Sohar Ancient Fields Project

INTERIM REPORT No. 1

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DURING surveys conducted in 1973 as part of the Harvard Archaeological Survey of Oman, Williamson[1] noted that the 9th–10th century trading city of Sohar had formerly been surrounded by a wide belt of intensive agriculture. This apparently stretched far inland of the present day limits of irrigated cultivation and its estimated area of some 6,100 hectares[2] was calculated to be four times that of the present day cultivation within the same length of coast. Furthermore, this figure is only 700 hectares less than the entire area of irrigated land to be found today along the Batina from the Emirates border in the north to Al Khaburah in the south,[3] (*Fig. 1*). To supply this area with irrigation water would have required a sophisticated system of water supply and the possible yield of such a system assumes added significance today when the water resources of the Batina are proving to be a limiting factor in agricultural development.

The Sohar Ancient Fields Project was therefore established to delimit and map the area of ancient intensive agriculture; to describe the methods of water supply used and in general to understand how

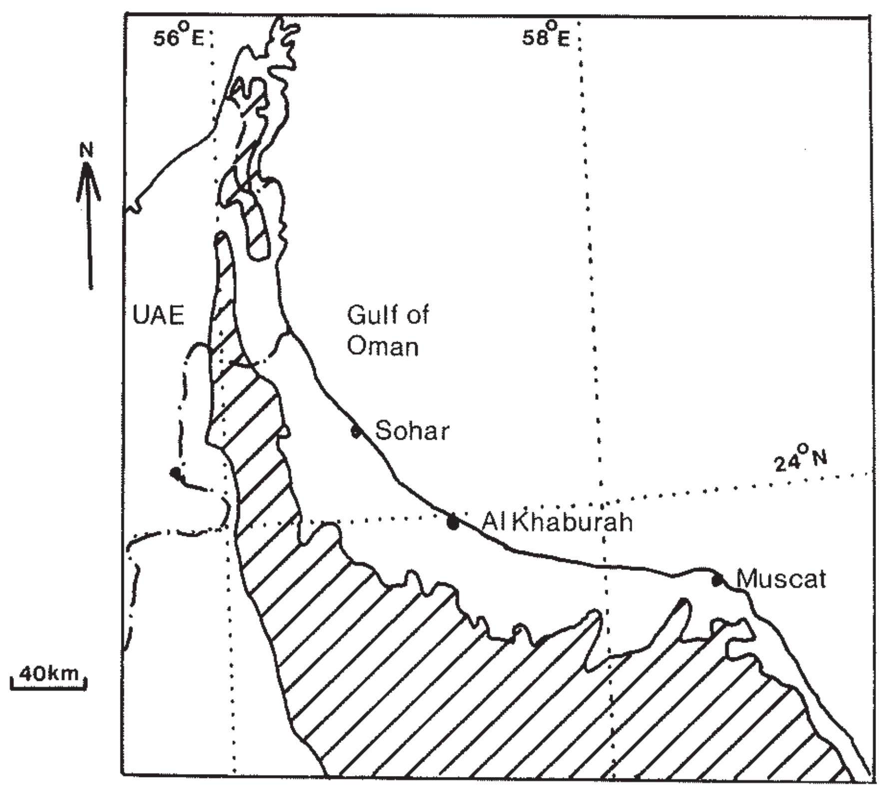

FIG. 1. *Position of Sohar within the Batina.*

the land was used by the inhabitants of medieval Sohar.[4] In addition it was hoped that the project would contribute to the present day studies of agricultural development and water supply.

Physical Environment

In the vicinity of Sohar, the Batina coastal plain forms a 13-14km wide belt of lowland which skirts the foothills of the western Hajar mountains. Towards the mountains the plain is composed of gravel outwash which spreads out from wadi mouths; these fans grade laterally to form a zone of coalescing alluvial fans which in turn grade towards the sea into finer sediments of sand silt and clay. Although the rainfall of the coast is sparse (at present unknown but estimated at 80mm. per annum) the mountains behind receive slightly greater amounts and the superfluous run off from their steep, impermeable slopes is contributed to the coastal plain aquifers. These strata store water which would otherwise be lost into the sea and as a result of this premium settlements sustained by shallow wells can exist in a strip of land along the entire coastal plain. Today this coastal land is occupied by a narrow zone of palm gardens which rarely reaches more than 2km. from the sea, but inland deep, fine and relatively fertile cultivable soils exist up to six km. from the sea and these are available for use if economic conditions and water supplies permit.

Land Use Mapping:

Occasionally field patterns and ancient terrace walls can be distinguished within the hinterlands of archaeological sites thus permitting the direct mapping of past land use zones. At Sohar, however, these

PLATE 1. *View of artefact scatter in the vicinity of* a, *Fig. 5. The dark area in the middle of the picture is an artefact scatter which features several mounds; that marked* a *was excavated, see text. To the right exists the distinctly formed upcast of an old well which is today being overlapped around the edges by sheet flood sediments.*

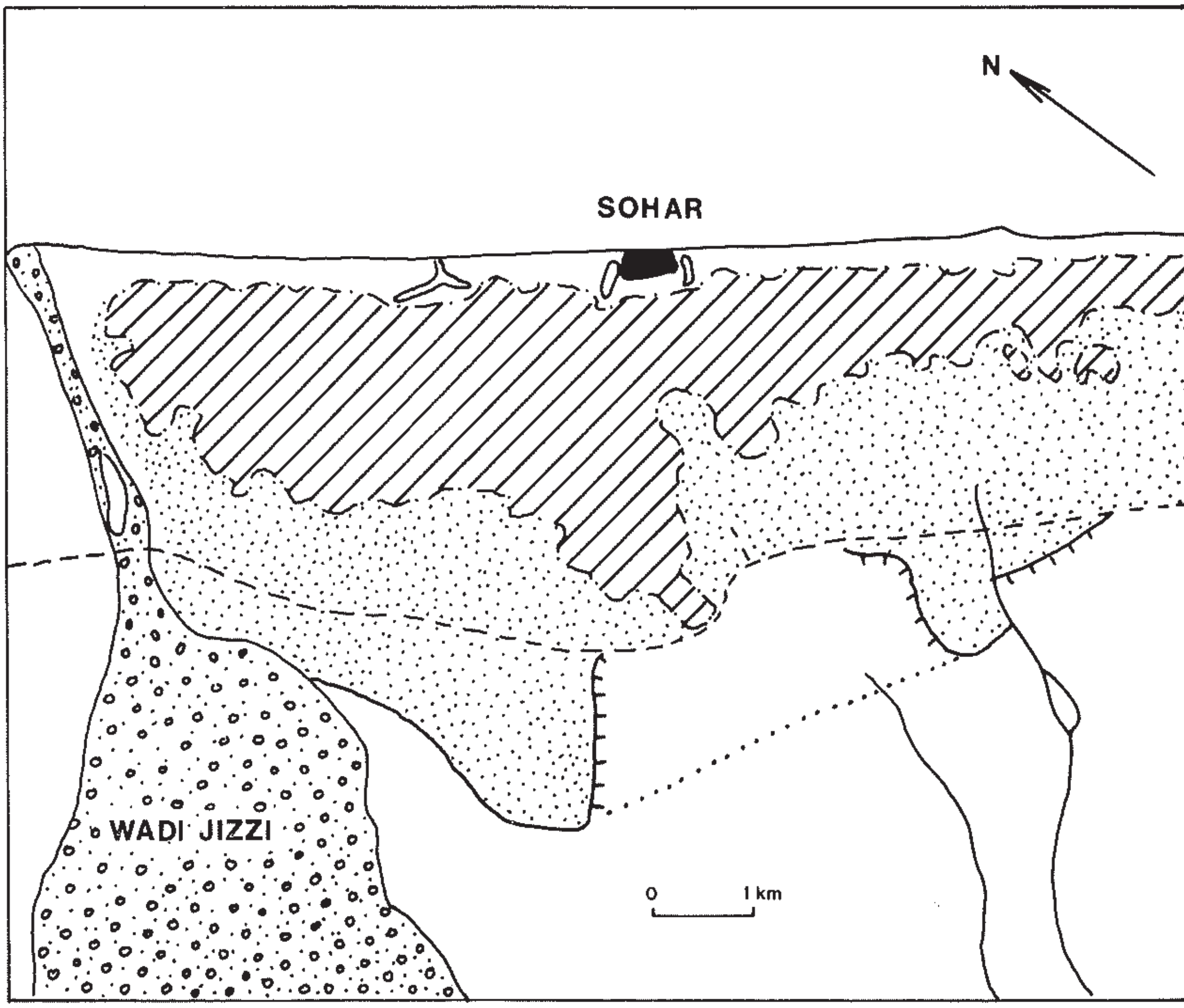

FIG. 2. *Distribution of intensive cultivation in Medieval Islamic times.*

Present day irrigated palm gardens.
Wadi beds.
Shinas–Mutrah road.

Area of dense artefact scatter (greater than 2.5 sherds/sq.m.). Beyond this limit the density of sherds dropped off very rapidly. On the seaward side of the main road the scatter was discontinuous because of later occupation and sedimentation.

Sherd scatter with boundary created by overlapping sediments.

Suggested inland boundary of cultivation before the obliteration of evidence by flood action.

features were absent due to the nature of the terrain and of the boundary materials utilised and consequently the delimitation of earlier cultivated land had to depend upon indirect evidence.

(i) Artefact scatters: Forming a dense surface scatter over the ground beyond the present day palm gardens was a carpet of potsherds, gladd, shell, slag, gravel, and brick fragments (*Plate 1*). This scatter could be traced up to 5·5km. from the old city and although it could be related in the field to a large number of small mounds the artefacts were too abundant to have been derived from these features—

if they did in fact form settlement remains. Such scatters can frequently be found in the agricultural hinterlands of archaeological sites and in some cases they actually litter the surface of ancient field patterns. In such positions they represent the undecayed remains of ancient manure which was hauled from refuse heaps and middens located within the city. Here pottery fragments and other inorganic waste would have become mixed with the refuse and consequently when the manure was dumped on the fields surrounding the city it left a sparse residue of artefacts. In the case of Sohar this scatter became concentrated by the winnowing action of the wind.

At Sohar, this residue although of variable density, could be mapped in the field and consequently the outer limit of dense sherd scatter was used to provide an approximate boundary to the ancient manured land. Mapping entailed setting out transects from a base line established parallel to the coast and then along these transect lines samples were collected at pre-determined intervals. Next the number of sherds per sample square were counted and dates for the sherds and therefore for the manuring could be suggested. The sherd densities are depicted in *Fig. 3* which shows the two main areas of dense sherd scatter mapped. Both areas yielded abundant 9th–10th century A.D. sherds while in the S.E. hatched Sgraffiato and Chinese wares of the 12th–13th centuries A.D. were also common. Between the two blocks of high density scatter extended a wide tract of land which exhibited little evidence of anything ancient while beyond their outer limits, on the gravelly soils of the outwash, sherds were rare or absent.

PLATE 2. *An oblique aerial view of a group of "well mounds" dating from the 9th/10th–12th/13th centuries* A.D. *In this position, to the N. of the S.E. enclave of Fig. 3, sedimentation by sheet flood has produced the light coloured spread of silts seen in the photograph. The three mounds in the centre measure c. 20–30m. in diameter.*

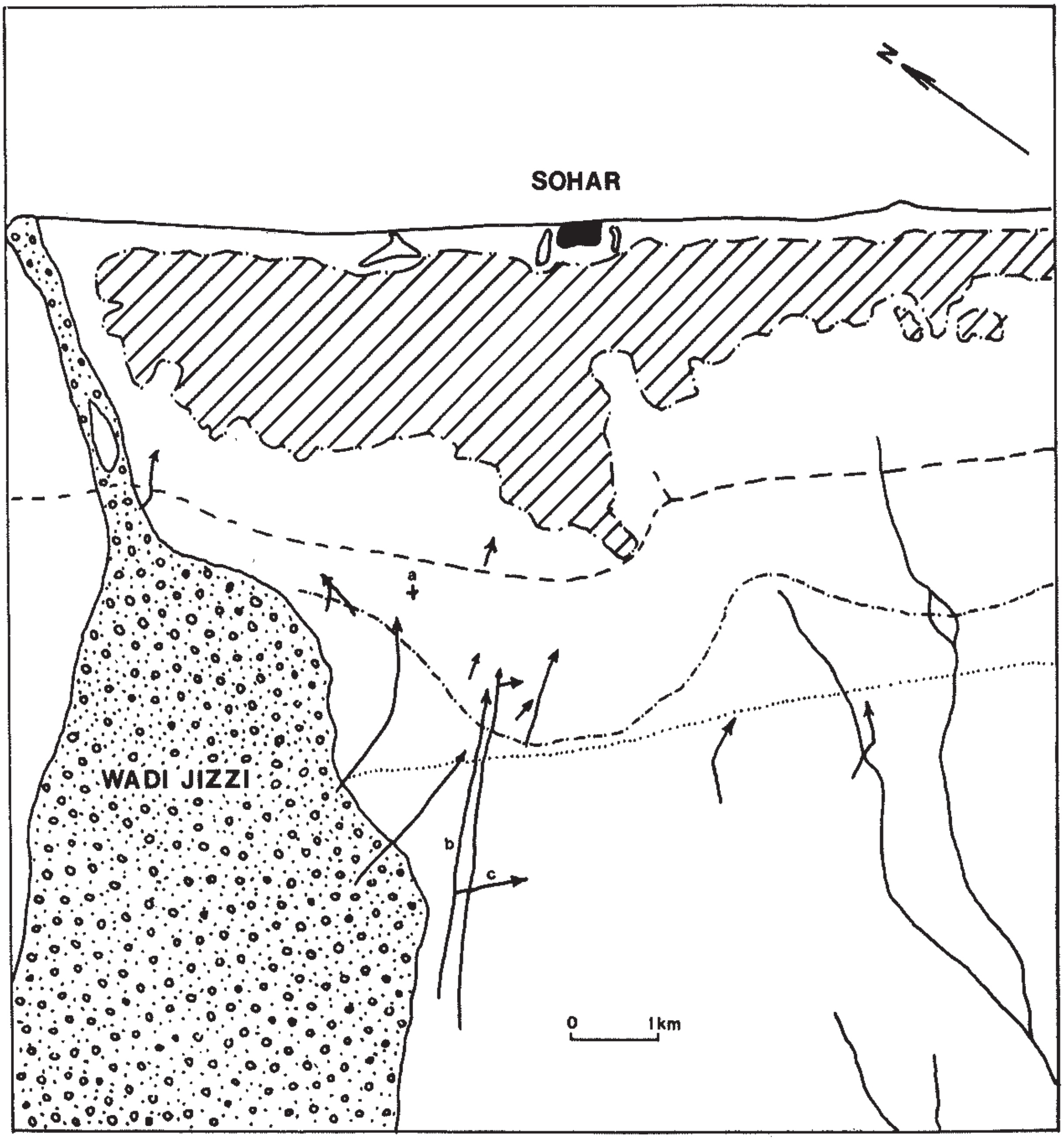

FIG. 3. *Medieval water supply.*

Present day irrigated palm gardens.
Wadi beds.
Shinas-Mutrah road.
Surface/sub-surface falaj.
Inland limit of well mounds, including the post 17th century A.D. *features of the blank area.*
Isopleth indicating 16m. to water table.
+ a *See text.*

(ii) Mounds: These low, rounded features measured about 20–40m. in diameter and were spaced between 40 and 20m apart (*Plate 2*). They were invariably covered in gravel which usually incorporated some dateable artefacts while beneath this mantle was a mound core of predominently fine sediments similar to those of the adjacent plain. Although superficially resembling small settlement mounds these features, which stretched to the outer limit of dense artefact scatter, required excavation to demonstrate means of construction as well as their relationship to the surrounding artefact scatter.

The nature of one mound situated at *a Fig. 5* was examined by means of a trench excavated through its centre. No architectural features were encountered and instead, stratified within the mound, were several lenses of gravel some cemented by a natural lime accumulation, as well as beds of wind blown sands. Nearby, modern well shafts revealed gravel layers at depths greater than 5·5m. below ground level while near the water table they became weakly cemented by lime. From this and other evidence it was concluded that we had excavated the remains of upcast derived from a deep well shaft and that the feature had formerly comprised several small mounds which were subsequently united into one feature by accumulations of wind blown sand as well as by localised redistributions of the mound materials. By analogy, those mounds in the hinterland with similar surface characteristics but without the orientation of falaj mounds were concluded to be the remains of ancient well upcast.

Surveys demonstrated that ancient wells extended approximately to the edge of the zone of high density sherd scatter where the water table is today about 16m. below ground level. Surface sherds indicated that most wells situated within this zone dated from Sohar's heyday although in the S.E. enclave mounds exhibited a scatter of 12th–13th century A.D. sherds as well. This coincidence in the distribution of ancient sherd scatter and wells suggest that together they form two archaeological components of manured and irrigated agricultural land which had a maximum extension in the 9th–10th centuries A.D. but also possessed a secondary peak in the 12th–13th centuries in the S.E.

Situated between these two major enclaves, the blank area only yielded scattered examples of mounds, this time forming both hummocks and depressions. Their surface morphology and sherd scatters indicated a much later date (post 17th century A.D.) and they could clearly be distinguished as the little-altered remains of animal powered wells or *Zajara*. The depressions had originally been deeply excavated inclined planes down which the oxen walked during water haulage while the surrounding gravel mantled mounds formed the upcast from the well and ox walk.

The occurrence of two areas of early intensive cultivation implies that either the available soil and water resources favoured these two localities or, that formerly a continuous zone had existed only to be subsequently removed by erosion or obscured by sedimentation. An opportunity to study these processes arose after rainstorms during February 10th/11th 1975 when the southern area was inundated by flash floods. Considerable scouring of the ground surface and of mounds took place near the main flow paths while fine sediments were deposited in the more quiescent region peripheral to the main flow. Field examination of the entire blank area indicated that these processes had periodically operated over a large area of terrain thereby removing archaeological evidence or obscuring it from view. It is therefore likely that the agricultural belt of 9th–10th century Sohar originally stretched as a zone fringing the present day palm gardens and that subsequently some of this land, amounting to some 8% of the total cultivated area of the period, has been obliterated by flood action. As the blank area does feature frequent remains of wells dating from the 17th–19th centuries A.D. it is likely that much transformation had taken place between the 13th and 17th centuries although it is also clear that the process is continuing today.

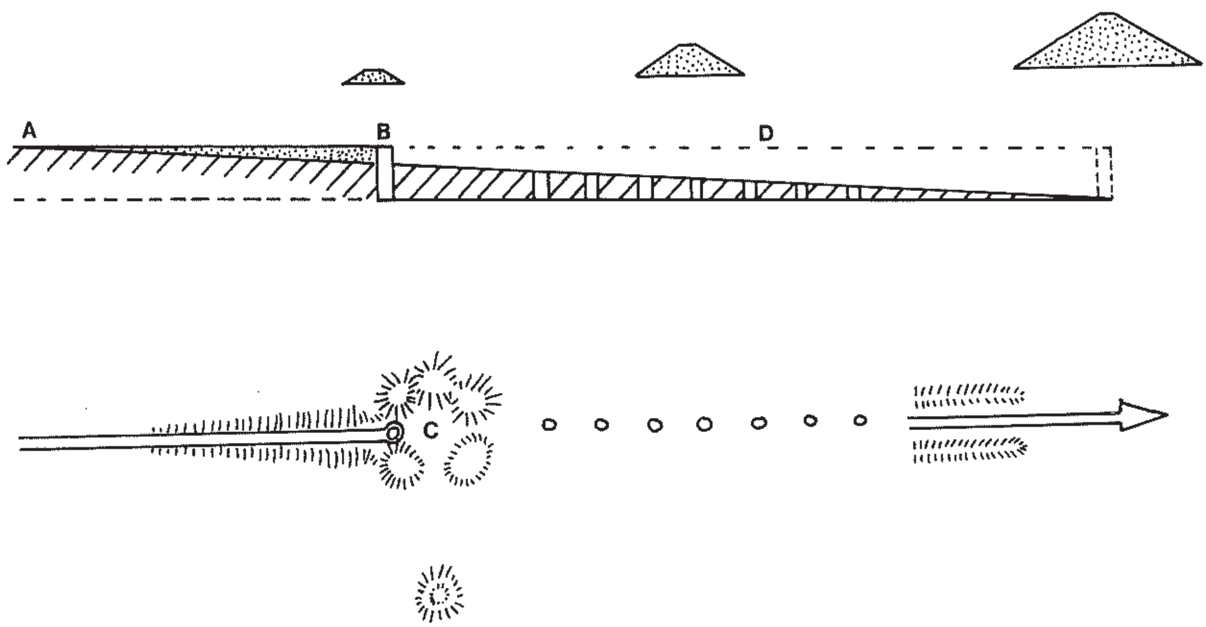

FIG. 4. *Tentative reconstruction of ancient mill situated on falaj b.*

Embankment.

Section through ground surface

a b c *See text.*

d *represents the path taken if the channel had been led along an embankment all the way to the plunging tower. The sections above illustrate how the volume of earth moved would increase disproportionately if the embankment sides were to be correctly graded. The excavation of this amount of soil, it is suggested, would be more costly than the construction of a short length of underground channel.*

The Falaj Systems:

During Sohar's heyday, in addition to wells, water was supplied by a large number of surface and subsurface channels (*falaj*, pl. *aflaj*) which conducted water from the water table inland to the surface in the manner of the Persian *qanat*. *Fig. 3* indicates the location of ancient falaj lines investigated during the 1975 field season. Although most of these remained undated due to the lack of clearly associated dateable remains, channel *b*, *Fig. 3*, could be dated to Sohar's heyday and it was this feature that provided some of the most interesting features of falaj engineering. Here, instead of having a continuous surface or underground channel the main channel possessed alternating surface and subsurface reaches one 'cycle' of which is illustrated in *Fig. 4*.

From *a* water flows along an open channel which is progressively raised above the surrounding terrain on a low embankment, then at *b* the channel abruptly ends in a large complex of depressions and mounds, *c*. About 40m. past *c* the channel can again be traced, this time as an underground conduit, and finally after a distance of some 700m. it attains the ground surface via a shallow cutting. Because the terrain in this area slopes at a relatively steep gradient of around 1:250, channels can be constructed at lesser gradients thus enabling them to cross the terrain at an angle (for example, *c*, *Fig. 3*) or to build up a surplus 'head' of energy. When sufficient 'head' has been built up the water is then plunged down a vertical column and the power expended is used to drive grindstones for milling cereals and possibly other products. It is therefore suggested that these features are the remains of water mills and that within the area *c*, *Fig. 4*, the grinding operations must have taken place. Similar mills also occur on *qanats* in Iran and it is significant that mills (this time situated along surface channels) were also found in the agricultural hinterland of Siraf, Iran, a trading city roughly contemporary with Sohar.

Conclusion:

As Andrew Williamson stated in 1973, Sohar did possess a considerably larger agricultural belt than is in existence today; this amounted to some 4,800 hectares within the area studied although about 400 hectares of this land has been obliterated by flood erosion and sedimentation. Irrigation was by means of *aflaj* and wells although the relative contribution of each cannot be stated yet. The nature of this land use and the crops grown remains a matter for speculation, but after further investigations into the cultivation practices of the recent past I hope to be able to present conclusions regarding these matters in later reports.

[1] Williamson, A. 1973, Sohar and Omani Seafaring Trade in the Indian Ocean. P.D.O. 36 pp.

[2] Extending from 8km. south of the town to 14km. to the north.

[3] I.L.A.C.O. 1975, Water Resources Development Project N. Oman. Interim report, v. 1. Arnhem, Netherlands.

[4] Also taking place within the compass of the project was the excavation of a sondage within the main city of Sohar. This was conducted by P. Farries.

[5] No allowance has been made here for urban land use or for spaces within the field areas.