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Environment and Land Use in the Wadi Faynan, Southern Jordan: the Second Season of Geoarchaeology and Landscape Archaeology (1997)

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This report describes the second season of fieldwork by an interdisciplinary team of archaeologists and geographers integrating geomorphological, palaeoecological, archaeological and hydrological studies to construct a model of landscape development for the past 10,000 years in the Wadi Faynan in southern Jordan. Geomorphological fieldwork has provided further understanding of the sedimentary fills of the survey area, and underlined the importance of tectonic activity as a controlling environmental process. Over half of the complex field system WF4 has been recorded in terms of wall construction, surface artefacts, and hydrological features. A complex sequence of settlement and land use is emerging from these studies, especially regarding systems of floodwater farming over the past three thousand years. Field observations of wadi downcutting and preliminary pollen analysis both suggest that one factor in this development has been considerable environmental change over the same period.

Background (GWB)

The Wadi Faynan Project of the British Institute for Archaeology and History at Amman has as its principal objective the provision of a detailed case study in the long-term relationships between environmental and human history in the arid zone, from prehistory to the present day. The project is addressing fundamental issues in the history of desert exploitation in Jordan, with wide relevance for arid-land studies in general (see McQuitty, fig. 1). The project consists of a series of investigations by different teams, one of which is an inter-disciplinary team of archaeologists and geographers co-ordinated by

Professor G. Barker, which is attempting to provide an overall framework of landscape change. This team has four specific objectives: (1) to construct a geomorphological and palaeoecological sequence for the study region and to establish its chronology; (2) to map and date the remarkably-preserved field systems that floor the greater part of the wadi, together with the settlement evidence within them, and to establish how these systems functioned; (3) to map and date the surface archaeology outside the field systems; and (4) to integrate these geomorphological, palaeoecological, archaeological and hydrological data within a model of landscape development, especially for the past 10,000 years.

The preliminary fieldwork by the team in 1996 was reported in *Levant XXIX* (Barker *et al.* 1997). This report describes the initial findings of the second campaign of fieldwork (April 4th–24th 1997), including further geomorphological and geological studies, the start of the detailed investigation of the main field system (denoted as WF4 in the project register), and the preliminary analyses of pottery and lithics collected by the field survey, together with some of the results emerging from the laboratory work on sediment samples collected in the 1996 season. The fieldwork concentrated on the part of the field system immediately west of Khirbat Faynan, the ancient site dominating the confluence of the three wadis that form the Faynan, the Wadis Dana, Ghuwayr and Shayqar (McQuitty, fig. 2, WF1). As described in the Preface, Khirbat Faynan is assumed to have been the principal settlement in the Wadi Faynan in the Nabataean, Roman and Byzantine periods, and is commonly identified with references to the *Phaino* to which Christians from Palestine and Egypt were transported in the third and fourth centuries A.D. to work in the copper mines which it controlled.

Geomorphological investigations (JPG and SJM, with DDG)

The principal aims in 1997 were to develop further the geomorphological models outlined by Gilbertson *et al.* (1997) and, in support of this, to identify sites for dating and sampling. Two main objectives were identified: to refine our understanding of the Ghuwayr beds, a major alluvial deposit, the understanding of which may be the key to understand the environmental processes which have shaped the landscape; and to understand the nature and diversity of the tectonic processes which have shaped the archaeological landscape. A significant improvement was made in the understanding of the geomorphological development of the areas around the confluence of the Wadis Dana, Ghuwayr and Shayqar (Fig. 1).

Fieldwork began in the Wadi Dana with the sampling of calcreted fossil river beds which preserve evidence of river conditions, sediment load, clast size and source. This continues a sampling programme begun in 1996. It was evident that several of the calcreted sediment bodies originated in tributary wadis and had apparently been deposited in a catastrophic manner which resulted in the damming of the main wadi at various times in the past. This was suggested by the presence of calcreted sediments on the wadi wall opposite the mouths of sev-

eral tributary wadis which contain calcreted river beds. This phenomenon is well illustrated downstream from the project base at the Royal Society for the Conservation of Nature's camp (marked RSCN Camp on Fig. 1).

Several new river terrace deposits were identified above the current bed of the Wadi Dana. These sites will be described in detail in a later report, but site 5063 is a key section, where a sequence of alluvially deposited sands and gravels was found some eight metres thick, approximately a hundred metres above the modern wadi floor. Samples for dating will be collected in 1998. From site 5063 it was apparent that another fluvial deposit could be traced across the landscape: each of the ridges immediately above and to the east of the RSCN camp was found to be draped with fluvially-derived material consisting of basalt, granite, limestone, flint, sandstone and quartz fragments. The size range for this deposit was considerable, from large boulders over a metre in diameter to quartz pebbles. Extensive exploration revealed that this terrace material extended down the valley to Khirbat Faynan and was found either on the ridges or as debris trains in more recently eroded wadis. On the western side of the Wadi Dana a similar deposit, 5060, was identified on the small ridge immediately above the RSCN camp, where fluvial sands and gravels were overlain and eroded by waterborne clasts typical of those which could be seen on the eastern side of the wadi. Furthermore, similar fluvial sediments were identified high along the western side of the wadi. Our survey suggested that two of these terraces may be preserved, an upper terrace which is clear and easy to trace and a lower terrace which is more ephemeral, though clearly seen above the RSCN camp.

Each of the side wadis flowing into the Dana south from the RSCN camp was surveyed. It was apparent that each was in a different stage of down-cutting and was of a different age to the adjacent wadis on either side. This survey will be reported in detail in a later report, but it is clear that micro-tectonic processes are controlling the uplift and erosion of the wadis along the Dana. The distance between wadis of significantly different age and maturity could be as little as a hundred metres. This finding is of critical importance as it is the down-cutting of each tributary wadi which feeds sedimentary material to the main streams. It is clear that the role of tectonics in the region will be critical to understanding the development and use of the landscape.

The Wadi Ghuwayr was explored to determine the degree of relationship between it and the Wadi Dana and to clarify the nature of the Ghuwayr beds mapped

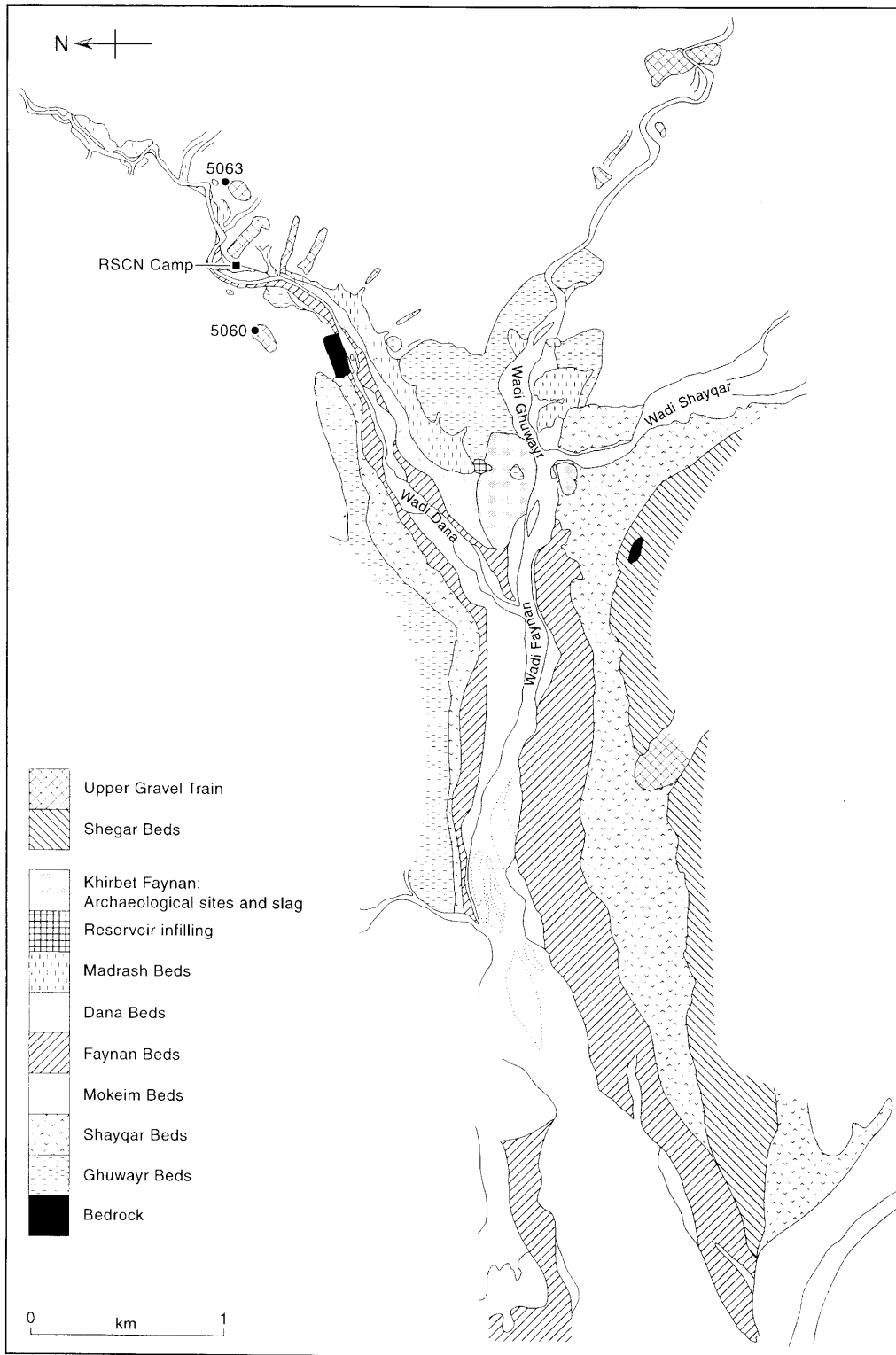


Figure 1. Geomorphological map of the confluence of the Wadis Dana, Ghuwayr and Shayqar, and the upper section of the Wadi Faynan.

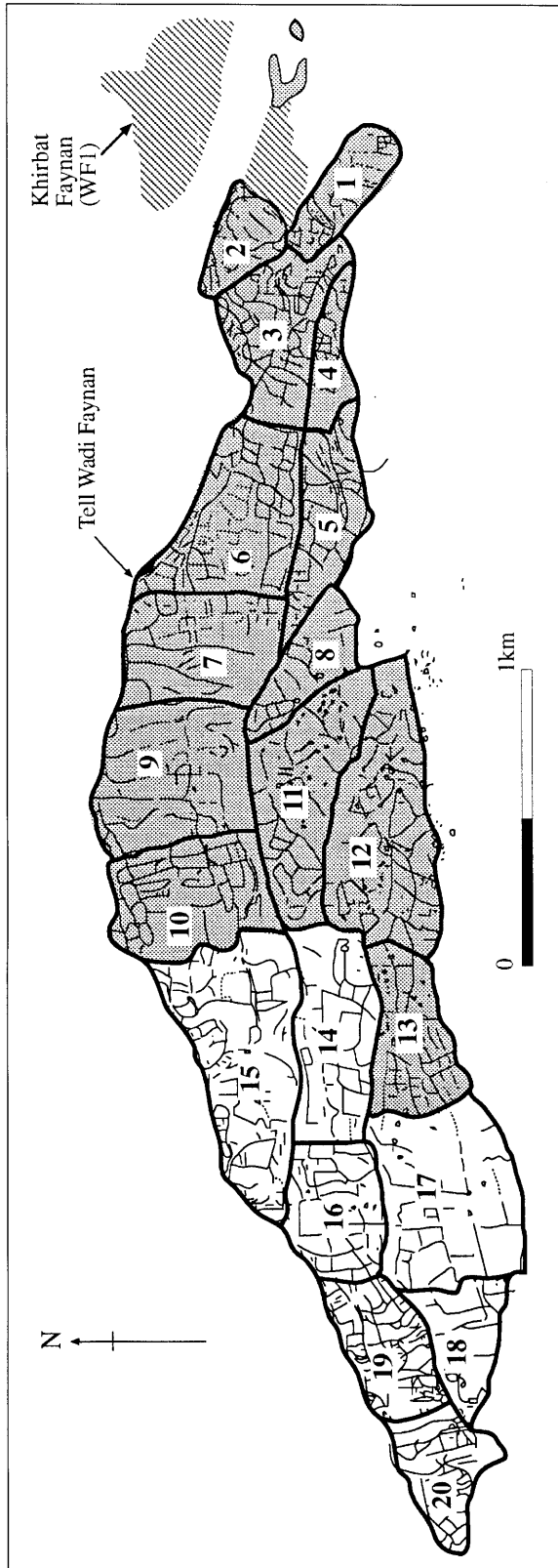


Figure 2. The Wadi Faynan field system WF4: the numbers indicate the sub-areas of the field survey, and the shading marks the zone surveyed in the 1997 campaign.

in 1996. No *in situ* calcreted sediments were identified in the wadi, though several blocks were present in the wadi bed. Further studies are needed to find their location and distribution upstream. On both banks of the wadi, however, several hundred feet above the present-day river bed, two distinct trains of fluvially-derived boulders could clearly be identified. Our present interpretation of these sediments is that these conform to those sediments identified in the Wadi Dana. These deposits were draped over, but not in, major alluvial fans found in tributary wadis and at the mouth of the Wadi Ghuwayr abutting the ridge which leads out to Khirbat Faynan. A smelting site was identified which had been constructed on one of these high terraces; the site had been dissected by a small wadi and a clearly-constructed channel was seen in section, which will be sampled for pollen and radiometric dating in the 1998 season.

As a result of the 1997 fieldwork the mapping of the terraces which took place in 1996 has been refined (Fig. 1). These beds now need to be subdivided into three separate events. The Ghuwayr beds are now seen to be massive accumulations of alluvial fan material in the Wadi Ghuwayr. These beds are predominantly composed of silt and angular fragments of igneous rock which largely derive from the bedrock immediately above the fans. Palaeolithic implements were retrieved from both the base and the top of these beds in 1996 indicating a date in the Middle or Upper Pleistocene. It is clear that the palaeolithic people who left these implements were in the area at a time of massive accumulation of sedimentary material – most of which has now been flushed out of the system.

The two terraces of fluvially-derived boulders, cobbles and pebbles which are found in both wadis and previously mapped as part of the Ghuwayr beds are now seen as being entirely separate. These have not yet been named, but represent a distinct change in the nature of the environment, from one where material was accumulating in the wadis to one where material was being discharged as predominantly large debris flows. Further exploration and mapping of these beds are seen as being key objectives of the 1998 season.

The alluvial fans systems discharging off the Jabal Muburak have now been assigned to a new unit, namely the Shayqar Beds, as they are believed to be of a different age to the Ghuwayr Beds. A further study of this area is needed.

In short, good progress was made towards developing a clearer understanding of the different sedimentary fills of the survey area, their use by people, and their relationship to each other. It is clear that the controlling environmental process in the region is

tectonic, operating at several scales. At the macro scale the relationship between the escarpment and the Red Sea fault is clear and controls the accumulation or discharge of material from the main wadis. At a slightly smaller scale each wadi exists in a different geologic and tectonic setting and this again controls rates of downcutting, sediment accumulation or discharge. Each distinct geological block, sedimentary or igneous, is responding to tectonic events at different rates and is also weathering and undergoing post-depositional changes in distinctly different ways. Finally, each 'geological block' is affected by micro-tectonic flexing, so that closely adjacent wadis may be of distinctly different age and maturity, and accumulating or discharging material at different rates.

The survey of the field system WF4 (GWB, OHC, DJM, PN, DCT)

Methodologies

Work continued on recording in detail the complex field system WF4 that extends for approximately five kilometres west of Khirbat Faynan (WF1), building on the methods and approaches described in last year's report. Briefly, these may be summarized as the structural record of the walls and hydraulic systems, the systematic collection and counting of pottery, lithics, other artefacts and slag on the surface of each field within the complex field system, and micro-topographical surveying.

The numerous field divisions, many defined as discrete terraces, provide convenient units of collection and the overall field system has been divided into a series of 20 sub-areas (Fig. 2). Each field is thus given a number such as WF4.1.1 or WF4.6.3, where the first element is the entire field system (WF4), the second element the sub-area within it (e.g. 1 or 6), and the third element the field unit within each area – each sub-area has its own sequence starting at 1. The recording of the structural features within each field unit and of the construction of its wall systems is carried out on a *pro forma* sheet. This structural survey has also been verifying the improved photogrammetric map of the field system produced for BIAAH from air photographs by Leoni Blank (University College London), part of which is illustrated as Figure 3. Significant or well-preserved structures related to water control such as sluices, baffles and spillways (see below) are also being recorded separately within the site recording system of the Wadi Faynan project, together with the many stone-built structures – settlements and (?burial) cairns especially – that survive within the field system.

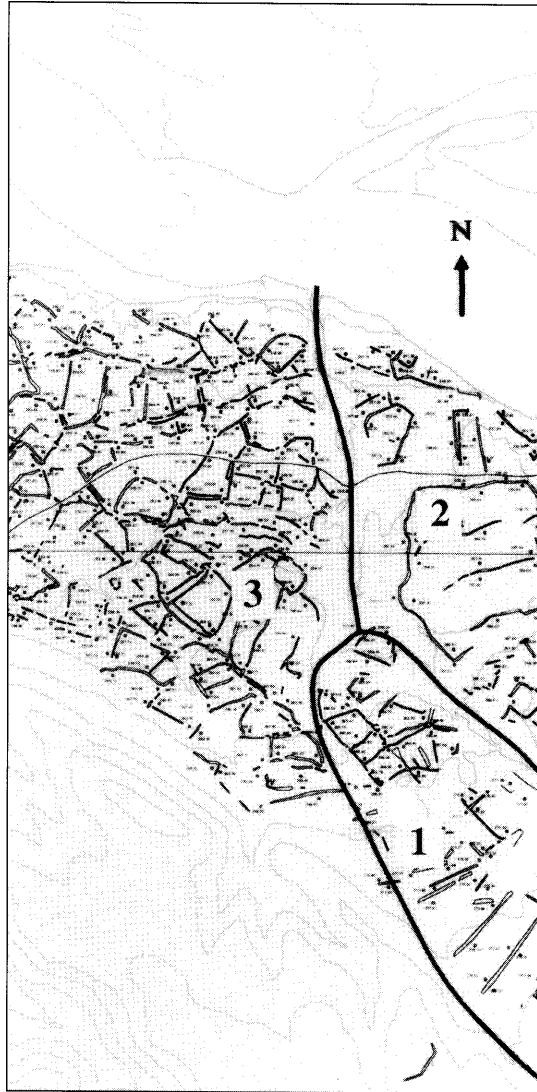


Figure 3. Detail of the photogrammetric map of the Wadi Faynan field system WF4, showing part of WF4.1–WF4.4. Scale: 1:2000.

The field-walking is carried out by a team of walkers traversing each field in a series of transects at a regular spacing of 10 metres, each scanning a one-metre strip of the ground. The record of artefact density combines a systematic total collection of the artefacts present on the surface of the field from at least one transect with a series of counts derived from clicker counts of other transects within each field. The finds from the systematic field-walking are augmented by – but kept separate from – a 'grab' sample of any particularly diagnostic or unusual

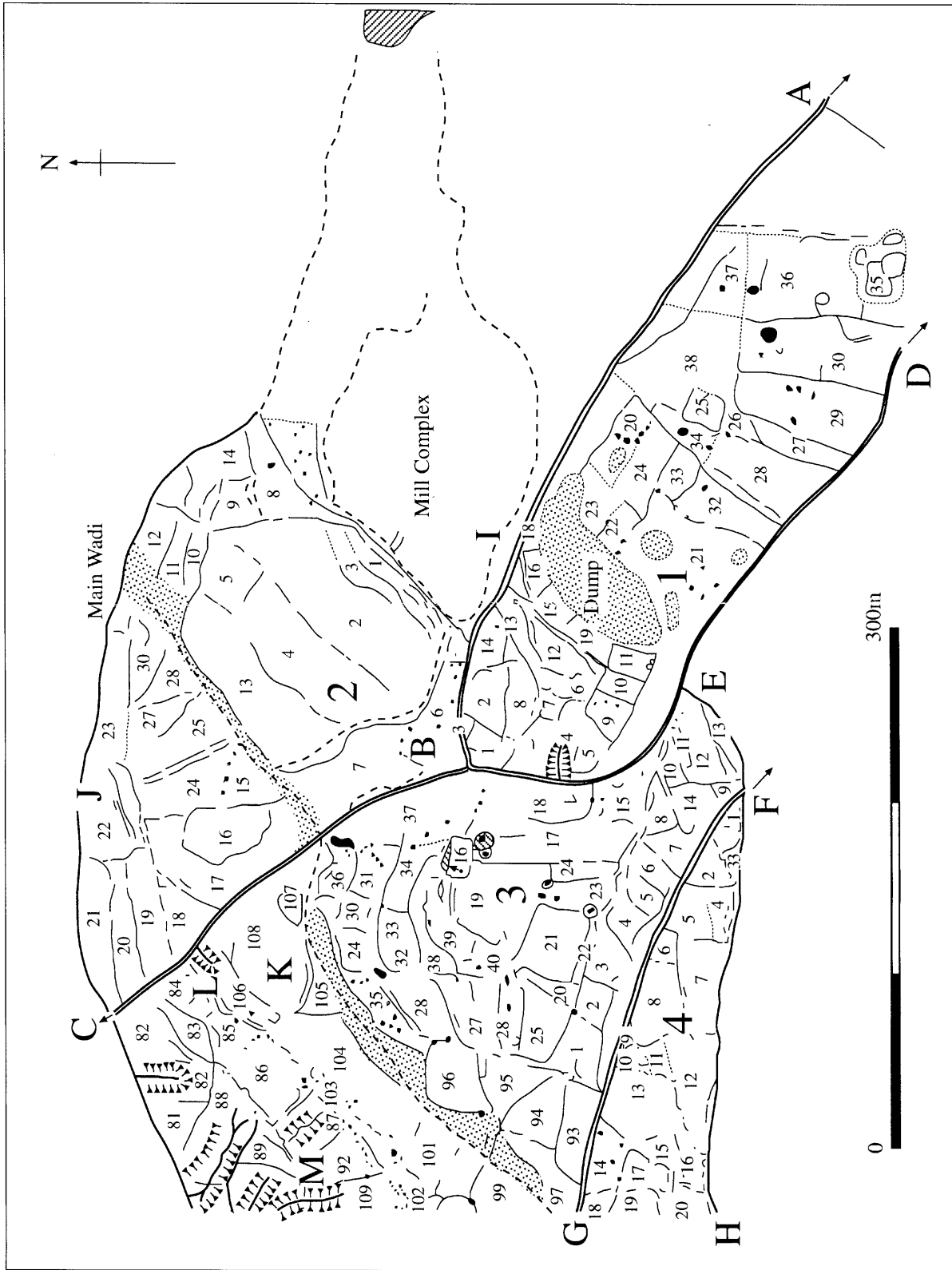


Figure 4. Field map of the same area of the Wadi Faynan field system WF4 shown in Figure 3, after ground verification by the survey teams.



Figure 5. The diversion channel WF243 at the head of WF4.3 (point E in Figure 4), looking north-west: the scale measures two metres. Note the down-cutting of the present wadi course. (Photograph: G. Barker).

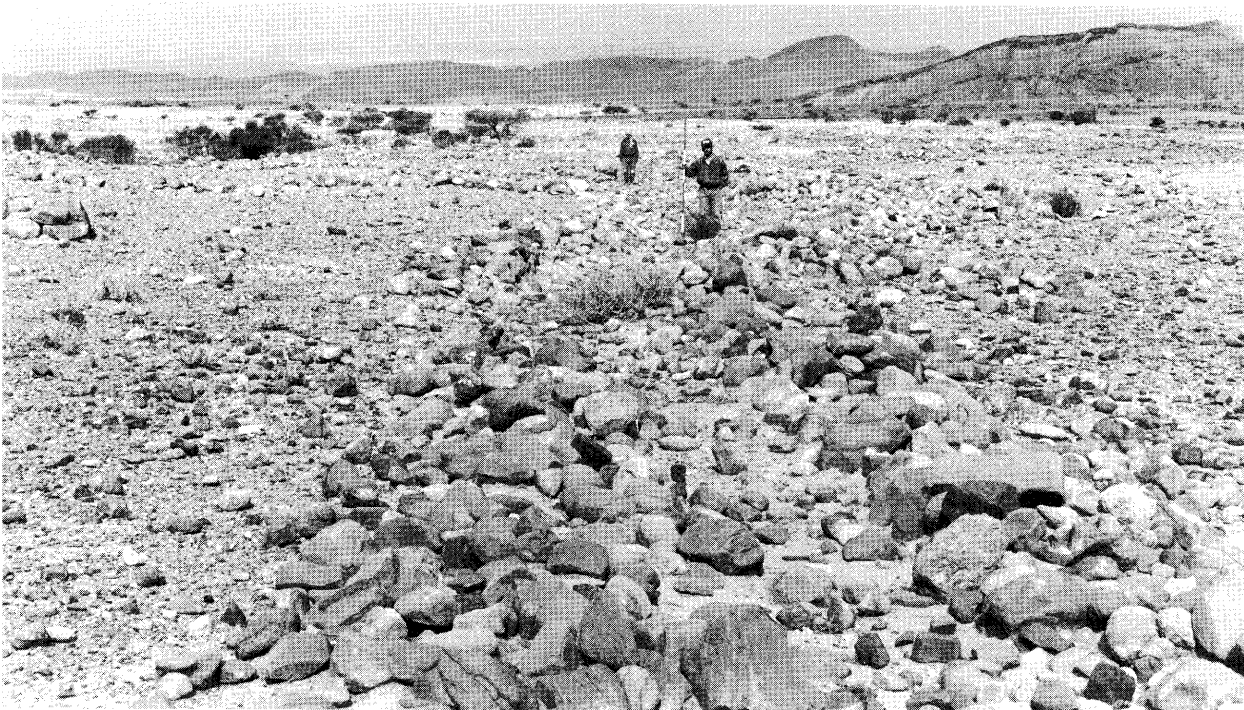


Figure 6. The same diversion channel WF243 in WF4.3: the nearer figure with the ranging pole stands in the channel, and the further figure stands at the junction by cairn WF237. (Photograph: G. Barker).