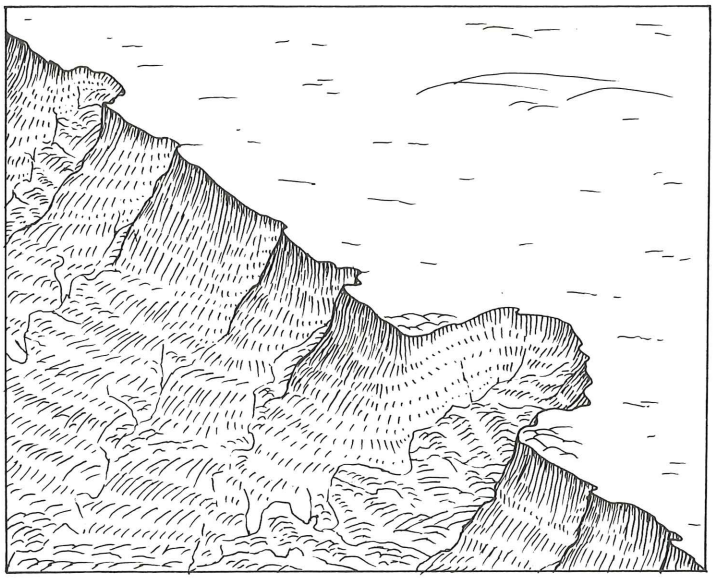
5. Schematic view of the Wadi el-Bustan drainage complex (lower right) at the escarpment separating the Wadi Araba (lower left) from the highland plateau (upper right).



accumulated provide a tentative foundation for interpreting past climates. Today, mean daily temperatures range from 12–14° C over the year at Shobak, with averages of 4–6° C in January and February and 20–22° C in July and August. Although there is noticeable diurnal change in wind direction, prevailing winds come from the west and northwest. Mean annual precipitation figures for Shobak range from 300 to 400 mm., with the bulk of this amount occurring as rain and snow from December through early March (Anon. 1971: 1–24). The effective precipitation is sufficient for dry farming, and in ancient times extensive stands of trees probably characterized at least the western edge of the plateau which today is treeless due to cultural overexploitation in relatively recent historic times. At the present time there are no permanent water sources on the plateau, although active springs near the bottoms of the wadis support lush vegetation along wadi margins and bottoms.

Paleoclimatic studies are in their infancy in Jordan, and substantive information concerning Late Pleistocene weather patterns and their effects on the local biota of the western plateau will take some years to be developed. On the basis of studies in Palestine and elsewhere in the Near East (e.g. Farrand 1971; 1979), it is clear that the Shobak region must have witnessed extensive periods of increased precipitation and decreased temperatures. The desert hinterlands of Jordan, to the east of the Wadi el-Bustan complex, were most likely vast grasslands and open savannahs, capable of supporting large herds of megafauna at those times, and it is possible that forests thickly covered parts of the western (and higher) edges of the plateau. The presumed cooler summer temperatures may have had some effect on the kinds of vegetation growing on the hills and eastern flatlands, but the most important effect on the biotic communities would have been noticed in the winter months. Temperature declines of 5–7° C (Farrand 1971: 561) would have contributed to long-term snow cover over much of the landscape. While periodic thawing may have exposed some vegetation at times during the winter, extended frost periods would have had a severe impact on the quality and quantity of forage available to grazing herbivores.

It is likely, therefore, that most herbivores would have migrated from the eastern grasslands and savannahs of the plateau to other areas of the region which were milder and where vegetation was more dependably available. For many of these animals, the Wadi el-Bustan drainage complex would have presented a natural migration corridor from the highlands to the warm and lush expanses of the Rift Valley in the late fall; in the spring season, many herds of animals would have found the route convenient in their return to the grazing lands on the plateau.

Seasonality and occupation

Several factors suggest that Late Acheulian hunters 'harvested' such herds in the Fjaje area during these migration events and that, in terms of the predictability of high yields in such matters, the major focus on hunting occurred in the springtime. Additionally, comparisons of general artifact densities at Fjaje with other Late Acheulian surface sites indicate that this part of the annual round may have witnessed a temporary formation of very large co-operative social units.

a) Artifact distributions

Precise information on artifact densities and distributions in the survey area has been rendered irretrievable due to intensive agricultural practices which may have a very long history in this part of Jordan. Nevertheless, generalized statements and reasonable estimates can be made which reflect the likely differential use of the region by its Late Acheulian occupants.

The stippled areas in FIG. 2 show the location of relatively dense exposures (ca. 20–25 artifacts per 10 m.^{2}) of Late Acheulian material, and the solid triangle indicates the particularly dense site at Fjaje (ca. 75–100 artifacts per 10 m.^{2}). Of particular importance is the restricted distribution away from the plateau margins, which rarely extended more than 250 m. from the escarpment edge except at Fjaje itself; furthermore, cultural material is negligibly present on the peninsular spurs that extend towards the center of the semicircular drainage basin. This restricted distribution of linearly extensive dense artifact concentrations conforms with a scenario of hunting groups waiting along the plateau edge for game animals to emerge from the deep wadi system below.

b) Landforms and predictability of game movement

The shallow wadis which slope gradually from the plateau east towards the eastern plains are numerous, and any of them would have been suitable routes for animals to follow on their autumn migrations westward towards the Wadi

Araba lowlands. As a consequence, it would be difficult for groups of hunters to predict which route the animals would take.

The number of large wadis leading up the escarpment to the plateau is smaller, so simply in terms of relative numbers, the choices for animals returning to the highland pastures in the spring is more restricted. In addition, high promontories on the cusps of the major drainage systems would provide vantage points for hunting scouts to detect which of the tributary systems was being used by game animals on their springtime trek. Since movements along the edge of the plateau would have been relatively easy for the scouts and the main hunting parties, the Acheulian hunters would have had sufficient time to adjust their ambush locations for maximum effect.

c) Landforms and hunting strategy

Visual detection of the hunters by the animals was probably not a major factor in the question of the seasonality of the hunting visits to the Fjaje area. Although it would have been easy for hunters on the wadi rim to hide from view of animals in the defiles below, the probable greater vegetation cover (especially trees and bushes) could have offered adequate ambush locations for hunting groups waiting for westward-moving herds in the autumn.

But the prevailing wind direction probably did play a major role in alerting animals to prospective danger: with predominating winds from the west and northwest, hunters waiting for the game in the autumn would be upwind of the animals, and a successful ambush would not be predictable. Hunters waiting on the rim during the spring, on the other hand, would not unconsciously give themselves away in their downwind positions.

During the autumn game migrations, the lack of appreciable relief along the highland drainages would have made it difficult for the hunters to confine their quarry in a localized area in order to obtain a maximum harvest, since the animals could flee in any direction at the first warning of danger. In the springtime, on the other hand, the arduous climb up the steep wadi defiles undoubtedly would have tired the animals, and the speed resources they would normally call on for escape would have diminished considerably. With strategic placements along the rim of the drainage basin, the hunters effectively could cut off escape routes to the flat terrain behind them, trapping many animals in a narrow ribbon of territory along the edge of the escarpment. Panic flight down the steep wadi slopes would increase chances of major injury to the animals, enhancing potential successes of the hunters.

d) Seasonal macrobands of Late Acheulian hunting groups

The nature of the landforms and climate at the Wadi el-Bustan drainage basin and the migrating habits of large herbivores combined to provide a lucrative situation for Late Acheulian hunters. It is reasonable to assume that thousands of grazing animals passed through the Fjaje area within a few weeks each autumn and spring, and for the reasons discussed above, it is likely that the harvest of this abundant source of meat protein took place during the time when animals were returning to renewed pasturage in the eastern Jordanian highlands.

For most of the yearly round, Late Acheulian social groups would have of necessity been fairly small, perhaps numbering no more than 10 to 15 members. The evidence supporting such an estimate is indicated by the restricted size of Late Acheulian hunting camps throughout most of Jordan (Rollefson and MacDonald 1981; MacDonald *et al.* n.d.) as well as the relative paucity of tools and debitage found in most Acheulian sites. The primary reason for such restricted group numbers lies in the general dispersal of most of the game animals throughout most of the year: hunting bands of large size could quickly deplete the animal population (by killing and frightening) in a given locale, with potentially grave consequences to the band's members in the ensuing days or weeks until other game could be found.

The seasonal situation at Fjaje, however, would alleviate temporarily the social Malthusian principles that normally governed group size. The enormous numbers of animals passing through this restricted locality in the spring would allow comparatively large numbers of hunting bands to come together to form a 'macroband' until the spring migration was past, after which the macroband would have to revert to its constituent autonomous hunting groups again. The size of the basin perimeter (20 km.) would require larger than normal groups to adjust to variations in herd migration options, both in terms of increased numbers of hunting scouts and ambush teams.

The artifactual evidence at Fjaje supports the contention that the social group was larger than normal. With an area of six hectares, the base camp is by far the largest known Late Acheulian site in Jordan, and ranks with the largest in the rest of the Near East. Artifact densities at the base camp are extremely high, again unmatched at any other known Jordanian site, attesting to repeated visits to the same location by units of abnormal size.

Unfortunately, little other evidence is available to substantiate this interpretation. Deflation and agricultural practices have severely disturbed the original artifact contexts, and all traces of animal bone, contemporary vegetational cover, and cultural evidence (e.g. fire, special activity areas) have been destroyed.

The seasonal hunting hypothesis to explain the artifact densities and distribution at Fjaje and the Wadi el-Bustan complex has some implications which could be tested elsewhere in Jordan:

1) In landform configurations similar to the Wadi el-Bustan complex, Late Acheulian localities would contain a focus of dense numbers of artifacts amid linearly extensive distributions along the basin rim. A test case might exist at the head of the Wadi Dana, where a semicircular drainage

basin, though smaller in size, roughly resembles the Wadi el-Bustan basin. Other similar configurations could occur along the escarpment north and south of the Fjaje area.

2) In areas along the escarpment *between* the land configurations discussed above, if any Late Acheulian are found at all, they will be small in size and of low artifact density.
3) East of the escarpment, where game animals would be dispersed during the spring, summer, and autumn, Late Acheulian sites may be numerous, but sites would tend to be small and relatively ephemeral. Such is the case along the southern bank of the Wadi el-Hasa, for example (MacDonald *et al.* 1982).

If any sites are found that contradict one or more of the test implications, the seasonal hunting hypothesis will have to be adapted to accommodate the new data. Nevertheless, recent research is providing clues that are beginning to form a more comprehensive picture of hominid exploitation of Late Pleistocene environments in Jordan.

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