящихся к различным периодам от неолита до раннего средневековья, установлена их относительная и абсолютная хронология, выявлена динамика изменения основных параметров материальной культуры. Как показывают эти исследования, в древности Йеменское Нагорье, расположенное в юго-западной части Аравийского полуострова, отличалось, по-видимому, значительно более влажным климатом, чем в настоящее время. По крайней мере с III тыс. до н.э. его территория была интенсивно заселена небольшими общинами, основу экономики которых составляло богарное земледелие. В течение II и первой половине I тыс. до н.э. население Нагорья неуклонно росло. Однако, со второй половины I тыс. до н.э., т.е. в начале периода древнейеменской «классической» цивилизации, и особенно в период возникновения Химйаритского царства, наблюдается сокращение поселений, что было связано, вероятно, с прогрессирующей аридизацией климата. Этот же процесс прослежен и для первой половины I тыс. н.э. Проведенные исследования показывают, что Йеменское Нагорье не являлось, как думалось ранее, областью, интенсивно вовлеченной в международную торговлю благовониями, существовавшую в регионе в указанное время.