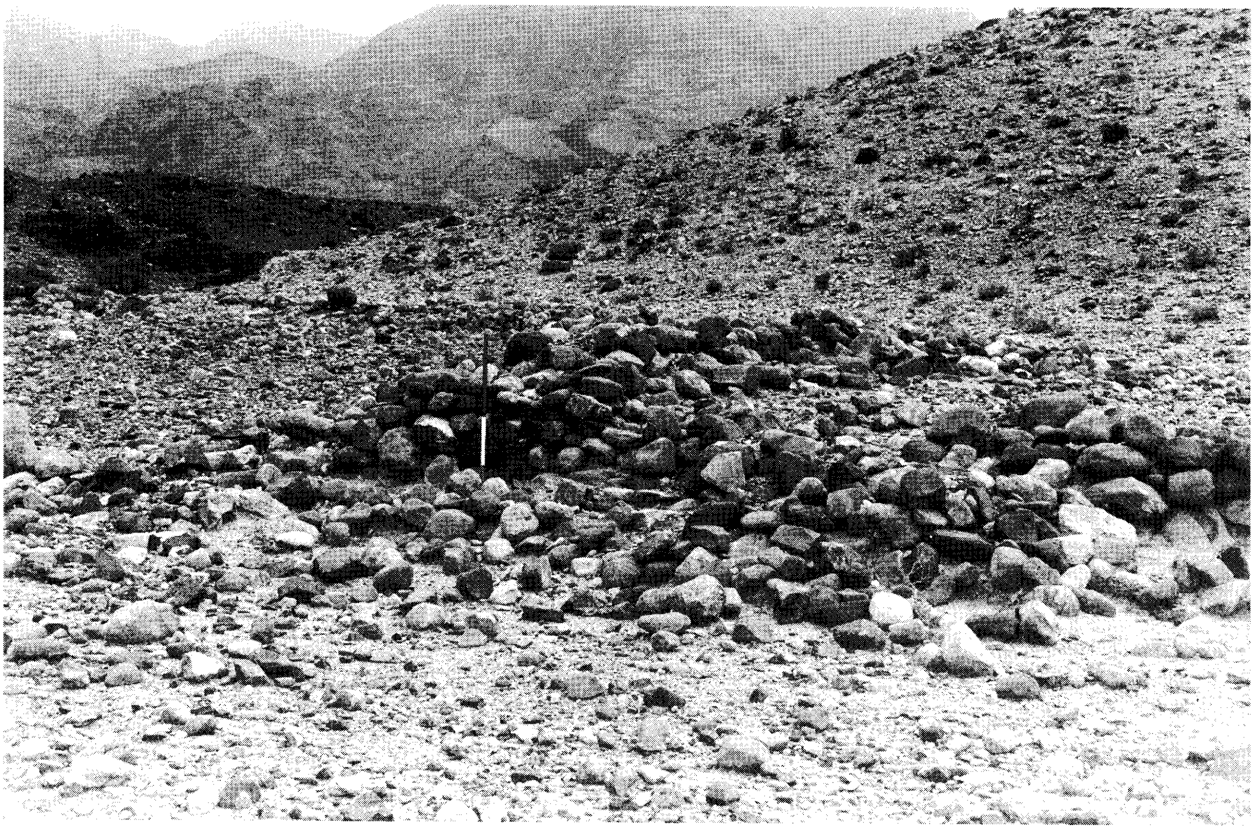

Figure 7. *The diversion wall of WF4.4, which diverts water from the wadi in the middle distance on the left with the trees; the two-metre ranging pole is by the spillway feeding water into fields 4.4.1 and 4.4.2. Looking south-east. (Photograph: G. Barker).*

pieces visible in the field at the end of the systematic field-walking, or picked up within the 'clicked' transects. A *pro forma* sheet is completed for each field, recording (in the field) the number and paced length of the 'sherded' and 'clicked' transects and the number of pieces of pot and flint observed by clicking, and (in the finds-processing afterwards) the number and weight of the sherds, lithics and any other artefacts collected in the systematic and grab samples.

These approaches are being augmented by detailed micro-topographical survey using a Topcon GTS 303 Total Station. In 1997 this work was trialed in the southern portion of Unit 4.3: over 1,000 spot heights were taken, based upon a five-metre interval grid, and supplementary measurements were taken to record additional micro-topographical variation within this framework. Following this, a Digital Terrain Model contoured at 25 centimetre intervals was constructed. Once the DTM is super-imposed over a 'ground-truthed' version of the photogrammetric plot, details of slope characteristic and channel morphology not recognisable in the field become apparent. This very detailed mode of survey can thus add an additional dimension to understanding the characteristics, function and management of hydrological flow within the field system.

Differential preservation resulting from recent agricultural activity greatly complicates analysis of the field systems and surface material. Another complicating factor is that few walls fall neatly into one typological category along their whole extent. In addition, although the field system was divided into logical units, it should be remembered that these are another imposition upon what was probably a unified system – Units 3 and 4, for example, are certainly interrelated. However, despite the inevitable teething problems in our methodologies, the 1997 work has made very substantial progress with the recording of the field system: of the 20 sub-areas of the field system (Fig. 2), a total of 13 (WF4.1–13) has been completely fieldwalked and the wall systems recorded. No less than 538 indi-

Figure 8. *The outer diversion wall of WF4.3.4, looking west. The one-metre ranging poles are located within a sluice/baffle structure: the vertical pole is in the sluice, and the right-hand end of the horizontal pole abuts the stones of the baffle. (Photograph: G. Barker).*

vidual fields were recorded by the field teams. It is already clear from our studies that there are significant variations in field morphology, surface assemblages, hydraulic function of walls and associated structures, and chronology of wall-building and use. A few observations are offered here on this variability, though a full assessment of these differences must await completion of the survey next year and full analysis of all the material collected and the distribution of material and structural features.

Field organization and function

The field systems in WF4 are bounded to the south by low hills and to the north by the deeply entrenched Wadi Faynan, which is progressively eroding the northern edge of the field system. Although gradients are quite gentle, the fields clearly step-down in terraces to the north and west. These topographic factors have greatly influenced the purpose and nature of the field systems. Differences are apparent in the organization of the field systems, largely as a response to topographical variation, but also reflecting the better preservation of the field system in the east. A rough tally of the different wall types, masonry classes and features was calculated for each field unit. Most of the walls appear to be single-faced or unfaced terrace walls, with more variation visible in the masonry classes. Numerous parallel walls and channels were noted, as were possible spillways (step-like constructions to allow water to flow in a controlled manner through a wall, rather than destructively over it) and sluices (narrow gaps in walls or between walls that could be kept open or that could be blocked), either of which could be reinforced with baffles (arrangements of stones set below the spillway or sluice gap, to spread the water as it flows past them). Larger, better constructed walls characterize the southern field units, where the emphasis is on slowing water and channelling it into the system. To the north, the walls are lower and more ephemeral, but also more intricate, reflecting their different function.

The field units in the south (4.1, 4.4, 4.5, 4.8 and 4.12) seem designed especially to capture surface run-off and wadi flow, reducing the latent water energy and distributing the water to fields lower down the slope. In Figure 4 we illustrate the working map constructed in 1997 for the part of the field system within our units 4.1-4.4. This is the part of the field system nearest Khirbat Faynan, immediately west of the Roman-period mill complex. Floodwaters enter the system here from three side wadis and traverse it en route to the main Wadi Faynan: the first flows down the line A/B/C, along the northern boundary of 4.1 and the southern boundary of 4.2; the second flows down the line D/E along the southern boundary of 4.1 and curves north to the junction at B and thence to the Wadi Faynan at C; the third egresses through a gap in the hills at F, flows westwards to point G as the boundary between our units 4.3 and 4.4, and then (see Fig. 2) meanders westwards across the main field system as the boundary between (on the north side) 4.6, 4.7, 4.9, 4.10 and 4.15 and (on the south side) 4.5, 4.8, 4.11, 4.14 and 4.16.

A well-preserved example of the ingenuity of the water-control measures in this part of the system can be seen within 4.3 (Fig. 4). Today, the water entering the system at point E descends steeply north-

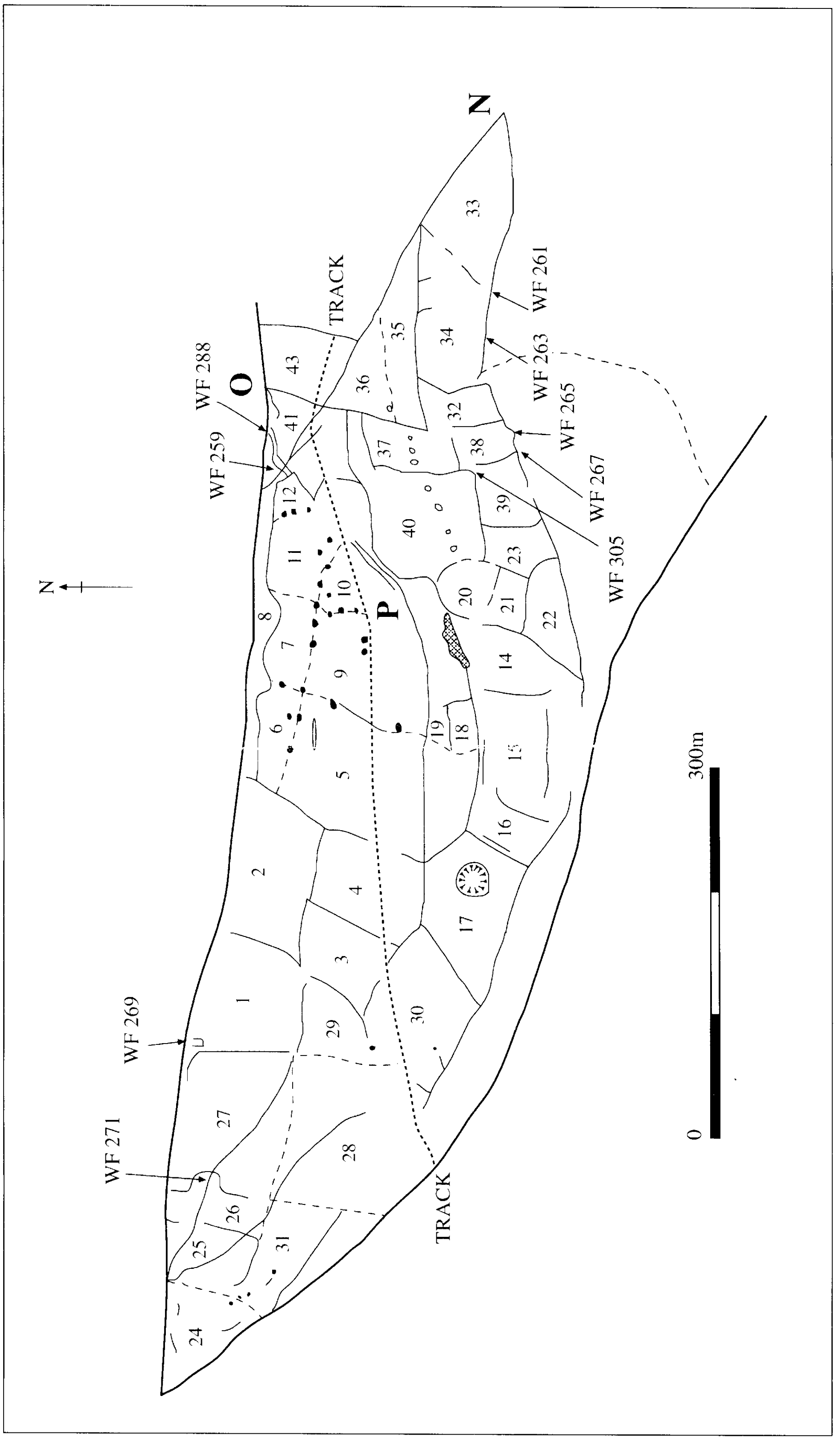

Figure 9. *Field map of WF4.5, after ground verification by the survey teams.*

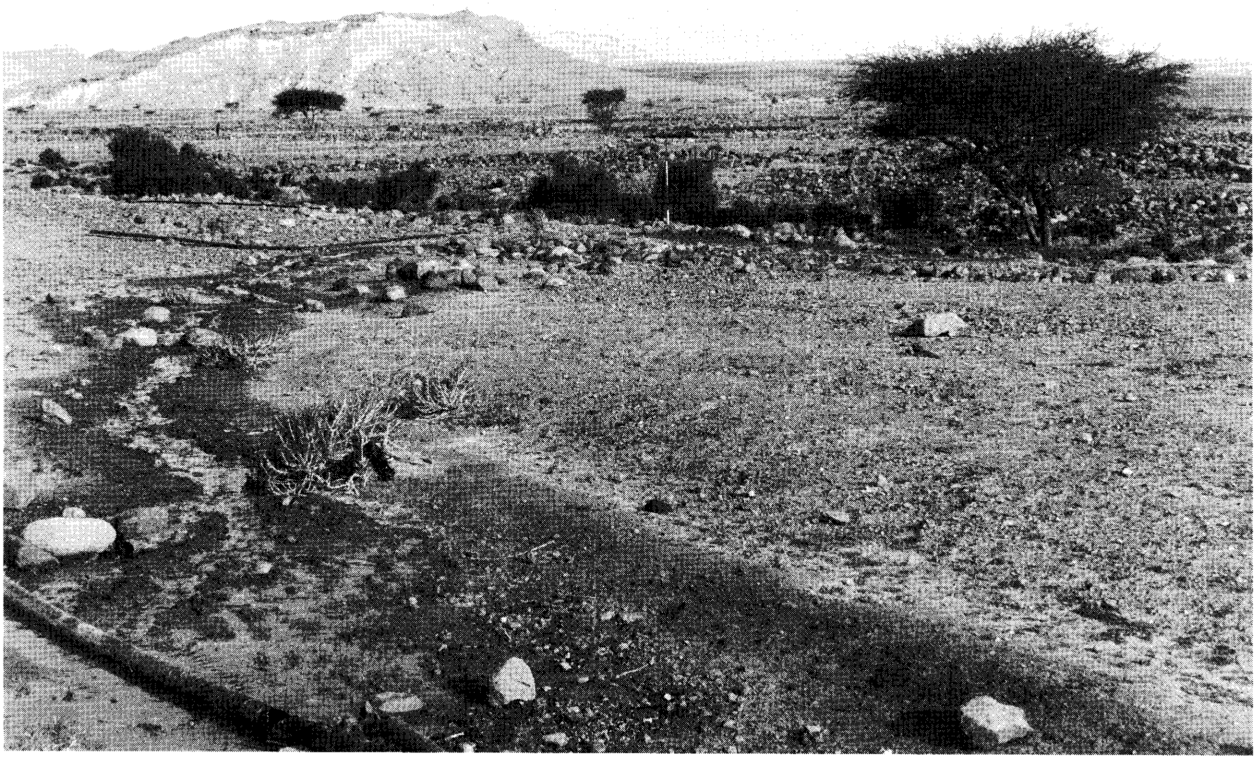

Figure 10. *The parallel-wall channel WF288, looking north; the channel captures water from the wadi marked by the line of bushes, diverting it from the wadi bed to the right of the tree. The near side of the channel is visible as a line of stones in front of the tree, and the two-metre ranging pole is on the line of stones forming the far side. Water is leaking from an irrigation pipe in the foreground and flowing over the channel towards the wadi. See also Figure 11. (Photograph: G. Barker).*

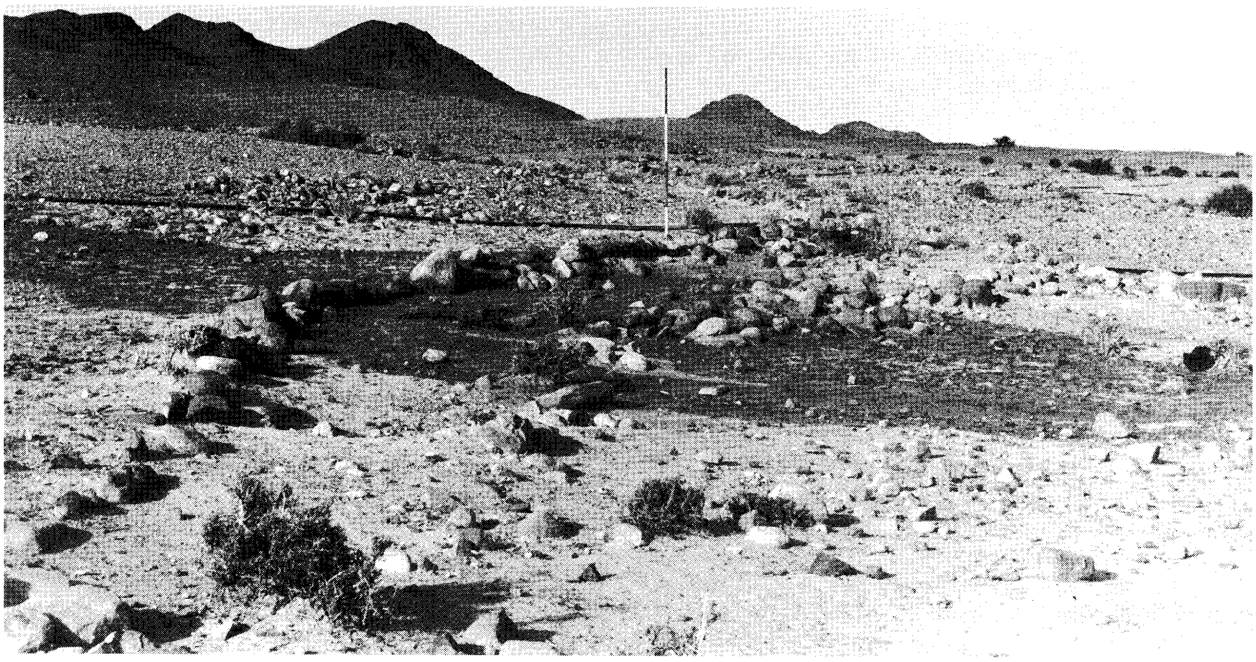

Figure 11. *The parallel-wall channel WF288, looking west from the wadi shown in Figure 10; the system diverts water from this wadi and carries it down the channel past the ranging pole (two-metres). Water is leaking from the irrigation pipe on the left and flowing over the channel towards the wadi. (Photograph: G. Barker).*

wards down the wadi channel to junction B and thence to Wadi Faynan at C, but the system was clearly designed at the time of its construction to divert the water at point E and send it instead down a long meandering channel (WF243 in the survey record) formed of parallel walls running north-westwards down the spine of the fan (Fig. 5). Small sluices, several with baffles, allowed water into the upper fields (in descending order: fields 11, 10, 8, 15, and 17), and the channel ends downslope at cairn WF237 (Fig. 6), where a complex and substantial junction was constructed which allowed water to be channelled variously westwards (3, 2, 1), north-westwards (22, 20, 25) and northwards (23, 21, 19). Thus floodwater could be directed into particular parts of the field system or, if the flow was particularly strong, the flood could be slowed and spread out right across the fan, to cascade slowly down the terraced fields south of the modern track towards the main wadi.

Unit 4.4 (Fig. 4) provides another example of a diversion system. At point F a single substantial barrage has been built to prevent the water flowing down its present channel (F/G), and diverting it instead westwards along its upslope side (F/H), with a variety of sluices and baffles spaced at intervals along it to feed water into the fields below. Figure 7 shows the line of the diversion wall from the wadi and one of these constructions, a right-angle of substantial terrace walling designed as a spillway to take the full force of the diverted water and spill some of it eastwards into field 1 and some of it northwards into field 2. Figure 8 illustrates a sluice and baffle further down the same diversion wall. The outer (southern) wall of WF4.5 (Fig. 9) had the same function, diverting water westwards from point N on Figure 9 and spilling it under control through sluices into the terraced fields below to the north.

Whilst today floodwaters of course still flow downslope through many of the terraced fields, through the sluices and baffles and down the terraces, none of these systems functions properly now because the wadi channels are incised 1–2 metres below the upper ends of the key diversion walls at points E, F and H, so the water flows below the level of the diversion walls into the present wadi channels (Fig. 5).

In the northern part of the field system, as the topography levels out, many more of the walls are perpendicular to the hills and to the Wadi Faynan. This part of the field system has been extensively damaged by modern agriculture, but the indications are that it was at least as intricate as the better-preserved sections upslope. The walls seem to be designed to direct low-energy water, spreading it across as wide an area as possible, before it eventually reaches Wadi Faynan. Walls immediately parallel to the wadis are very noticeable here: presumably the priority here was to prevent water and sediment escaping the system into the main wadi flow for as long as possible. Severe erosion is particularly visible in the north, where walls parallel to Wadi Faynan no longer exist.

Despite the damage from track-building, agriculture and erosion in the lower parts of the field system here, detailed survey is revealing a series of examples of parallel-wall systems constructed to divert water from the lower sections of the tributary wadis before it reached the Wadi Faynan. In Unit 4.1, for example (Fig. 4), one of these (WF213) captured water flowing down the A/B wadi channel at point I and spread it over the fields near the confluence. Water from the main wadi was diverted in Unit 4.2 by the channel J. Channels K, L and M in Unit 4.3 are probably remnants of systems that took water into the lower fields of this unit from the floodwaters moving down the watercourse B/C. Whereas the upper fields of Unit 4.5 (Fig. 9) were fed from waters flowing through the diversion barrage taking water from the upper wadi at point N, all of the lower fields were fed from the large tributary wadi flowing along the northern boundary of the unit by a major parallel-wall system starting at point O, fragments of which are also well preserved at point P (Fig. 9). Figures 10 and 11 show the first part of the channel, designated WF288. As in the case of the upper diversion walls, wadi downcutting since the time of wall construction is such that the parallel wall systems are no longer effective in capturing wadi flow.

Structures within the field system

In many parts of the field system there is a complex suite of stone-built structures, and a priority of future fieldwork will be to establish their chronology, functions and association (if any) with the ancient fields and water-control systems. In Unit 4.1, for example, there is a complex of small rooms and yards (WF 233) of Nabataean and Roman date at the south-eastern end of the system that is the western outlier of a group of such settlements east of the A/B watercourse and south of the Roman mill complex. There are numerous cairns of unknown date within the fields, some of which may be burial cairns, others clearance cairns – and several probably served both functions. There is a major farmstead with Nabataean and Roman pottery on the hilltop immediately above Unit 4.3, and a series of substan-