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Tepe Tula'i, and the Question of Nomadic Pastoralism

Frank Hole

Department of Anthropology, Yale University, New Haven, United States.
E- mail: frank.hole@yale.edu

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Abstract

Tepe Tula'i in Khuzistan, Iran is one of the few acknowledged Neolithic pastoralist camps, but some question whether it is a camp of *nomadic* pastoralists. Features of Tula'i and its environment are discussed in relation to the possibility of nomadism. The debate concerns whether whole-group nomadic pastoralism could be sustained before the use of horses and other pack animals. The alternative is seasonal transhumance by small groups of herders detached seasonally from permanent settlements. Using evidence from Tula'i and other archaeological sites, ethnography, climatic and environmental studies, and physiological needs of humans and livestock, this paper argues for nomadic transhumance in the Neolithic and for the necessity of nomadism in the Iranian Zagros Mountains for as long as people have inhabited these lands.

Keywords: Iran, Zagros Mountains, Nomadism, Transhumance, Neolithic, Goat, Agriculture.

Article Type: Research Article

Introduction

Using the pastoralist camp of Tepe Tula'i in Khuzistan (Southwest Iran) as a point of departure, this paper discusses early nomadic pastoralism in the Central Zagros of Western Iran, as well as the broader question of nomadism. Did the development of pastoral nomadism depend on horses for transport, or settled agriculturalists that provisioned the nomads? Or was it the inevitable consequence of a set of unique environmental factors, including the natural movements of wild animals across the landscape? Some scholars (Hammer and Arbuckle 2017; Potts 2014) favor the former. This paper makes a case for the latter, based on principles of survival.

Nomadism (whether pastoral or otherwise) is to be expected because it had been a successful adaptation for millennia; indeed, full-time year-round sedentary life was a fundamental change in human behaviour that required special accommodations. While proof is elusive, environmental imperatives suggest whole-community migration in the Neolithic, as well as in prior eras wherever there was marked seasonal availability of needed resources. Resolution of the question of nomadic pastoralism in the central Zagros of Iran requires a multi-disciplinary approach: archaeology, climatology, geomorphology, botany, zoology, history, and ethnography to reconstruct the conditions in the Neolithic.

The origins and history of nomadic pastoralism have been debated by many authors who often conflate the practice across widely different environments, and usually from the time perspective of recent history (Abdi 2002; Alizadeh 2008; Gilbert 1983; Hammer and Arbuckle 2017; Hole 1996; Honeychurch and Makarewicz 2016; Khazanov 1994; Lees and Bates 1974). Despite the common underlying need for moving herds seasonally to fresh pastures, vast differences exist between camel-riding Bedouin Arabs, reindeer-herding Saami, cattle-herding East African tribes, and mountain-dwelling herders of sheep and goat. Given the modest equipment needed to sustain this life, as well as the often short-term use of camps, it is understandable that traces of the deep history of pastoral nomadism have rarely been discovered or analyzed; rather, the topic has often been approached speculatively, based on what seems possible or desirable today.

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The central question examined here is whether nomadic pastoralism existed as early as the Neolithic, as suggested by my excavation of Tepe Tula'i in northern Khuzistan (Hole 1974, 1978, 1979, 1980, 2009). The Neolithic notwithstanding, I maintain that, from at least the Middle Paleolithic, occupants of the Central Zagros were migratory. This contention is based on facts of life: all creatures require water, food, shelter and protection, which are provided by social organisation. In an environment of scarcity with extremes in the availability of required resources, flexibility through movement is essential for survival. Apart from normal seasonal weather, unexpected events such as droughts, blizzards, hail, fires, withering heat, crop and animal diseases, insect plagues, injuries, and human and wild predators—all create uncertainties that preclude stationary year-round residence. The development of successful agriculture and the construction of solidly built dwellings, relaxed some of the uncertainty, but did not eliminate it. Throughout human history, nomadism has been the quintessential adaptation to environmental changes (floral, faunal, weather) and periodic, often devastating, short-term catastrophes, and conflict.

The Importance of Community

The four primary needs for humans are water, food, shelter, and community. Satisfaction of these needs dictates how and where people can live and survive over generations. *Water* and *food* are evident. *Shelter* means maintaining body temperature, as well as protection from natural elements such as storms and predators. *Community* acknowledges that a single person or family cannot survive long in isolation, let alone reproduce. Simple demographic facts—the distribution of age and fitness of individuals, alone or in small groups—determines long-term stability and sustainability. Few places in the world enjoy environments that are stable and beneficent, allowing year-round sedentism; in most places predictable and unpredictable fluctuations affect livelihood and must be overcome through ingenuity, cooperation and/or mobility. The cultures of the world demonstrate that nearly any obstacle to one or more of the imperatives can be overcome through technology, cooperation, and migration. These adaptations also demonstrate that community lies at the heart of sustainability. Maintaining wide social relations through fictive kinship or other means, is essential to reproductive success and helping one survive the "rough times."

As I define it, *community* designates associations of people by means of language, kinship, occupation, territory, or other criteria, in which mutual obligations function for companionship, help, support, and defence against outside threats. Among modern cultures, clans and tribes are community associations and socioeconomic networks, which often derive from kinship and share other aspects of culture such as language and customs. The basic module for such associations is the "family," while groups of "families" comprise a co-resident camp or settlement (band), and a community (tribe) may number tens if not hundreds of bands, which recognize their "kinship." As ethnographic studies make clear, camps are most likely not composed of closely related families. While ethnography verifies this (Hill *et al*. 2011:1286), the analysis of the Sungir burials shows that as far back as the Upper Paleolithic the co-resident group was not in-bred (Bower 2017). Rather, then as now, procreation outside the extended nuclear family is the norm, thus strengthening interrelationships and cooperative activities. The larger community is thus a mix of individuals from bands scattered across the territory. Moreover, low-density communities have permeable edges that enhance social interaction, through trade, innovation, conflict, conflict resolution, or other means.

The point of this introduction is to emphasize the importance of communities to the sustainability of humans at any level of society, from hunter-gatherers to modern states. When livestock are involved, the community extends to the herds on which people depend; and reciprocally, the herds depend on humans. The structure of both the human and herbivore communities is inextricably modified through these interconnections.

Prehistoric communities are usually shadow entities as the archaeological record is spotty in regional and temporal coverage, so that sites are usually seen in isolation. We would expect ancient communities of pastoral nomads to be even more difficult to discern than early villages of settled agriculturalists. When considered at all, communities are often inferred from shared material culture. If sites contain abundant pottery, or other notable artifacts, comparison among them may indicate some level of sharing, from which we can infer communities. We *assume* that they exist, because human life depends on then, yet the evidence is too sparse and temporally disparate to

verify them through material culture. This would be particularly true of nomadic communities.

In the future, emerging methodologies may provide new forms of evidence for inferring ancient communities. For example, a DNA studies of the Sungir burials showed apparent outbreeding (Bower 2017; Sikora 2017). It would be interesting to discover whether, for instance, the inhabitants of Ali Kosh and Ganj Dareh shared genetic kinship, thus implying transhumance. Beyond this, the burials in Ali Kosh and Chagha Sefid might inform on familial relationships within and between communities (Yaka 2021).

Based on the requirements of life, it seems certain that nomadism existed wherever resources fluctuated, periodically rendering some locales either uninhabitable or undesirable. Neandertals and other hunter-gatherers were nomadic. So were animals. So were early horticulturalists and herders of livestock. The situation in the Central Zagros Mountains, the focal point of this essay, is the prototypical environment in which nomadism and strong community networks could flourish.

I approach the broad topic of transhumant nomadism from the particular and geographically restricted case study of the Central Zagros of western Iran, the traditional homeland of migratory Kurdi, Luri and Bakhtiari tribal herding groups. The Central Zagros is uniquely suited to seasonal migration owing to its stair-step series of mountains and valleys that rise successively from the lowlands (150 m) to the highlands (>1500 m). This ensures staggered succession of ripening vegetation, and hence suitable pasture and forage plants for humans as the seasons progress, as well (importantly) as the avoidance of most extreme weather.

Interpretations of Tepe Tula'i

Tula'i in northern Khuzistan, Iran, has stone alignments, fire installations, ceramics and stone tools, and faunal remains dating to the eighth millennium BP, all of which imply a pastoral camp rather than a permanent settlement (see details below) (Figure.1). My assertion that Tula'i was a camp of pastoral nomads has been criticized by at least three authors (Pires-Ferreira 1977), (Bernbeck 1992), and (Potts 2014); and its age has been questioned (Cribb 1991:213-214). The central issue raised is whether the physical remains, which none doubt as "tent" sites, imply that communities migrated seasonally to remote mountain pastures, or whether they represent a detachment of a small group of herders from a permanently settled village.

Pires-Ferreira's Assessment

Based on her faunal analysis, Jane Wheeler Pires-Ferreira (Pires-Ferreira 1977), concludes that the Tula'i camp held a fallow herd that was closely tied to a settled village but is far enough removed from the village to relieve grazing pressure on the primary subsistence herd. She bases her interpretation on the degree of fusion of the articular ends of goat bones, which reveal the animal's age. Of the measureable goat bones recovered (87 out of 438 examples), nearly all were more than one year of age. Overall she found low mortality in the first 2 ½ years, and the near absence of very young goats. She concludes that Tepe Tula'i contained few, if any, pregnant and lactating females with newly born young, as well as few other young animals. She says that since goats "give birth during every month of the year, only the absence or near absence of pregnant and lactating females in the herd could produce such a survivorship curve" (Pires-Ferreira 1977: 279). Therefore, very young goats should be present in a settled village, but not in a fallow camp. A critique of her analysis is in (Sutliff 2015).

This would fulfil the description of a fallow herd as given by Dahl and Hjort (Dahl and Hjort 1983). Dahl and Hjort's book is a thorough, detailed compendium of data on all aspects of herds and herding in East Africa, where caprids normally are secondary to cattle. The passage Wheeler uses refers specifically to cattle. "Bulls, cows and a couple of milkgivers are often kept further away from the settlement in reserve herds, so that the best grazing is left for the milkgivers"….The total herd may then be "split into one subsistence herd and one or several reserve herds. The concept *fallow herd* should be more relevant to signify the quality of reserve herds" (Dahl and Hjort 1983:135).

Dahl and Hjort predicate their discussion on the year-round availability of lactating cattle, so that at any time of the year some cows will give milk and others will be dry. Their study is based on East African herders in an environment quite different from Khuzistan-Zagros.

By contrast, according to my notes from visits to many herding camps over several decades, as well as Jacob Black's detailed discussion, at least

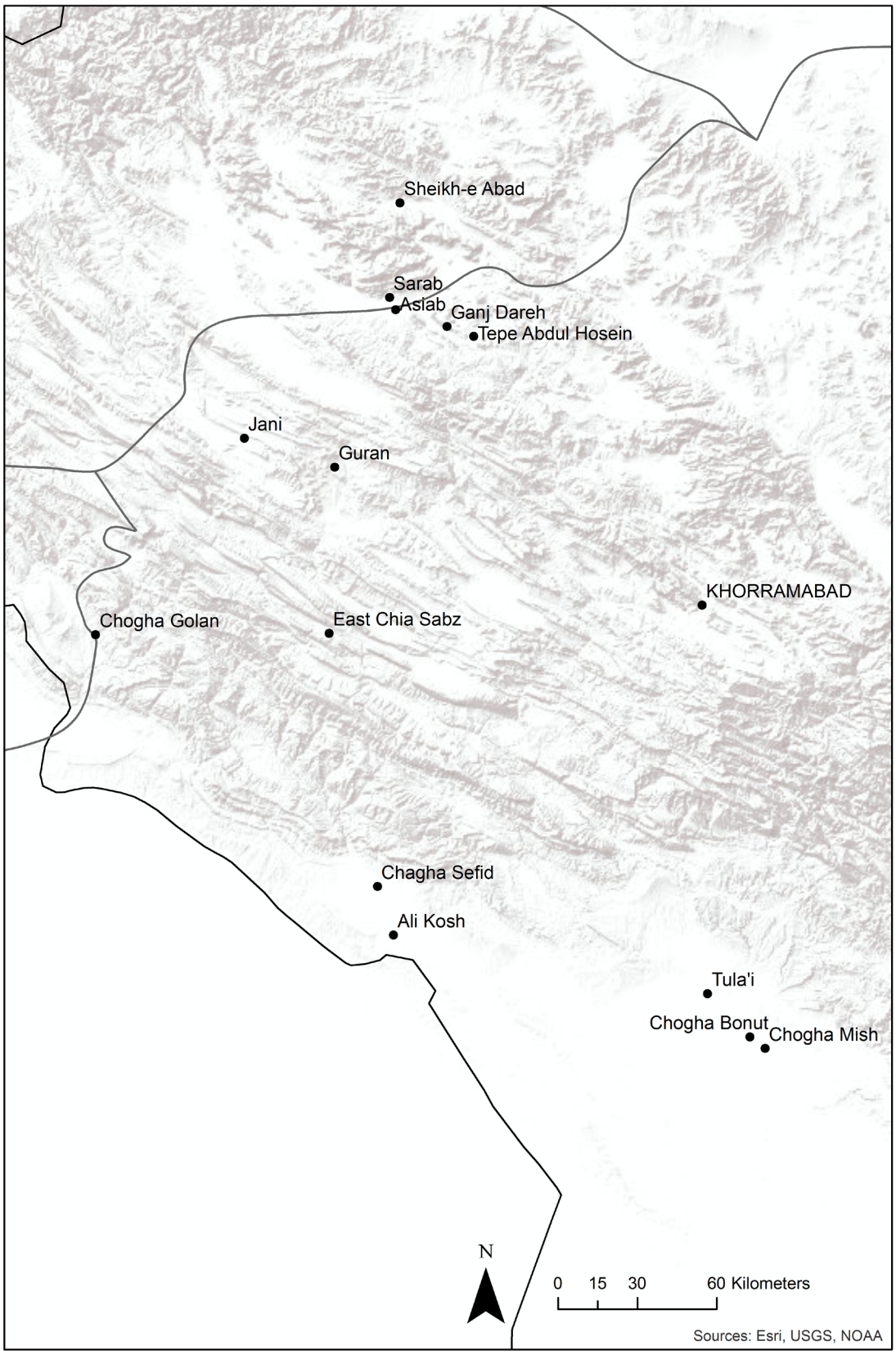


Figure. 1:*Upper Khuzistan and the western Zagros sites discussed in the text*

in modern times, goats in Luristan breed from early August to mid-October, immediately after milking ceases; and lambs are born between late December and early March (Black-Michaud 1986:43). Pires-Ferrera is correct, however, that with supplementary food, and shelter from the weather in a permanent settlement, goats may be bred twice annually.

Considering the small bone sample, which was consolidated from all contexts in her report, and the probable inappropriate imposition of East African herding practices to Khuzistan, Wheeler Pires-Ferreira's conclusions are problematic.

Bernbeck's Assessment

Reinhard Bernbeck (1992) does not doubt the pastoral nature of the site. However, based on his interpretation of the intra-site similarities of the ceramics, he prefers horizontal rather than vertical migrations, since the ceramic styles can be closely related to contemporaneous settlements in both Deh Luran and Susiana. If this were the case, year-round grazing would occur along the lowland steppe, as a way to keep herds away from agricultural fields. In the abstract, this may seem feasible, but it should be noted that during summer, Khuzistan is one of the hottest environments on earth: Wadis do not flow, and the annual vegetation is desiccated. According to Black-Michaud's (Black-Michaud 1974) and my experiences, the heat of Khuzistan, lack of fresh forage, and sparse supply of water would have dictated that people move for the sake of their flocks. Upper Khuzistan and Deh Luran may have enjoyed surface flooding and rain pools on aggrading plains during the winter (see below), neither surface water nor fresh forage would likely have been available during the summer except along the perennial rivers. While people might well have engaged in horizontal migrations in the winter–spring, they are unlikely to have stayed in the lowland the entire year.

Sir Arnold Wilson, who surveyed the area for the Border Commission in the early 20th century, reported no settlements, only tribal nomads as late as 1931(Wilson 1941:273). In 1931 when Freya Stark visited Deh Luran, "there was no settlement other than a police border post: no built house exists here in a square of a 100 miles or more" (Stark 1933:248). Settlements in Upper Khuzistan at that time were confined to fields irrigated from the major rivers, and the steppe was utilized by tribal nomads. Aurel Stein, who visited Luristan shortly after forced settlement of the nomads reported summer desiccation and its effect on herds and people. He reacted strongly to the misery of the Lurs who had been forced to stay in the winter pastures throughout the year. "It cannot be doubted that this change,…must involve serious hardships for a considerable proportion of the tribal population. For those who were accustomed to seek warmth and grazing during the winter months partly in the plains of Khuzistan and partly in the adjacent lower valleys and to migrate with their flocks to high ground in the mountains for the rest of the year, are now forced to face climatic extremes in one form or another for which they have not been prepared by the experience of former generations" (Stein 1940:327).

This observation was echoed by Justice William O. Douglas who traveled extensively on horseback through Luristan, the Bakhtiari and Qashgai, in 1950. When the tribes were forced by Reza Shah to settle in villages, "Their flocks decreased because they needed both the lowlands and highlands for grazing. Disease spread and the level of health dropped…. Horses died from the severe cold of the high mountains in winter…forage in the hot low country was sufficient only for a fraction of the year" (Douglas 1951:126).

Daniel Potts' Criticisms

Referring favorably to Pires-Ferreira's and Bernbeck's analyses of fauna and ceramics, Potts presents a detailed and extended critique of my assertion of migration. His skepticism is based on his comprehensive study of written history of Iranian nomads (Potts 2014).

He argues that Tula'i cannot verifiably, or even believably, be regarded as evidence of nomadic transhumant pastoralism. He defines what he means by pastoral nomadism:

-The paramount role of herding;
-the extensive nature of herd management strategies and free-range grazing without the use of stables or the accumulation, storage, and transport of fodder;
-periodic mobility within or between certain pre-determined grazing territories;
-the participation of the vast majority of the group in seasonal migration;
-the orientation of most economic effort toward primary subsistence rather than production for the market (Potts 2014:2-3).

While conceding that transhumance probably occurred in the remote past, he finds it plausible that it was carried out only by special groups of herders who detached from their agricultural villages seasonally. Potts repeatedly cites the fact that there are tepes (mounded archaeological sites) throughout Iranian history (and prehistory), but few to no verified nomadic camps. "Prior to the first millennium BCE., sedentary agricultural villages with herds that were taken seasonally to summer and winter pastures away from the immediate vicinity of the settlement, *by just a few specialist shepherds or goatherds practicing transhumance* (my ital.), were the norm throughout Iran" (Potts 2014:420).

He says that "Iran's nomads have been a major force—albeit a 'silent' one because they produced no chronicles themselves…(and they are) best known for their woven rugs and textiles" (Potts 2014:429). Despite the admitted lack of archaeological evidence for nomads when they are well known historically, he rejects "any assumption of behavioural continuity between groups observed in the twentieth century and those of antiquity" (Potts 2014:419). He especially disdains the testimony of a native informant who was certain that Tula'i was a nomadic campsite. "It is patently inconsistent… to accept the identification by a Lur or Bakhtiari tribesman of archaeological remains as relicts of ancient nomadism and not to believe the veracity of 'explanations' for many other sorts of monuments" (Potts 2014:41). Potts agrees that Tula'i is the remains of a temporary camp, but he dismisses the notion that their occupants were "nomads."

He regards Pires-Ferreira's analysis of the age structure of herds as conclusive evidence that Tula'i is a fallow herding camp (Potts 2014:45), and he cites the "midden" at Tula'i as evidence of a settlement rather than a nomadic campsite (Potts 2014:420).

A consideration by both Potts and Cribb is whether nomadic pastoralism is possible without pack animals. Cribb says, "the blankets and eiderdowns, the cushions, kilims and embroidered rugs—indeed the tent itself—are much more than just home comforts. In a sense they come as a complete cultural package, a transformation of the same standards and models of household organisation that apply in sedentary village society" (Cribb 1991:82). In short, impedimenta—traveling with portable shelters, borne by pack animals, define and make nomadism possible.

Potts takes a somewhat different approach. He asserts that, since the need to transport food necessitates pack animals, projecting nomadism into the remote past is not reasonable. He argues that, even absent agriculture, intensive collecting of wild cereals would create unmanageable bulk to transport. He assumes that a family is capable of harvesting a ton of einkorn in three weeks (Harlan 1975), but there is no evidence for similar monocultural stands of einkorn in the Zagros. If such a bounty were available, along with tools for milling the grain, it would be a formidable load to move easily without pack animals. However, today, transhumant pastoralists who also plant crops, often store their grain where it is harvested, and then use it at each end of the migration route when the group returns the following season, thus obviating the need to carry it on migration.

Cribb's Question about the Date of Tula'i

Cribb has also expressed reservation about the age of stone foundations at Tula'i, with the following argument: "The ceramics found in the same area as the stone platforms consisted solely of 'grey ware' which, according to the excavator, places these features at the earlier phase of the sequence. However the absence of clear stratigraphic connections between the culture-bearing deposits of this northern part of the site (Area D) and the main mound (Area A)—just cast some doubt on the chronology (Figure.2). The sherds in Area D were apparently not found in *direct* association with the stone platforms but in lower deposits.…It is possible that the stone features may not be quite as ancient as has been claimed" (Cribb 1991:213-214). This is based on misinformation. The 21 gray ware sherds, *alongside* 171 Neolithic sherds in the same strata, were found only in Area D1, beneath the rocks (see below).

Cribb also discusses the mound. Quoting Hole (Hole 1975) "The mound portion of the site was clearly a focal point of activity in the sense that sherds, flints, figurines and animal bones were left there. However, it is worth noting that the few grinding stones were found only in the campsite area. Pending further excavation I suggest that the mound is a midden area used by the people who were camping nearby…a similar midden lies under campsite D1 where we placed another pit" (Cribb 1991:215). Cribb's response, quoted favorably by Potts, is: "By their very nature campsites do not have 'focal points', at least not in the form

of middens. Either the interpretation is incorrect or we have a genuine case of 'anomaly' in which unexpected findings may suggest that things were done differently in the past. The discovery of a midden layer directly under one of the tent sites suggests that the function of this particular zone changed with time from a discard to a living zone" (Cribb 1991:215). As explained later, my use of the word "midden" is the source of confusion.

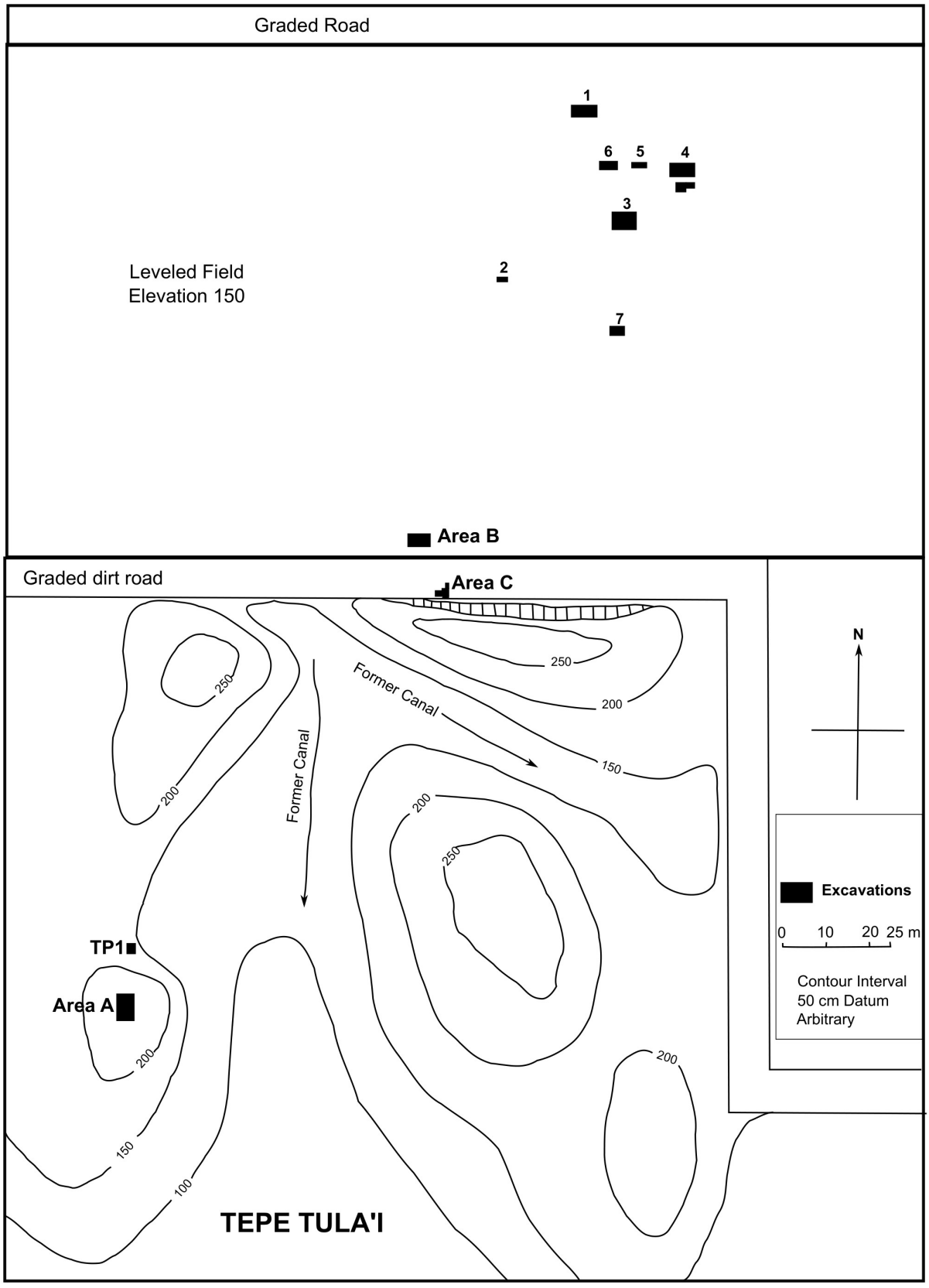


Figure. 2: *Plan of the excavation areas at Tepe Tula'i*

Revisiting the Site

Located in the northwestern part of Khuzistan, Tula'i is 110 m (354') elevation, at 32° 25' 25.49" N and 48° 11' 54.62" E (Figure.2). In order to clarify the nature of the physical remains at Tula'i, which has a bearing on its presumed uses, I present details of the excavation that were not given in my original paper (Hole 1974), making use of a soil survey map (1950) (Computing Center, 1957–58a) and CORONA photos (1968) to help explain the landscape and its evolution, as well as clear up any misunderstandings about what I found.

A series of soil maps, created in preparation for the agricultural development of the plain in the 1950s, clearly shows both the canals and the rocky/gravel wadis that drained onto the plain above Tula'i (Figure.3) (Computing Center 1957–58b). A 1968 CORONA image gives a photographic view of Tula'i's surroundings before land leveling and agricultural development (Figure.4) (Computing Center 1957–58a). That image shows evidence of a network of drainages/canals surrounding the site, but there are no modern settlements in the area. South and east of Tula'i a canal system from the Karkheh fans out into a rocky delta, with numerous anastomosing wadis crossing the land and depositing alluvium during flooding events. The choice of this location for the canals suggests the understanding that richer and more level arable land lay beyond Tula'i in a depression between the Karkheh and Dez Rivers.

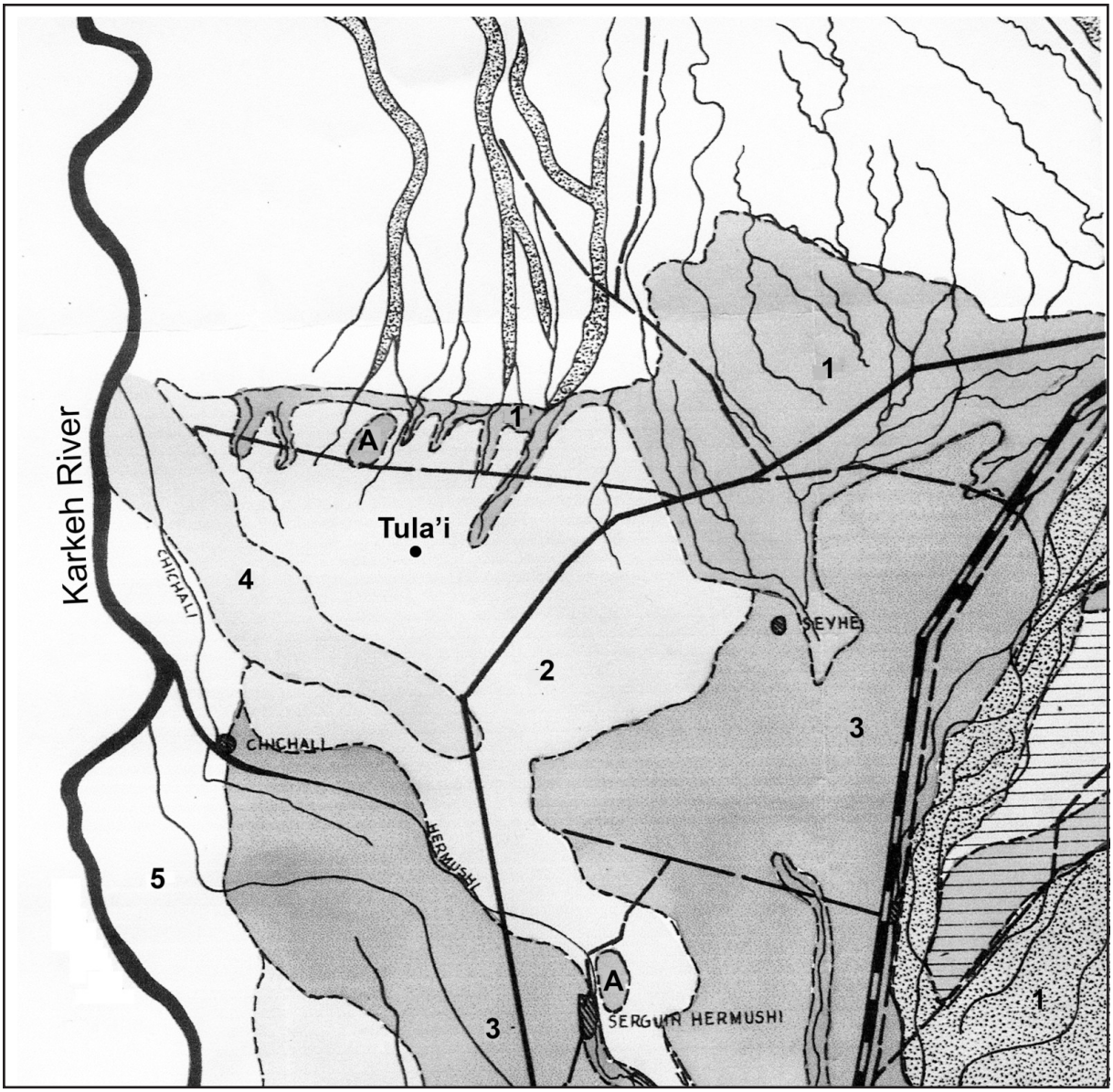


Figure. 3: *Location of Tula'I, adapted from the soil survey map, DezirrigProj General Soil Map 29/4/58, Development and Resources Corporation.(Key : Archaeological Site,1: River and Wadi deposits,2: Fine Textured,3:Irrigation Deposits,4: Old canal Deposits, 5: Younger river Deposits.)*

(After: DezlrrigProj General Soil Map 29/4/58 D&R Corp)



Figure. 4:*Location of Tula'I in 1968 showing the absence of agriculture and the remains of irrigation canals stemming from the Kharkheh River. (After: CORONA 1045-2181, 5 February 1968).*

The important observation from these images is that wadis draining the Zagros foothills debauched onto the plain at Tula'i. At the time Neolithic Tula'i was occupied, the Upper Khuzistan plain was still aggrading and may have received considerable, but intermittent, surface flow, which deposited a layer of silt above a gravel layer, which in turn, topped a layer of sandy clay (Figure.5). Subsequently it may also have received accretion as a result of Sasanian irrigation and aeolian action.

The Excavation Areas

Figure 2 shows the excavation areas superimposed on a topographic plan drawn by a surveyor from the Dez Irrigation Project after the area had been leveled. According to local informants, before enforced settlement of tribal nomads, the landscape was one of low hills on a relatively level plain and the winter territory of the migratory Sagvand Lurs. The historic images show that some of the topography consisted of old canal banks. The raised banks of a shallow canal, identified by Henry Wright, cut across the site and may have irrigated land around a small Early Sasanian hamlet. The only topographic features remaining are the small mounds along the canals. Henry Wright, who was following the canal from its takeoff at the Karkheh River, found both Neolithic (8000 BP) and early Sasanian sherds (AD 250–350) on one of the mounds.

The Mound

Tula'i was 60 m across and rose about 1.5 m above the surrounding plain. As the site plan shows, there were several small mounds within the canal complex, although few sherds were seen on the others (Figure.1).

Believing that the mound indicated a small settlement, I dug a 4 x 5 m trench (Area A) into the Centre of its top. The trench did not reveal architecture, hearths, ash layers, or other features that might be attributed to residential activities. On the other hand, it contained large numbers of sherds, chipped stone tools and bones (Figure.7a). Lacking a good alternative, I called the deposit a "midden," a focal point of activity, which may have misled some readers. Citing Cribb's comment that nomad

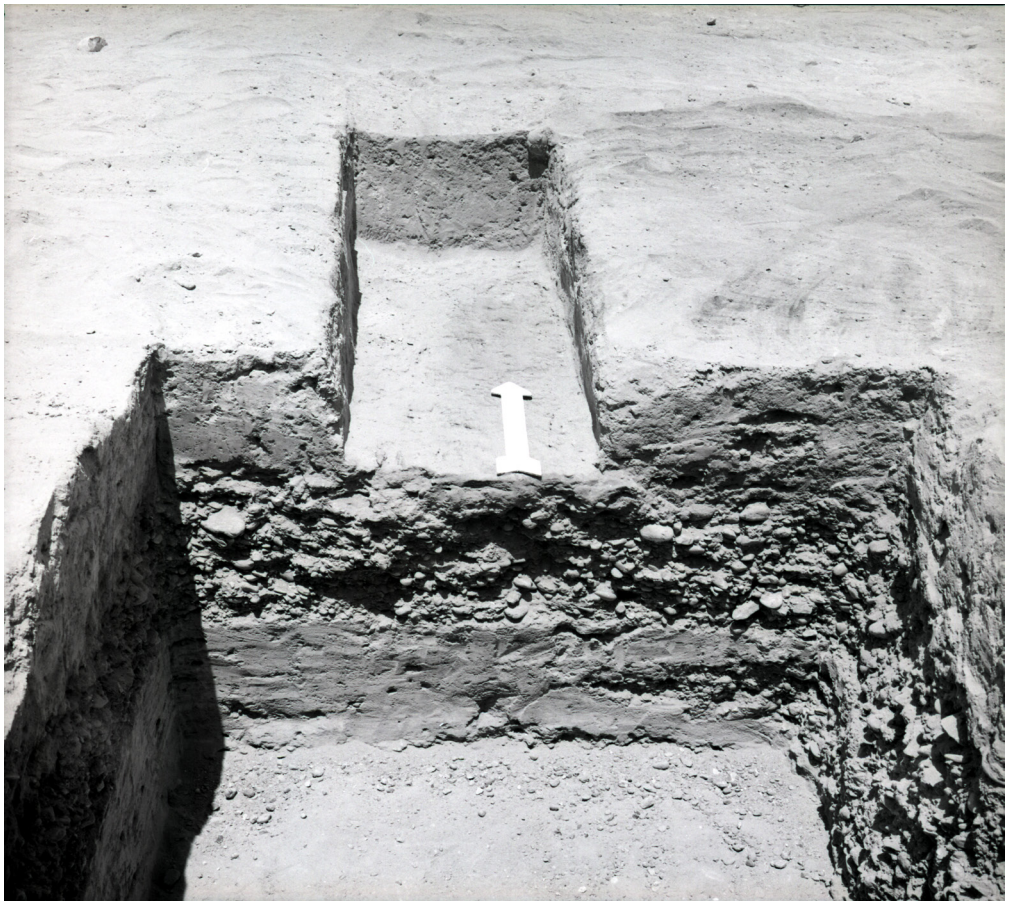


Figure. 5:*Photograph of the stratification in Area B. Diffuse ash with Neolithic sherds at the surface above compact silt, a gravel layer and a sandy base. Compare with Figure. 8b.*

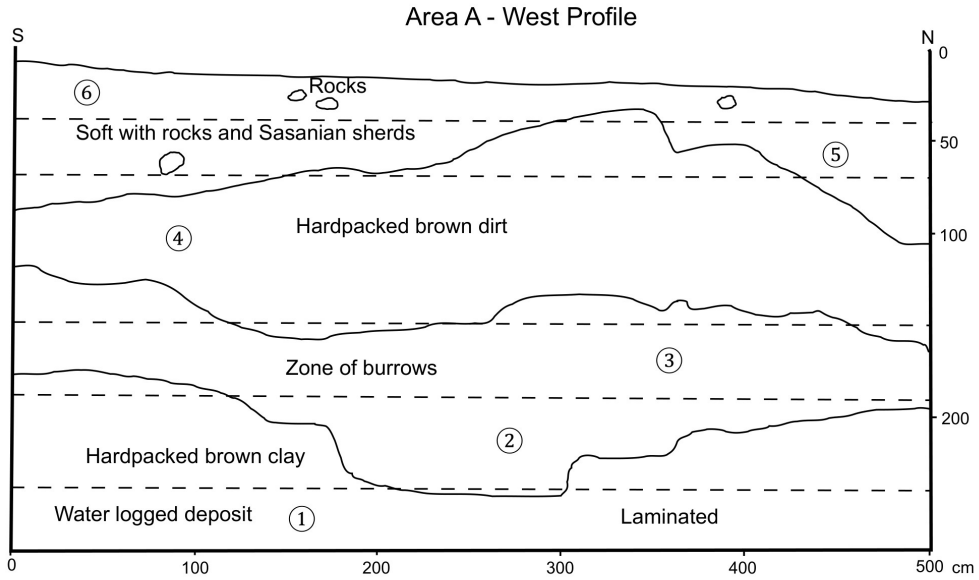
camps do not have focal points, Potts asserts that the "mound" at Tula'i is a "focal point" and hence part of a settlement (Potts 2014:12).

To clear up the confusion from the 1974 report, I suggest that the mound deposits, which consisted of highly disturbed "layers," are more appropriately described as "heavily pitted, depositional events." Rather than defined layers, they were irregular undulating deposits between which one could recognize something like stratigraphic breaks (Figure.6). This was true of all but the basal unit, which consisted of hard packed soil, essentially lacking in artifacts, overlying laminae that alternated between carbonate lenses and dark layers, probably because of waterlogging. Despite the disturbed nature of the deposits, the ceramics show a series in which Sefid Painted Ware declines while Plain Wares increase from bottom to top (Figure.7b) (Hole 1974:Tables.1and 2), suggesting a lengthy period of deposition.

However, using a different analysis (Brainard-Robinson matrix), Bernbeck observes that "the differences of assemblages are slight, a remarkable fact for a sequence 2.6 m deep" (Bernbeck 1992:79). He attributes the homogeneity of the deposit to rapid deposition. Still, he finds it likely that there were two probable sources for the ceramics, Deh Luran early and Susiana later, based on specifics of designs on the ceramics (Figure.7b) (Alizadeh 2003: Figure 28, Pls. 24, 25). The entire collection is published (Hole 1974).

It is noteworthy that the oldest strata with artifacts are in the sand layer above the gravel—suggesting that the first camps were situated on a relatively wet, aggrading plain, and were buried by further low velocity flooding and perhaps aeolian deposits.

A few sherds of gray wares occurred in the oldest layers of the site, D1–2, beneath the stone structures. Gray wares do not occur in the Neolithic deposits in either Deh Luran or Chogha Bonut, although dense and burnished "Gray wares" do occur in the Middle and Late Susiana of Chogha Bonut. However, the total absence of other later sherds in Tula'i suggests



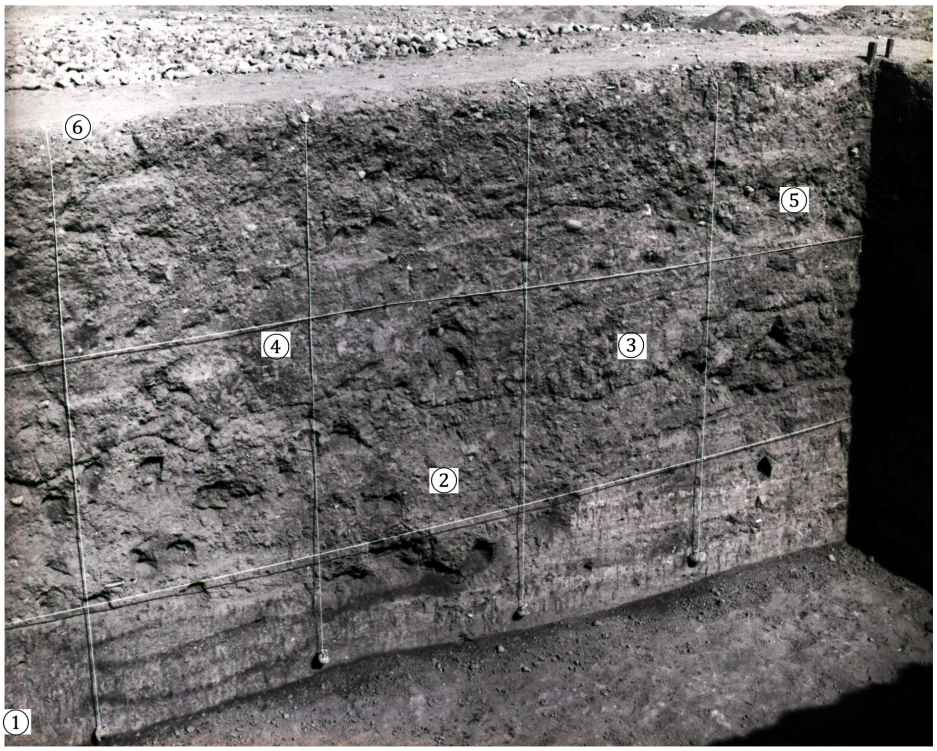


Figure. 6:*Profile of the west section of Area A showing the designated, irregular jumbled deposits.*

that the wares are not intrusive, but a previously unrecognized Neolithic ware. Until the Tula'i sherds can be examined in Tehran, it cannot be determined whether they are the same as these later Susiana types. (Alizadeh *et al*. 2004-47).

For establishing the ages of the tent sites and the various ash deposits, it is important that in all cases we recovered both chipped stone and ground stone in association with Neolithic sherds, and without any Sasanian or later material except in the upper layer of Area A.

The mound is unlike middens seen in other sites, which usually display lenses of ash, as well as artifacts, and are visible as distinct layers (Figure.6). Ordinarily one finds an upper zone of featureless sediment, albeit with artifacts, lying

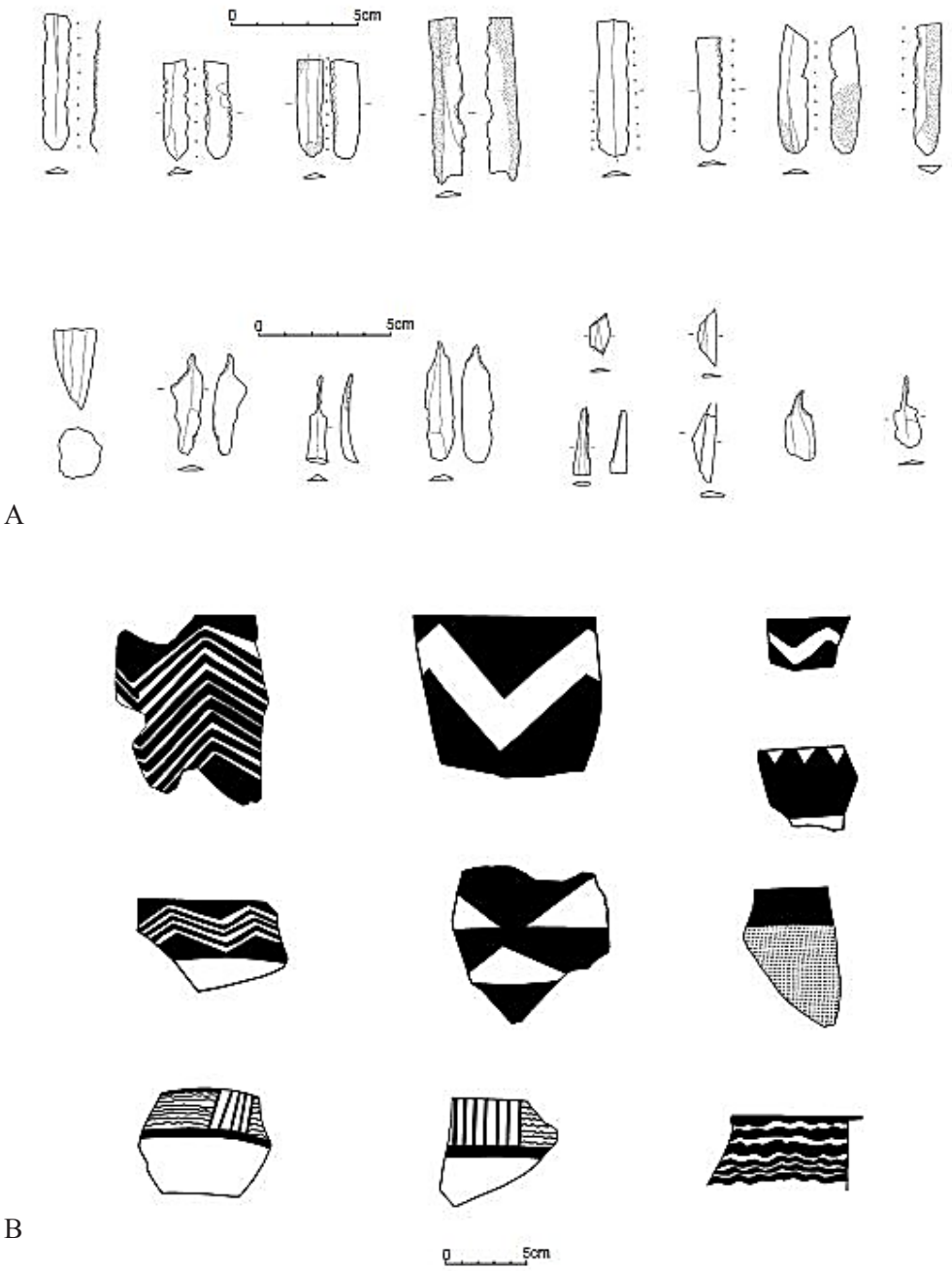


Figure. 7:*(A) Examples of flint sickles and borers from Tula'i. (B) Examples of ceramics showing similarities with both Chagha Sefid and Chogha Bonut.*

atop secure archaeological layers. This layer was missing, probably because of deflation. Immediately beneath the modern surface was an irregular zone of "tumbled/jumbled" earth containing a mix of Sasanian and Neolithic artifacts. Because of the massive disturbance by burrowing animals in this and subsequent "layers," evidence of distinct strata may have been dispersed. The "layers" that are designated in Hole (1974: Figure.4) were recorded when the excavation was complete and the section was sprayed with water and could be scrutinized.

The excavation was carried out by arbitrary levels, indicated by dashed lines in the section drawing, which cut across the interpreted "layers" (Figure.6). In other words, except for the sterile basal layer, the deposit consisted of stony fill that looks as

if it had been dumped in, rather than laid down in uniform fashion. The fact that as much as 30 percent of the fill consisted of animal burrows might have been responsible for the absence of layering, but as the burrows contained few to no artifacts, it appears that they had not seriously affected the sequence.

One "feature" in Area A deserves further discussion. This is a curvilinear, narrow bed of pebbles in Zone 2, lying directly on Zone 1. While this might suggest an architectural fragment, it is more likely (based on sections in Areas D1 and C) that it is a remnant of the pebble layer that underlies the cultural deposits across the site and lies above a hard packed clay layer (see Figure.5). The test pit in Area D1 reveals the same depositional sequence as in Areas A–C. Clearly that the plain had a sedimentary layer of silty clay, deposited by low energy flow, followed by a relatively active flow that deposited the gravel layer, followed by another low energy flow, during which the campsites were founded (Figures.5and 8). In the millennia since, further fine silt buried the tent sites, which were then uncovered by massive leveling to prepare for irrigation.

By this reasoning, only Layers 1 and 2 in Area A have actual stratigraphic veracity; Layers 3–6 accumulated as dumps of sediment and rocks, which had been excavated from somewhere else. In this case the "layers" in Area A were excavated from the canal bed, which cut through Neolithic deposits that were lying in and above the old land surface—a slowly aggrading plain surface, which accumulated over decades if not hundreds of years. After some thousands of years these deposits were dumped on the canal bank, thus accounting for their jumbled and stony nature. In short, the mound is neither the result of a series of buildings, nor a midden; rather it is an artifact of Sasanian canal digging, heavily disturbed by porcupine burrows.

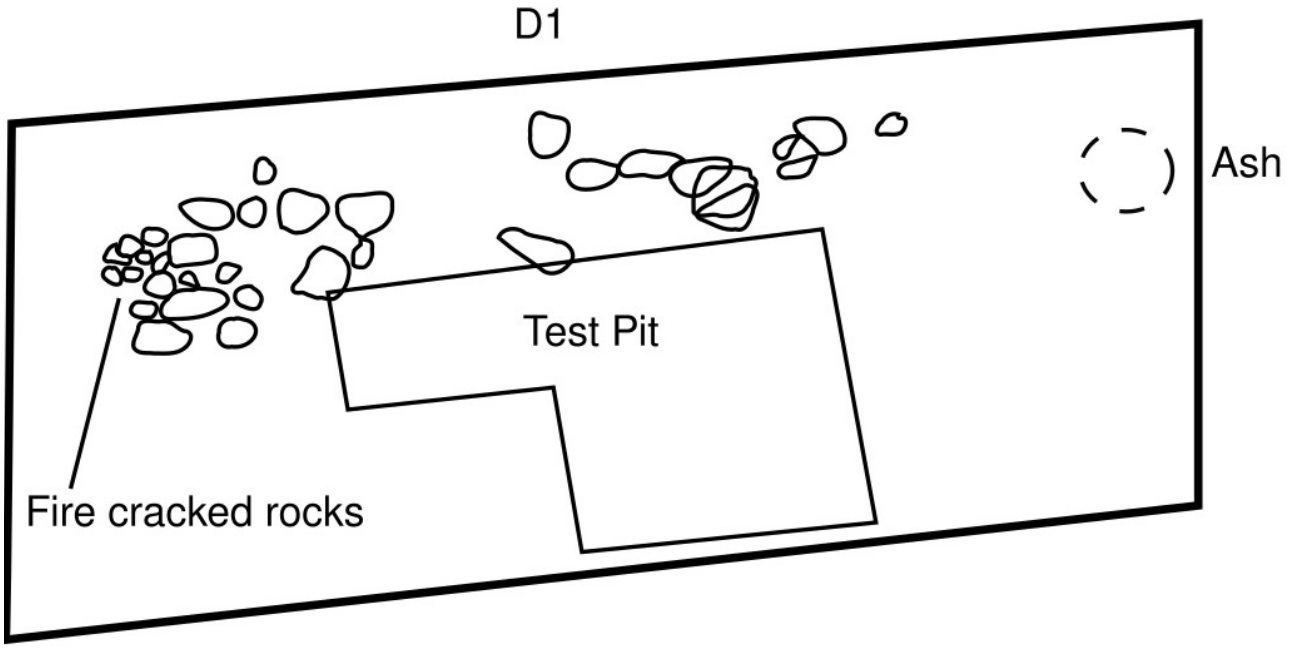
Chogha Bonut, a Neolithic site some 35 km distant in the Dez drainage (Central Khuzistan), shows a similar initial sequence of deposition. The basal deposits are "a series of ashy and greenish layers separated by rather thick layers of clayish soil down to virgin" (Alizadeh 2003:21). Macro plant remains and phytoliths indicated that the residents of Chogha Bonut planted crops in a marshy environment (Miller 2003; Rosen 2003). Owing to the ashy, greenish layers in the lower levels, Alizadeh suggests that Chogha Bonut represents a seasonal camp, rather than a permanent year-round occupation (Alizadeh 2003:21). The faunal remains of young caprines at Chogha Bonut suggest a winter–spring occupation, as do the cormorant bones (Redding 2003).

The Stone Arrangements

There is little new to add on the stone alignments. In all respects they follow the pattern of modern camps, as verified by observation of recently abandoned camps and our workers' testimony (Figures.9 and 10). The one aspect that arouses attention is the use of large stones lying in fine-grained silt. As discussed above, the source of such stones lay only a short distance north of the site in the wadi deposits (Figure.3) or, more remotely, along the Karkheh. Owing to our brief excavation permit, the weather in late spring, and the scarcity of adequate labor, we were unable to determine whether the sites we discovered were unique or simply among hundreds or more that might have dotted the plain.

The date(s) of the campsite have been questioned, but in the absence of other information we can only point to the absence of evidence of later use. Moreover, the several concentrations of ash (e.g., Area C) that we found away from the mound, albeit without stones, all contained Neolithic lithics and sherds. In Pit D1, the stones lay above layers with Neolithic sherds, but the stones themselves lay amidst Neolithic sherds. This suggests that the camping area was used over some centuries during the Neolithic. We last saw the site in 1977, when it had been planted in irrigated maize. Sherds could still be found, but deep plowing has no doubt destroyed the integrity of the campsites.

It is likely that the camp at Tula'i had structures like a kula, which consists of an open pole framework, perhaps surrounded with reed screens and roofed with leafy branches (Figure.11a). Suitable building material could have been found in the reed beds along the rivers or wet depressions. Throughout the regions of transhumance, such shelters have been used as the only shelter needed. Easily erected, with readily available reeds and branches, they were a common sight in both winter and summer pastures. In 1959, I photographed the reed-built huts erected by migratory Kurdish pastoralists near Kermanshah (Figure.11b).





A



B

Figure. 8:*A: Plan of tent site in Area D1, B: Photograph of Area D1 showing scraped surface that exposed the rocks and the underlying strata. An unknown amount of sediment lay above the rocks before the leveling.*

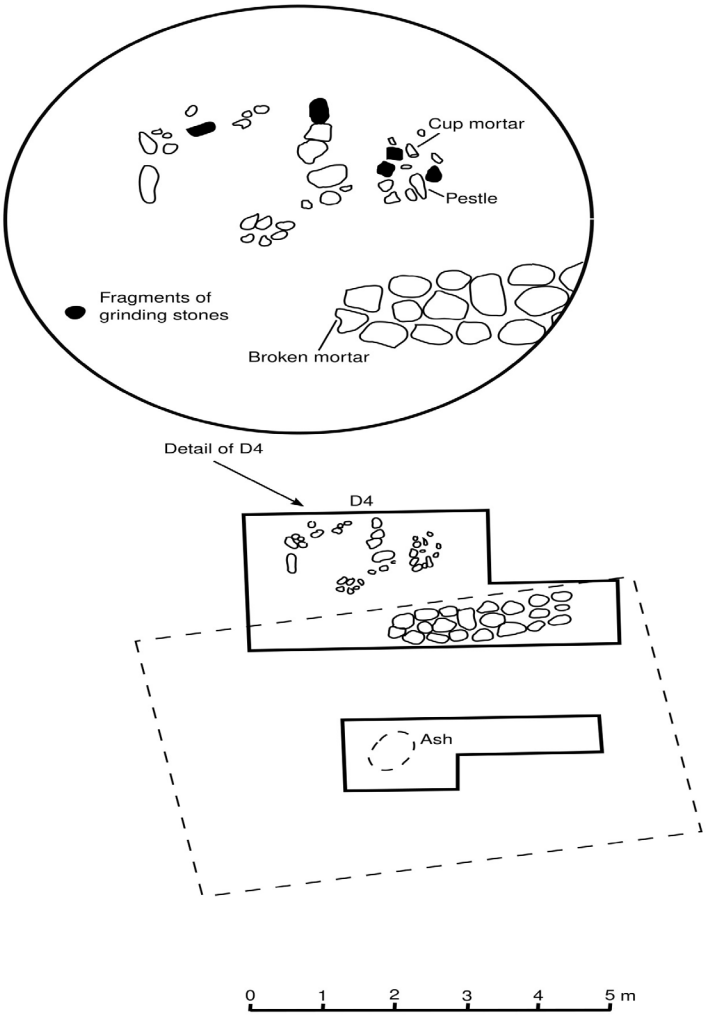


Figure. 9:*Plan of tent site in Area D4 showing the toss zone behind the tent and the area of presumed tent in dashed lines.*

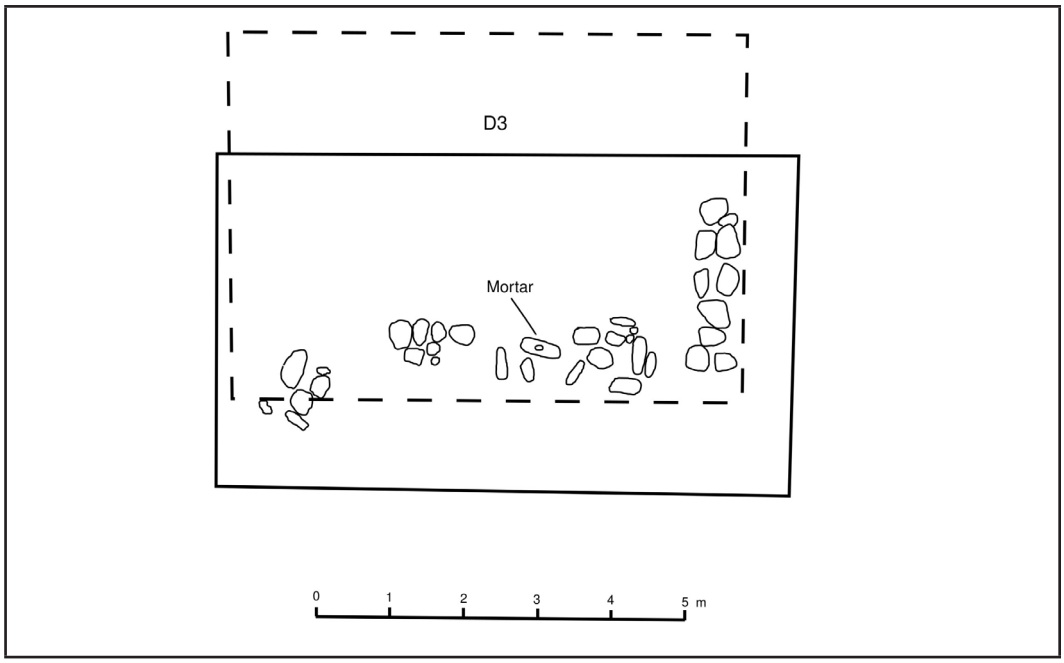


Figure. 10:*Plan of tent site D3.*

Under modern conditions, during the dry summer season there is little need to protect bedding and other material that is susceptible to damage from wet or damp ground, but the plain would have been regularly wet during the rainy winter. Considering that the site was occupied during the Climatic Optimum, it may have been wetter than today, even into the late spring, owing to the rain-bearing northward expansion of the Intertropical Convergence Zone (ITCZ) (COHMAP 1988). As a result, the annual migration to summer pastures might have occurred later than it does today, so long as the goats could find sufficient forage near the camp. In view of what was probably a low population density, plenty of forage may have been available until the heat of March–April desiccated the graze.



Figure. 11:*A: Recently occupied kula in Luristan,B: reed huts built by migrating Kurdish nomads near Kermanshah.*

Fauna

When bones could be identified they were predominantly of domestic goat (Pires-Ferreira 1977). During the early Neolithic, goats were the first domesticate (Zeder 2000). Interestingly, bones of the primary steppe animal, gazelle, occurred in low proportion, suggesting that the people depended almost exclusively on their domestic flocks for meat. Goats, which are well adapted to the higher and cooler elevations and rocky terrain, are not native to Khuzistan, and they can subsist on rough, shrubby vegetation as well as grass. Nor are sheep native to Khuzistan; they prefer hilly terrain and abundant grass. As the temperature rises in spring so does the need for water continually increase.

Seasonal weather is a major concern for domestic livestock. In hot weather, modern pastoralists take their herds to pasture before dawn, retire them during the day and resume grazing in the evening into the night. Migration activities are also confined to the early hours to reduce the combined stress from heat and steady movement. Slow and steady—with frequent stops (days to weeks) where the pasture and water are available is is the norm during migration between summer and winter pastures. Inversely, the herds must move from the uplands to avoid cold in the winter, following the natural migration patterns of the species.

Among the fauna, Pires-Ferreira found canids, including domestic dogs, as well as some aquatic specimens: fish, turtle, crabs and snails. As these occurred in the uppermost layers of Area A, in which Sasanian sherds are mixed with the Neolithic, there is cause to wonder whether these species may have lived in the canal and thus pertain to the later occupation. This kind of mixing would also indicate that the deposits of the mound were combined during digging of the canal.

Stone Artifacts

After the excavation in 1973, apart from sorting the lithics to discard the débitage, I did not carry out a thorough typological study. The expected shipment of the artifacts to Rice University did not arrive, so the material remained unstudied until I made a trip to Iran in 2002 and was able to examine the lithics and other artifacts in the Musée Bustan in Tehran over a period of two days (Figure.7).

My study was rapid and focused on identifiable types rather than close examination of the large number of blades. It is likely, therefore, that more sickles will be found, and a reliable count of bladelets can be made. I doubt, however, that I systematically missed fine retouch on bladelets of the types found in Ali Kosh and Chagha Sefid.

The assemblage is entirely based on blades, struck from pyramidal and sometimes bullet cores. All designated types were made on blades or segments of blades. Sickles, many with traces of mastic, are numerous and there is no apparent change among the contexts at Tula'i. Similarly with borers, many are delicately made with long tips; others perhaps in early stages of manufacture. Figure 7 shows this range of preparation and use.

Apart from these two types, the only other notable chipped stone artifacts are bullet and blade cores, a few crescentic-shaped pieces and one trapezoid. The apparent absence of retouched bladelets suggests a Sefid–Surkh phase assemblage in comparison with Deh Luran (Hole 1977:Table. 42). This accords with the ceramics. The lithics at Chogha Bonut, although only briefly examined, fit well into the Deh Luran and Tula'i assemblages (Moqaddam 2003).

In terms of use categories, cutting edges dominate, but a notable number of tools used for boring (probably of beads) occur, although we did not recover any beads. The most striking omission is scrapers, particularly those on the ends of blades. While a large number of blades and flakes have some use/retouch, none appears to have been deliberately retouched to form a side or end scraper. The absence of scrapers may suggest limited use of animal hides, either wild or domestic. Added to this is the absence of grinding stones of the types so abundantly found in contemporary settlements like Ali Kosh and Chagha Sefid (Hole 1977; Hole *et al*. 1969). Clearly cereals or other grasses were not processed onsite. It may be that a seasonal pastoral camp is unlikely to have all of the lithic assemblage of a settled village, even though an array of pottery, figurines and so on, like those in settlements, was in use.

The livestock, Seasonality, and Settlement

As 90% of the fauna from Tula'i can be assigned to goats, Tula'i is undeniably a camp of herders. Because of the predominance of goats, Redding wonders whether the sites in Deh Luran also were "large herding communities and processors of herd products" (Redding 1992). If so, such sites might qualify as home bases for a site like Tula'i, or at least part of a multifaceted community of interaction.

Whether or not Tula'i was tied to a residential site in Khuzistan, the goats would not survive the summer–fall–winter season without supplemental provisioning. Supplementing livestock during the early stages of agriculture would have been nearly impossible as agricultural fields would necessarily have been small—cultivated by hand, and harvested with flint sickles, and unlikely to have produced enough surplus to provision goats (Hole and Tonoike 2016:410-414). Hand stripping or beating ripe seeds of wild grasses into baskets, and cutting grass for straw could have been practiced, but only on a relatively small scale that would not have been sufficient to sustain both humans and goats over the lean season.

Although both Bernbeck and Redding consider that year-round herding on the Upper Khuzistan–Deh Luran steppe would have provided adequate grazing, this does not take into account the extreme heat of summer and the desiccation of potential forage species as they completed their life cycles: thus the imperative to migrate to higher elevations and fresh pasture. That some form of transhumance was necessary is indisputable; even if climatic conditions had been more favorable, seasonality would still have been a driving factor.

Rather than engage in further speculation without context, let us attempt to reconstruct conditions in Khuzistan at the time of Tula'i.

Khuzistan at the Time of Tula'i

Tula'i is some 3–4 km east of the Karkheh River and a day's walk to the base of the Zagros Mountains. Michael Kirkby carried out a geomorphological study of the Upper Khuzistan plain in parallel with his more detailed survey of the Deh Luran plain (Kirkby 1977). The two plains are 150–200 m above sea level and their rivers have low gradients that lead to marshes; neither the Mehmeh and Daiwairij in Deh Luran, nor the Karkheh in Khuzistan reach the Persian Gulf (Figure.1). In modern times the beds of these rivers are incised well below the level of the surrounding plains, but perhaps not in the seventh millennium. Steppe vegetation with grasses and shrubs dominate the landscape, with riverine vegetation along the rivers.

In summer, the modern landscape is barren. "Deh Luran is a sparsely vegetated steppe, hot as a furnace in summer, utterly desolate on rainy days and during winter dust storms" (Helbaek 1969:384). To some extent Helbaek's views reflect the time of year when he carried out his botanical survey (autumn 1963) and might have been somewhat more favorable had he seen the plain in the spring. A more beneficent view of the potential of the steppe is illustrated by Kent Flannery's diagram of the potential food resources on the Deh Luran Plain, which takes into account the various environmental zones, from the edge of the mountains to the alluvial plain and the marshy depression (Hole *et al*. 1969: Figure.135) (Figure.12). The diagram combines information from the fauna in the archaeological sites as well as Helbaek's field survey of the local vegetation, and seeds recovered from flotation. The potential resources would be similar in Upper Khuzistan, some 70–80 km to the south and at the same elevation.

Early nineteenth century travelers reported a considerably more favorable landscape, which may more closely resemble conditions at the time of Tula'i. On March 9, 1836, Rawlinson visited the site of Susa, visible because of its enormous size from Tula'i. "The ruins of Sus and the surrounding country are celebrated for their beautiful herbage: it was difficult to ride along the Shapir (Shaur River) for the luxuriant grass that clothed its banks; and all around, the plain was covered with a carpet of the richest verdure" (Rawlinson 1839:71). Lions "frequent the thickets and the high reeds which grow along the banks of the Shover (Shaur), the Kherkheh, and the Dizful rivers" (DeBode 1845:196). In 1810, Kinneir said, "the city of Shus is now a gloomy wilderness, infested by lions, hyaenas, and other beasts of prey. The dread of these furious animals compelled Mr. Monteith and myself to take shelter in the night within the walls that encompass Daniel's Tomb" (Kinneir 1813:106).

Layard described the spring of 1940 in the steppe east of the Tigris, a northerly extension of the steppe of Upper Khuzistan: "The middle of March in Mesopotamia is the brightest epoch of spring…. Flowers of every hue enamelled the meadows; not thinly scattered over the grass as in northern climes, but in such thick and gathering clusters that the whole plain seemed a patchwork of many colours. The dogs, as they returned from hunting, issued from the long grass dyed red, yellow, or blue, according to the flowers through which they had forced their way" (Layard 2004:77-78).

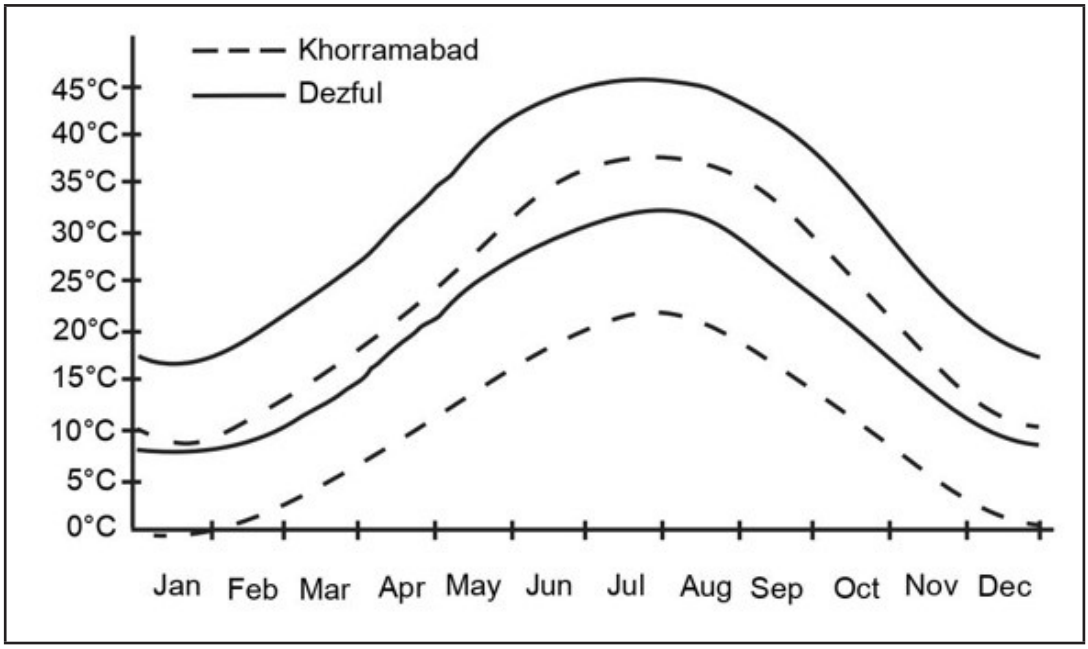


Figure.12:*The daily average high and low temperatures at 2 metres above the ground. (Adapted from www.weatherspark.com based on statistical analysis of data from January 1, 1980 to December 31, 2016.)*

These memoirs imply the unusual fertility of the land in the spring to support grazing. At the time of Tula'i, only a few "permanent" settlements, such as Chogha Bonut, dotted the Upper Khuzistan plain (Alizadeh *et al*. 2004). In view of the severe summers, one wonders whether apparently permanent settlements on the central plain may have been viable only because of the dispersal of floodwater during the period of aggradation, a situation that was reversed by river-incising after the third millennium and required the digging of canals to support agriculture (Kirkby 1977).

Historic sources testify to not only the abundance of pasture, but also the richness of the fauna. Despite some hyperbole, repeated over 150 years by several authors, the abundance of game, even in the era of firearms in the 19th century, suggests a plentiful source of subsistence.

A diary (notebook) written by Husain Quli Khan, leader of the Bakhtiari in the 1870–80s, recorded some of the game hunts, as follows: "I went [1873] to Malamir for several days of hunting wild boar. We killed 250. Another group of hunters killed 460 boar in two days.…At Asmari [1874], we killed 200 head of game.…I was in Dizful [1876] hunting gazelles, and we killed many…hunting at Kuh Asmari [1876], where we killed 200 head of game.…Every day [at Ab Bid, 1876] we hunted gazelle, and of course every time we rode out we killed 50 head of gazelle" (Garthwaite 2009:148-153).

Husain Quli Khan said all was not well in those years, however. In 1878, locusts came. "In all of Arabistan (Khuzistan) and the Bakhtiari mountains they bred." The following year too many "locusts came to Arabistan [1879], and have hatched many young. God knows how it will end (Garthwaite 2009:160). "In the yailaqs this year [1879] there is no spring rain for the grass. It will be a hard year. God protect us." (Garthwaite 2009:161). Wilson reported that in 1907 there had been no rain in Khuzistan for two to three years (Wilson 1941:6).

In 1908 in eastern Khuzistan, "there was no lack of wild life—black-legged partridges and a smaller *sisi*, quail and pigeon, for the pot, jackals and foxes, porcupine and now and then a wolf or leopard or cinnamon bear" (Wilson 1941:24).

Owing to difficult terrain and hostility of the tribes, before the 1960s, Bala Griveh Luristan (the likely migration territory used by herders from Tula'i) was scarcely visited by Westerners interested in flora or fauna. However, while traveling with a Qashgai tribe, Justice William O. Douglas reported, "Almost all the animals migrate with the Ghashghais. There are ibexes and mountain sheep in the hills. They too move with the tribes. So do the gazelles. So do the

foxes. The predators follow suit—wolves, leopards, and jackals.…Thousands of birds move south, even the hawks and vultures. For me the most thrilling sight of all in the migration of the partridge.…They walk in mass formation—several thousand in one group—headed south.…Men and animals…move as a group to the land where the days are warm, the nights are cool, the grass is high, and other food is plentiful" (Douglas 1951:153). This was 1950.

During winter–spring, Khuzistan would undoubtedly have much to offer the hunter and herder. Hence it is remarkable, that wild game—mostly gazelle, a year-round occupant of Khuzistan—apparently formed only a small part of the diets of the herders at Tula'i.

Weather of Khuzistan

Weather is of major importance in nomadic life. Today the average monthly temperature in Upper Khuzistan, from May through October is 37.5–41.7 °C (90–107 °F). While it rarely exceeds 48.5 °C (119 °F), during the span 1961–90 the hottest temperatures in July and August were 53.6 and 52 °C (125 and 128 °F). Nine out of ten days in July are 109 °F or above. On the other hand, from November–April average monthly temperature was 26–30 °C (79–86 °F). The lowest average in January was 17 °C (63 °F), but overnight freezing may occur in the months of December–April. The difference between seasons on average is roughly 11 °C (40 °F), with far greater annual extremes 35 °C (95 °F). The seasonal range of temperature is close to the difference between lowland and highland pastures Figure.12. (www.weatherspark.com).

We can compare temperatures in Khorramabad, the closest weather station to highland pastures for tribes that winter near Tula'i. There is a temperature lapse rate of approximately 0.7 °C per 100 metres of elevation (Wright 1983:506). The difference in elevation between Upper Khuzistan and the summer pastures is approximately 1100 m; thus a difference of 7.7 °C (46 °F) between the two seasonal pastures. Actual temperatures depend on aspect and cloud cover so averages only indicate potential differences and none of the extremes. For example 2/6/2018, reported temperature in Dizful, Khuzistan was 49 °C = 120 °F, while it was 34 °C = 94 °F in Khorramabad, a difference of 15 °C =26 °F (Accuweather 2018). Such a gradient would be a significant incentive for mobility.

In 1840, Baron DeBode visited Shushtar, once the principal city of Upper Khuzistan. "The inhabitants of Shushtar complain greatly of the heat during the summer months.…The present inhabitants seek shelter in the daytime, as already mentioned, in the deep vaulted cells of their dwellings, which become suffocating toward evening; and in order to catch a breath of air, the whole population rush to the terraced roofs of their houses, where they spend the night" (DeBode 1845:155-156).

In May 1908, British Political Office, Arnold Wilson described the intense heat in eastern Khuzistan: "The shade in my tent was 110 °F, from 9 a.m. till 4 or 5 p.m. Following local custom I had deep caves dug into the hill side," where Wilson spent the afternoon (Wilson 1941:31).

The unrelenting heat of Khuzistan severely impacts humans and livestock if they cannot maintain a balance between body heat and heat loss. If the ambient temperature exceeds normal body temperature (37 °C = 98.6 °F), heat stress may occur. If prolonged body temperature reaches 40.6 °C = 105 °F, heat exhaustion, heat stroke, and possible death ensue (Harvard 2018).

Essentially the same is true of goats and sheep. Prolonged ambient temperatures exceeding 32.2 °C (90 °F) affect the fertility of rams for six to seven weeks after the heat subsides. When core temperature reaches 40.6 °C (105 °F) goats show clinical signs of heat stress, and if it rises to 41.7 °C (107 °F) "death may occur, as the animal's cells begin to degenerate" (Schoenian 2010). Consuming parched forage low in moisture content would increase animals' water needs at the time when water is scarcest. Without large quantities of water to replenish body fluids, or to create evaporative cooling to reduce body temperature—to meet human and livestock needs during the long hot, arid season—life in Khuzistan for humans or herds is not possible.

In both the lowland and highland, the other determining variable is precipitation, which falls chiefly in the winter months. Dizful records an average (with great fluctuation year to year and season to season) of 384 mm (15"), with a peak in January. Khorramabad has an average of 512 mm (20.2"), also with a peak in January. Normally this is sufficient for rain-fed agriculture, and it is problematic in either zone but especially in Khuzistan. For crop growth it is important to

have early moisture, but also a secondary peak before grain filling. According to historic records, droughts occur on cycles of 3–7 years and may last 1–3 years, seriously imperiling vegetal growth (planted and wild), particularly in the lowland (Hole 1978:142; Wilson 1941:6). As Husain Quli Khan stated, swarms of locusts also periodically ravaged the vegetation of Khuzistan. When we first visited Khuzistan in 1961, a Dizfuli told us that they regretted the use of DDT, which killed the locusts they formerly gathered by the basketful and roasted to eat.

Reconstructing Past Conditions

No local source of information about the weather in the 9th millennium BP exists, but based on studies of pollen and micro fauna recovered from lake cores in the mountains, oak forest and associated grasses reached their current extent by 6000 BP. Following the Younger Dryas (13,000–10,500 BP), oak forest began to spread from north to south along the Zagros, preceded by almond-pistachio forest, which requires less moisture (Stevens *et al.* 2001:753). It is possible, therefore, that the forest gradient seen today, with pistachio-almond forest at lower elevations and some oak at higher elevations, may have been established in the Central Zagros at the time of Tula'i.

We can verify the general availability of a suite of edible vegetation in the lowlands by the results from Chogha Golan, at 485 m elevation 55 km north of Deh Luran, and 2000 or more years older than Tula'i (Weide 2015; Weide *et al*. 2017, 2018). By 9800 cal BP, evidence exists of domesticated-type emmer wheat there (Starkovich *et al*. 2016), perhaps 800 years older than domestic wheat and barley at Ali Kosh; thus residents of camps like Tula'i may have had access to cultivated grain.

At Chogha Bonut, study of the botanical (Miller 2003) and phytolith (Rosen 2003) remains indicate that trees were not locally available, reeds were used in construction, and an assortment of wild grasses, along with some emmer wheat, barley and einkorn suggest agriculture in what then was a wetter, perhaps marshy, stream-side environment. This is like the surroundings of Ali Kosh and Chagha Sefid in Deh Luran (Helbaek 1969; Kirkby 1977) (Figure.13).

Tula'i was occupied toward the end of the Early Holocene during the Climatic Optimum (maximum 8000 BP), when it is probable that Khuzistan had an extended spring rainy season (Jones *et al*. 2013; Stevens *et al*. 2001). These conditions may have been more like the northern Mesopotamian steppe recorded by Rawlinson than to today's Upper Khuzistan. Seasonality undoubtedly prevailed (Orland *et al*. 2012), but climate models are not detailed enough to give specific information on a small region (van der Horn *et al*. 2015:115).

The combination of an extended rainy season, and surface water on an aggrading Khuzistan plain may have fostered an abundance of grass, shrubs, flowers, riparian trees, and reed beds, like what early Western travelers reported. As well, there may have been a rich arboreal flora on the uppermost slopes of Khuzistan, featuring Zyzifus spina Christi, pistachio, almond, among others (see Figure.13). In short, pastoralism probably had better conditions in Upper Khuzistan than in most of the millennia since Tula'i was occupied. In such a landscape, rain-fed and flood-based agriculture could also have flourished, albeit limited in extent and productivity because of primitive technology. It is well to underscore that hand tilling, harvesting and processing of crops is arduous and labor intensive so that surpluses for human consumption, let alone for livestock would be meager (Hole and Tonoike 2016:411). Any planted crops may have been supplemental rather than staple foods.

The present is a poor analogue to climatic and environmental conditions that existed 8000 years ago, yet some of the essential parameters, such as elevation, weather patterns, and seasonality must have had similar effects.

Were they Nomadic?

The remaining question is whether the Tula'i herds and herders were separated from a settlement. Pires-Ferreira thinks that a small group of herders would have separated from the permanent settlement to take the herds to pasture. She and Potts both argue that such detachments would have been the norm, provisioned periodically (with the attendant impediments of weight and bulk) from the settlements. No doubt such arrangements could have been made; however this ignores that humans and animals alike would suffer the heat and baking aridity of Khuzistan. What would have been the incentive for people to stay put during the summer? Why would anyone with the ability to move temporarily to someplace more suitable not do so?

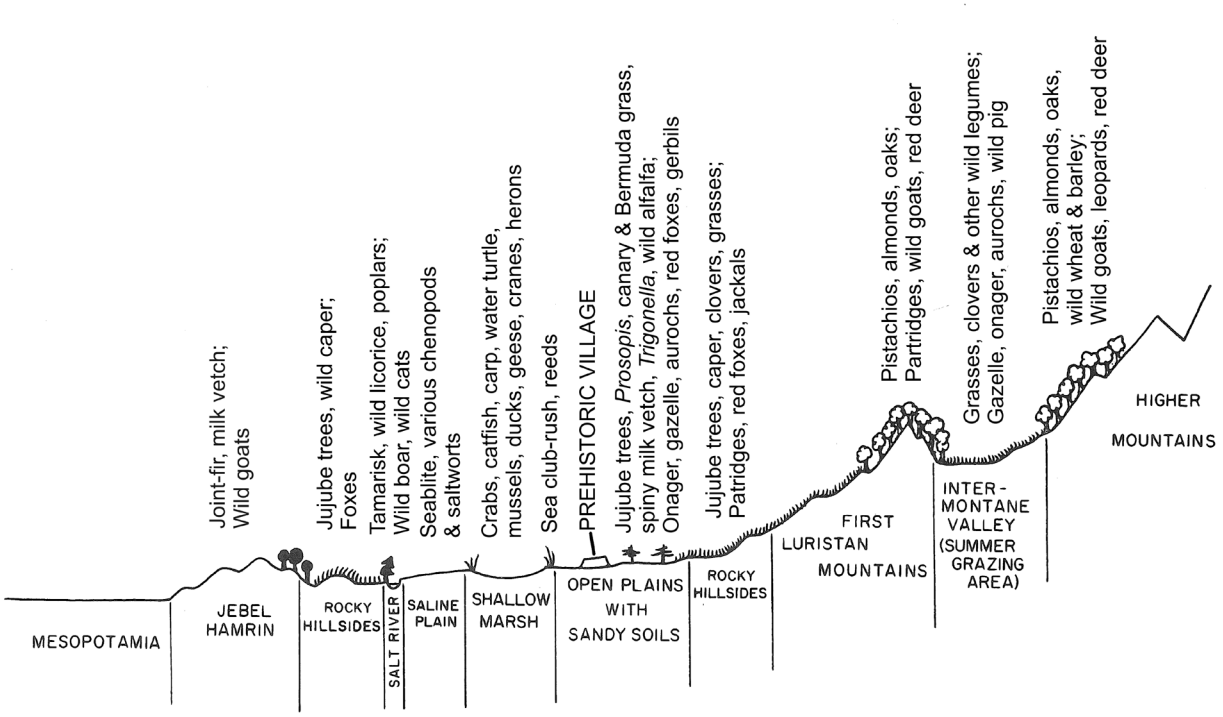


Figure. 13:*Profile of natural resources available in Deh Luran, Upper Khuzistan. Adapted from sketch by Kent Flannery (After:Hole, Flannery and Neely 1969:13).*

The practice of closing whole settlements for the season when people move out with their flocks is seen today and makes sense for the Neolithic. For reasons of sheer herd survival, seasonal transhumance must have been practiced. Redding is probably right when he sees the Deh Luran sites as fixed bases for people whose livelihood was based as much or more on the products of the herds as on agriculture. However, this does not rule out the possibility that most, if not all of the people moved to the mountains in summer, using a succession of temporary campsites at increasing elevations until summer pastures were reached. As today, these destinations allow for clustering (households, bands, tribes) of separate camps to renew social contacts, exchange information on the health of pastures, make contacts with outsiders and tend to other important matters, such as celebrating marriages and other festivities.

Potts regards the necessity to move a great amount of gear as the major impediment to migration. Certainly, in modern times, when pack animals were available, this is true. It may take two or more animals—horses, cows, mules—to carry a single black tent, and further animals for the household bedding, cooking, and other equipment. Is it possible that migration of whole families could be achieved without pack animals? The answer is an emphatic "yes". There are many ethnographic studies of cultures around the world where much of the load-bearing was borne by women (Speth 2022). We should also not discount the possibility that goats were used as pack animals (Sutliff 2019). The primary needs of humans and their herds are for water, food, shelter, and protection of the herds. With careful staging of movement, because of the step-like series of mountains in Luristan, and the lapse rate of temperature, it is possible to avoid both extreme heat and extreme cold. Owing to the abundance of native vegetation—reeds, and trees—it is possible to erect a *kula*, a leafy roof supported on poles, in a few hours, thus providing shelter from sun (Figure.11a). A *zemga*, a more substantial structure with thick thatching or mud or stone walling could be a satisfactory shelter against both wind and rain. Modern ethnographic records provide many examples of just such shelters, and they require little technical skill to build (Edelberg 1966–67; Mortensen 1993).

Travelers could sustain a fully satisfactory diet with wild grasses and legumes, possibly augmented by wild large-and-small seeded cereals, and

reliance on small game, fish and birds to augment the domestic herds. Apparently this was the case at Chogha Golan, an anchor site (seasonal?) which endured for perhaps two millennia before Tula'i (Weide *et al*. 2017).

Cribb maintains that migration with herds is incompatible with foraging for plant foods. "Essentially nomadism involves the regular migration of a community *together with much of its productive base* within a single ecological niche. This may occur between different environmental zones or within a single zone. According to this definition neither hunter-gatherers nor shifting cultivators are nomadic. The former may be highly mobile, but exploit a variety of resources and niches, which constitute the productive base. The latter may well exploit a single niche—perhaps through swiddening—but again they do not move their productive base into the new location" (Cribb 1991:20). "The hunter-gatherer schedules his movements with regard to consumption, and the pastoral nomad is tied to a schedule of pastoral production which is in turn dependent on upon the consumption patterns of pastoral stock" (Cribb 1991:21). Pastoral production, combined with a pattern of consumption based on wild resources, would inevitably result in major strains and conflicts between the schedule for exploiting wild resources and that necessary for successful herding—except in the happy circumstance that both kinds of resources are abundant in the same localities at the same time" (Cribb 1991:82).

As it happens, such happy circumstances do occur in the Zagros where the ripening of desirable foods is staggered according to elevation and aspect. Both herds and people can have simultaneous access to the best resources along a migration route.

Marguerite Harrison traveled in 1924 with the Bakhtiari during the filming of Grass, a documentary of the migration. In her memoir, she commented on the use of wild plants along the route: "It was a healthy life, except for the fact that vegetables and green things were entirely lacking from our diet; but I soon learned from the Bakhtiari women to pick thistles and eat the pith inside the thorny stems. They also taught me where to find little wild onions that grew in the green valleys, and occasionally we passed stunted trees called konars, covered with small red fruits that looked something like cranberries, which I ate by the handful" (Harrison 1935:627).

A significant problem for migrating groups, particularly ones that included only a few members of a group, would have been protecting the herd from predatory wild animals. Upper Khuzistan was home to lions, hyenas, and small carnivores. The Zagros was home to wolves, bears, panthers, bobcats, lynx and fox, all of which are predators, dangerous to herds as well as the people themselves. Even in modern times, bears, wolves and lions were regarded as omnipresent dangers. The advantage of having several "families" camping together is to present a force against predators, perhaps (as in recent times) by maintaining fires throughout the night and keeping the herds within the perimeter of the camps. "Wolves and hyenas…find it easier to prey upon a flock when the sound of rain and high winds makes it difficult for the shepherd to detect their approach" (Black-Michaud 1986:47).

If agriculture had been practiced at Tula'i, it need only have been sufficient for the season of occupation, and a crop could be planted at each end of the migration. The harvest of wild legumes and small-seeded grasses could be accomplished without sickles through hand stripping, and the produce could also be stored with any cultivated plants. Limited evidence from Deh Luran and Chogha Bonut indicates that the initial settlements enjoyed relatively wet (local marsh or stream) environments, which would have allowed for relatively easy cultivation, albeit on a limited scale (Helbaek 1969). (Miller 2003; Rosen 2003)

Final Discussion

The debate over whether Tula'i was a camp of migrating pastoralists, or more generally, whether nomadism existed in the Neolithic, cannot be resolved with the information at hand. Logic argues for the necessity of nomadism. However, other approaches may resolve the question for this and other sites that may have evidence of transhumance, independent of their ages. At a time when populations were relatively small and resources abundant, it is likely that seasonal migration would have been the norm, with traditional campgrounds—"anchor sites"—at each end of the annual trek.

A small number of archaeological sites would seem to be suitable candidates for pastoral camps along a migration route. The easiest route from the lowlands to the highlands begins near the modern town of Mehran, near the border with Iraq. It is the route of a modern highway, known in ancient times

as the High Road, which linked Mesopotamia with the Iranian plateau (Figure. 1). The road (a boundary between Kurdistan and Luristan) traverses a stair-step series of valleys, with relatively gentle passes between mountains. Thus, it is not surprising, that most of the known pre-pottery and early Neolithic sites are in these valleys. By contrast, the mountains that the herders of Tula'i traversed are rugged and the valleys narrower, with relatively difficult possess and less desirable agricultural land. Archaeological surveys have yet to focus on the routes crossing this landscape.

Apart from Tula'i, Ali Kosh and Chagha Sefid, sites like Chogha Golan, East Chia Sabz on the Saimarreh River (one mountain range above Deh Luran), Tepes Jani and Guran (still higher), Tepe Sarab near Kermanshah, and Ganj Dareh, Tepe Abdul Hosein and Sheikh-e Abad (at the highest elevations), make a credible series of sites suitable for migratory pastoralists.

Ganj Dareh is an excellent candidate for the summer camp (seasonally "sedentary," repeatedly used) of herders. The architecture of Ganj Dareh consists of small storage bins, suggesting summer agriculture and/or storage of the crops of wild plants (grasses, legumes?) (Smith 1983; van Zeist *et al*. 1984). An informant told me that it takes two days to walk from to Hulailan, (the valley of Guran) albeit without impediments and herds. The relatively short distances required to travel between seasonal pastures owe to the unique stair-step topography of the Central Zagros. Abdul Hosein likewise displays ephemeral occupation (Pullar 1979), and carbon isotope analysis reveals that the inhabitants subsisted on wild C_4 plants (Broushaki *et al*. 2016) rather than primarily on their herds. The oldest layers (also pre-pottery) of Sheikh-e Abad have yet to be uncovered, but the site lies in a favorable ecotone suitable for an anchor site worthy of repeated seasonal use (Matthews *et al*. 2008; Avila - Arcos 2023).

The high elevations near Kermanshah are suitable summer locations, while the other sites descend toward the warmer winter pastures. The higher elevation sites all receive considerable snow and below freezing temperatures in winter. By virtue of the insubstantial evidence of houses, and the locations of sites, it is likely that transhumance of whole families would have been necessary for the sake of both humans and livestock.

Modern ethnography gives a clue to winter conditions in the mountains. Villages have underground stables for their livestock. "During severe winter days now (in times of snow or downpours of cold rain), the animals are kept in their stables and must be fed by hand. The commonest fodder is chaff saved from threshing, eked out with dried weeds.…The underground stables…keep the animals quite warm throughout the coldest weather" (Watson 1979:104). Since goats are born in late winter–early spring and without the protection of stables, it is imperative that they be in the warmer pastures with fresh graze at that time.

Two sites about the same age as Tula'i—Tepe Sarab and Tepe Guran—have features that suggest transhumance. Sarab consisted of layers of ash, with fauna and ceramics, but without architecture, accumulated over a lengthy period (Hole 1961 1987) "The early levels at Guran reflect a number of semi-permanent, seasonal camps for transhumant herders" (Mortensen 2014:17). Tepes Jani and Chogha Golan are both older than Tula'i and are likely intermediate camps of migratory pre-pastoral people, occupied repeatedly over the millennia. East Chia Sabz is also pre-ceramic, and has stone alignments suggestive of transitory camps.

Unfortunately this is a small but suggestive sample that represents a *plausible* transect for migration from Deh Luran. Proof of migration is still needed. At this time sites that may hold evidence of transhumance are widely separated in time and space, yet they range in altitude and seasonal suitability from typical winter to typical summer locations. The arguments for transhumance are strong, yet *scientific* proof has yet to be adduced. This is beginning to change (Avila - Arcos 2023).

Isotopic Studies

Marjhan Mashkour is currently testing whether Bakhtiari sheep/goat bones and teeth show seasonal differences in their $\delta^{13}C$ and ^{18}O isotope ratios, which reflect different sources of feed (Mashkour 2003:41; Mashkour *et al*. 2005). The former tells the type of vegetation, while the latter refers to water, whose isotopic composition varies with altitude, temperature, and evaporation. The theory behind the differences, which are related to the metabolic pathways of the plants (C_4, C_3), and evaporation of water, are well understood. "C_4 plants include trees (and therefore fruit and nuts), temperate grasses,

legumes, and most major food crops, including wheat, barley, rye and rice. C_3 plants include species of grasses (e.g. *Aleuropus* sp.) and chenopods (e.g. *Salsola* sp) from warmer temperatures and/or saline environments" (Pearson *et al*. 2007:2173). The hypothesis is that plants differ between winter and summer pastures, and this should be reflected in the isotope ratios incorporated in bones and teeth (Bocherens *et al*. 2001:68). Therefore, it would be expected that the botanical remains would reflect these differences. Since the teeth of livestock also retain the isotopic ratios of the plants they consume, it may be possible to determine whether animals grazed in two distinctly different pastures (Makarewicz 2017; Makarewicz and Tuross 2006; Makarewicz 2013).

An important test of the theory in relation to archaeological evidence is from isotopic values of carbon (^{13} C) in the bones of herds at Aşikli Höyük as compared with Çatal Höyük (Pearson *et al*. 2007; Pearson *et al*. 2015). The former show a narrow range of diet, presumably derived close to the site, whereas the latter show a broad range, implying that herds were moved away from the immediate vicinity of the site (Pearson *et al*. 2007).

Given the potential shown by these studies it may be possible to examine the fauna, both wild and domestic, from lowland sites like Tula'i, Ali Kosh, Chagha Sefid, Chogha Bonut and upland sites to see whether the herds were fed exclusively on Khuzistan grass and shrubs, agricultural crops, mountain vegetation, or both (Pearson *et al*. 2007). The answer should tell whether the herds were transhumant or remained in place the year round. This will not, however, prove that people were migratory in Potts' sense.

Archaeological and Historical Implications

As discussed above, a strong case exists for the existence of whole-group transhumance in the Zagros Mountains as early as sites with prolonged use are recognizable, that is, from the Pre-Pottery Neolithic. This is "semi-sedentary transhumance"—repeated seasonal occupation of permanent locations, e.g., Sheik-e Abad and Chogha Golan. The stair-step succession of mountains and valleys, rising in elevation a thousand metres or more, from the lowlands to the uplands provide an optimum set of environments that can be accessed seasonally. For the same reasons, transhumance has probably existed since at least the Middle Paleolithic long before the domestication of goats, using the same routes of travel as migratory game. Anchor sites and locales, endowed with diverse and rich resources became favored end points of migration and these continued in use during the early stages of crop cultivation and goat domestication. The construction of built facilities, and storage of food crops further solidified these anchors. Sedentary life was the outcome of the ability to store food and provision animals through the lean seasons and this required agriculture that could provide the necessary surpluses. Eventually this allowed people to live year-round in environments that seasonally were extreme and deficient in fresh food. Nevertheless, with permanent settlements, one also acquires vermin, unsanitary conditions, and depletion of the surrounding landscape. These problems are relieved by frequent changes of habitation.

This paper avoids the "tyranny of ethnography," which claims unchanging conditions, based on what we know of nomads today; rather it considers *what would have been possible* in the Neolithic and much earlier. It concurs with Hammer and Arbuckle that mobile pastoralism is "a set of variable decisions and flexible strategies based on detailed knowledge of animal ecology and the local environment within specific historical contexts" (Hammer and Arbuckle 2017). It is "a three-way fit between animals, human beings, and environments" (Honeychurch & Makarewicz 2016:345). Essentially this means that people adapt to the rhythms of their physical, faunal and human social environments. Once successful agro-pastoralism could be practiced, people were able to modify, but not completely override, the basic parameters of survival for both humans and livestock. This eventually led to the multiple varieties of pastoralism that we know today.

Given the poverty and paucity of archaeological evidence it may not be possible to show conclusively whether any prehistoric site was part of a truly nomadic pastoral lifestyle, but one should not reject it on grounds that are based on ethnography, history and popular belief in what was possible. Humans existed for untold millennia without the "necessities" of life that some people consider as fundamental to a migratory lifestyle.

If migration was an inevitable adaptation to life in the Zagros Mountains, from the beginning of

occupation of these lands, it follows that evidence must be sought along physical routes of potential transhumance, locations with special qualities such as dependable water, and a variety of high quality resources for food and fuel, as well as sources of good quality flint, which is absent in much of Luristan. We should also recognize that a single site tells little about the larger communities of which the camp is representative and which would have been essential to its viability. Any site will have been linked through various associations with other similar or different sites. While camps and settlements may have been sparse as compared with today, some hundreds of camps in a circumscribed region must have had close interactions.

In this scenario, Tula'i, as Bernbeck has suggested, was part of a larger community of interaction that encompassed both Deh Luran and Khuzistan, although perhaps not simultaneously. Tula'i almost certainly was only one of innumerable similar camps in Upper Khuzistan. Regrettably, owing to both geomorphic processes and recent landscape modifications, sites like Tula'i are always going to be difficult to find (Brookes *et al*. 1982; Kirkby and Kirkby 1976). Serendipity, as in the case for Chalcolithic Dar Khazineh in Khuzistan (Alizadeh *et al*. 2004), or Tuwah Kohskeh (Abdi *et al*. 2002) will continue to play a role in our understanding of the history of pastoral nomadism. Still, arguing from first principles, the inevitability of nomadism in the early stages of domestication is without doubt.

We should bear in mind two things. First, the Zagros has seen human habitation well back into the Pleistocene when hunters followed game through their annual migration cycle, with few durable remains other than lithics and bones. Second, the oldest sites are precisely in resource-rich locations, which enabled millennia of repeated occupation by pre-agricultural hunters and foragers. The pattern was well established before people adopted and began to herd goats and sheep. It is probably correct to say that humans adopted patterns well established by the animals that they later incorporated into their lives. This ancient synchronisation and symbiosis between people and animals could only be challenged with the adoption of efficient agriculture and built living facilities for people and herds.

The archaeological record is sparse, but telling. We should reject notions that nomadism was impossible without settlement-based agriculture and pack animals, and focus on what was possible and necessary 8000 and more years ago. While common sense argues for nomadism, unfortunately, geomorphic processes may have buried or swept away most of the evidence of campsites. Referring to the upland regions around Kermanshah, Brookes says, "Inferences drawn from the modern habitat would have been misleading for the reconstruction of past ecosystems. The original piedmont ecosystem has been destroyed, that of the valley floor buried.…The lack of small sites over much of the piedmont zone cannot be taken as an indication that the resources of this area were of little interest" (Brookes *et al*. 1982:299). Therefore, what we can locate by survey is as much geological accident as cultural artifact. Despite this acknowledged problem, with new tools of science, such as isotopic analysis, we may be able to bridge some of our information gaps. It would be well to concentrate future archaeological surveys in regions with exceptional qualities for both resources and camp sites, along routes of modern migration paying attention to the kinds of built facilities, such as stone tent foundations, corrals, acorn processing mills, and storage, that may have existed throughout history (Hole 2004, 2009).

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