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Patterns of Mobility in the Negev over the Long Term

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Abstract

In the long transition from hunting-gathering to nomadic pastoralism, patterns of mobility in the Negev evolved concomitantly. Although often implicitly perceived as a single-phase transformation, the development of mobile pastoralism was a millennia-long process effecting cumulative changes in desert societies across the full spectrum of social structures and functions. Patterns of mobility became increasingly complex, reflecting the diverse factors driving the social changes. If the baseline hunter-gatherer mobility systems of the early Neolithic derived primarily from ecological factors, that is, seasonal availability of resources in different areas, the integration of domestic flocks into the desert system required ecological and especially social adjustments, entailing changes in the factors behind, and the structures of, mobility. With the evolution of pastoral societies in the desert, other forms of mobility evolved as well, they too reflecting the richness of the historical record among so-called peripheral peoples.

Key-words: Nomadic pastoralism; Hunting-gathering; Negev; Mobility patterns; Archaeology.

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Patrones de movilidad en el Néguev en el largo plazo

Resumen

En la larga transición de la caza-recolección al pastoreo nómada, los patrones de movilidad en el Néguev evolucionaron de manera simultánea. Aunque a menudo se lo percibe implícitamente como una transformación de una sola fase, el desarrollo del pastoreo móvil fue un proceso que duró milenios y produjo cambios acumulativos en las sociedades del desierto a lo largo de todo el espectro de estructuras y funciones sociales. Los patrones de movilidad se volvieron cada vez más complejos, reflejando los diversos factores que impulsaron los cambios sociales. Si los sistemas básicos de movilidad de los cazadores-recolectores del Neolítico temprano derivaban principalmente de factores ecológicos como la disponibilidad estacional de recursos en diferentes áreas, la integración de rebaños domésticos en el sistema desértico requirió de ajustes ecológicos y, especialmente, sociales, que implicaron cambios en los factores detrás de la movilidad, así como en sus estructuras. Junto con la evolución de las sociedades pastoriles en el desierto evolucionaron otras formas de movilidad, que también reflejan la riqueza del registro histórico entre las llamadas "poblaciones periféricas".

Palabras clave: Pastoreo nomáde; Caza-recolección; Néguev; Patrones de movilidad; Arqueología.

1 Introduction

Patterns of mobility among nomads, both hunter-gatherers and pastoralists, in the deserts of the southern Levant can be classified into four types based on scale (time and space), and function: (1). Seasonal migrations exploiting different resources available at different times in different places, (2). Territorial shifts, contractions and expansions, sometimes seemingly cyclical, (3). Movements connected to trade and exchange, and (4). Tribal displacements showing fundamental long-term shifts in territories. Variation is evident within each category as well. Building on the substrate of relatively fixed ecological parameters, for example, winter-spring growing seasons, summer drought, and altitudinal variations, which may well dictate patterns of grazing, this variation is historically contingent. Changes in

social and cultural systems, including changes in subsistence, technology, demography, social structure, and pastoralists' perceptions of their mobility (Adriansen 2005), as well as external factors such as environmental fluctuations and external relations, will also affect patterns of mobility. Some factors, such as technological changes and the construction of desert infrastructures (e.g., digging of cisterns) are cumulative, and may become fixed, similar to the ecological parameters.

The archaeology of the Negev, from the hunter-gatherers of the late Pleistocene through early forms of nomadic pastoralism and on to Bedouin adaptations of recent times (Table 1), offers a case study of the dynamics and complexity of patterns of mobility over the long term. Rather than simply grafting models from modern ethnography onto past nomadic peoples of the desert, the picture is one of cumulative complexity and richness. Mobility evolved, belying stereotypical perceptions of stasis among so-called primitive peoples.

2 The forms of mobility

As above, and based upon the historical sequences from the Negev along with models drawn from history and anthropology, I distinguish four types of mobility based upon scales of time and geography and function.

2.1 Seasonal migrations

Mobile pastoralists migrate seasonally to exploit resources, usually pasture and water, available or accessible in different places at different times of the year. Patterns of mobility are dictated by physical geography, the animals herded, and political considerations. In a classic work, Johnson (1969, 1978) distinguished between horizontal and vertical nomadism (cf. Manzano et al. 2020). Horizontal nomadism occurs in relatively homogeneous environments where long distances must be traversed in order to exploit resources available in different seasons. Vertical nomadism is predicated on environmental contrasts caused by altitudinal differences. Both types of nomadism can be further classified according to specific geographical features, for example bottlenecks in the migratory routes. Khazanov (1984: 17-25; Cribb 1991: 17) emphasizes the impact of agricultural practices among pastoralists and how these may affect migration patterns. Goldschmidt (1979) notes that different animals will have different needs and abilities in terms of

Years	Negev	Economy/subsistence	Organization
CE/BCE			
	Bedouin	mobile pastoralism → sedentism/farming	large tribes
	nadir		
1000	Abbassid		
Islamic Era	Umayyad	mobile pastoralism/mixed farming	
0			
Classical Era	Byzantine	mobile pastoralism, caravan trade	tribes
Iron Age			
1000		caravan trade, introduction of camel	
Late			
Middle	*nadir*		
2000			
Intermediate	*Terminal*	mobile pastoralism, copper trade	
Bronze Age	*Late*		
3000	Timnian	early multi-resource mobile pastoralism	
Early		developing economic asymmetries	
		introduction of the donkey	
4000	*Middle*		
Chalcolithic		early copper trade	
5000		early tabular scraper trade	
Pottery	*Early*		
Neolithic		herding-(hunting)-gathering	early tribes
6000		desert kites	
		small scale husbandry	
PPNC	**Tuwailan**	**introduction of goat (sheep?)**	
7000			
	Late		
8000	*Middle*		
PPNB	PPNB	trinket trade	
	Early		
9000			
PPNA	*nadir*		
10000	Harifian		
	Late		
	Natufian	reciprocal exchange	complex bands
11000			
Late			
Epipaleolithic	*Early (nadir)*	↑	
12000		hunting-gathering	bands
	Ramonian	**gazelle, ibex, small game**	
	Mushabian/		
13000	Geometric		
Middle	Kebaran		

Table 1: Chronological chart. Dates and periodization are approximate. Economy/subsistence refers to indigenous desert dwellers and not to the expanded settled zone.

migrations, and that the presence of mounted animals also influences migratory patterns. Many ethnographies in the Middle East have noted that political considerations, large and small scale, also influence migration patterns and timing (e.g., Barth 1961: 93-100; Barfield 1990; Marx 1967, 2013; Lancaster 1981). Seasonal aggregation and dispersion are also tied to these movements (e.g., Cole 1975: 33-36), sometimes tied to special activities, such as specialized herding, wage labor, or mineral exploitation.

Hunter-gatherers also migrate seasonally, with the similar rationale of obtaining resources differentially available. Binford's (1977, 1980) seminal analyses of hunter-gatherer mobility patterns divided them into foragers and collectors, residential mobility versus logistical mobility. The model can be characterized roughly as radiating versus circular mobility. It has parallels in studies of pastoralism, for example, in Ingold's (1980) tethered versus fixed point mobility patterns, and in general, patterns of aggregation and dispersion (e.g., Johnson 1978; Evans-Pritchard 1940: 31-138).

2.2 Territorial fluctuations

Over the longer term, pastoral territories expand and contract, often dependent on the state of their sedentary cousins. Lewis (1987) documents the shifting edges of pastoral presence in the Syrian steppe in the 17th through 19th centuries. Rosen (2009) has documented the expansion and contraction of desert pastoralist societies in the Negev over several millennia, sometimes (but not always) consonant with the expansion and contraction of agriculture. These patterns can be compared to processes of sedentarization/nomadization documented ethnographically (e.g., Barth 1961: 101-122); historically, Rowton's (1976, 1977) dimorphic society, based especially on the Mari texts relating to pastoralism, and Adams' (1978) concept of resilient societies are similar. Archaeologically, it may be difficult to distinguish between shifting pastoral/sedentary territories and shifting patterns of subsistence, from nomadism to sedentism and back. Either way, we are looking at dynamic patterns of mobility.

2.3 Trade and exchange mobilities

Exchange systems evolved as well. Beginning with small scale exchange of preciosities, probably linked to various forms of identity and status, shells, beads, and other trinkets (e.g., Wright and Garrard 2003), the introduction of pack animals (e.g., Ovadia 1992; Milevski and Horwitz 2019; Sapir-Hen

and Ben-Yosef 2013; Rosen and Saidel 2010) allowed for transport of bulk goods. The increasing demand for minerals and goods originating in the desert (e.g., copper), and beyond it, as in trans-desert caravans (Sapir-Hen and Ben-Yosef 2013; Finkelstein 1988). Nabatean caravans resulted in tremendous changes in the structure of pastoral mobilities.

2.4 Long term displacement

The movement of tribes and peoples, long assumed by archaeologists reconstructing prehistoric demographics (e.g., Rouse 1986; Chapman and Hamerow 1997), has now been well established as a major factor in history by genetics (e.g., the arrival of farmers from Anatolia, establishing the European neolithic [Groß and Rothstein 2023; Renfrew 1990]). In the context of pastoral societies, Ingold (1980:46) has referred to such migrations as "displacement", caused by long term shifts in resource bases. While often difficult to document reliably for early periods without genetics or trustworthy historical texts, such movements must also be considered in any reconstruction of patterns of mobility.

3 Nomadism in the Negev

3.1 Environment

Given this background, the reconstruction of the long-term dynamics of mobility among nomads in the Negev Can be attempted. Of necessity, reference must be made to adjacent regions, Sinai, southern Jordan, and North Arabia as well, if for no other reason than the artificiality of the Negev as a construct of modern geopolitics. The modern borders never existed as such in earlier times (e.g., Bienkowski 2006; Rosen 1991), and even the term 'Negev' is modern, in ancient times referring only to the region now known as the northern Negev.

This said, the Negev (Fig. 1) still constitutes a specific research area, precisely due to the limitations imposed by regional geopolitics. The region can be roughly characterized as an inverted triangle with its apex at the Gulf of Aqaba/Eilat, and a latitudinal baseline stretching from the Mediterranean to the Dead Sea. Low rainfall is the defining characteristic of the Negev as a desert. Rain falls exclusively in the winter months, part of the Mediterranean climatic regime. Varying from 250-300 mm/year in the north, the edge of dry farming practicability, to a mere 25mm in the far south, variability

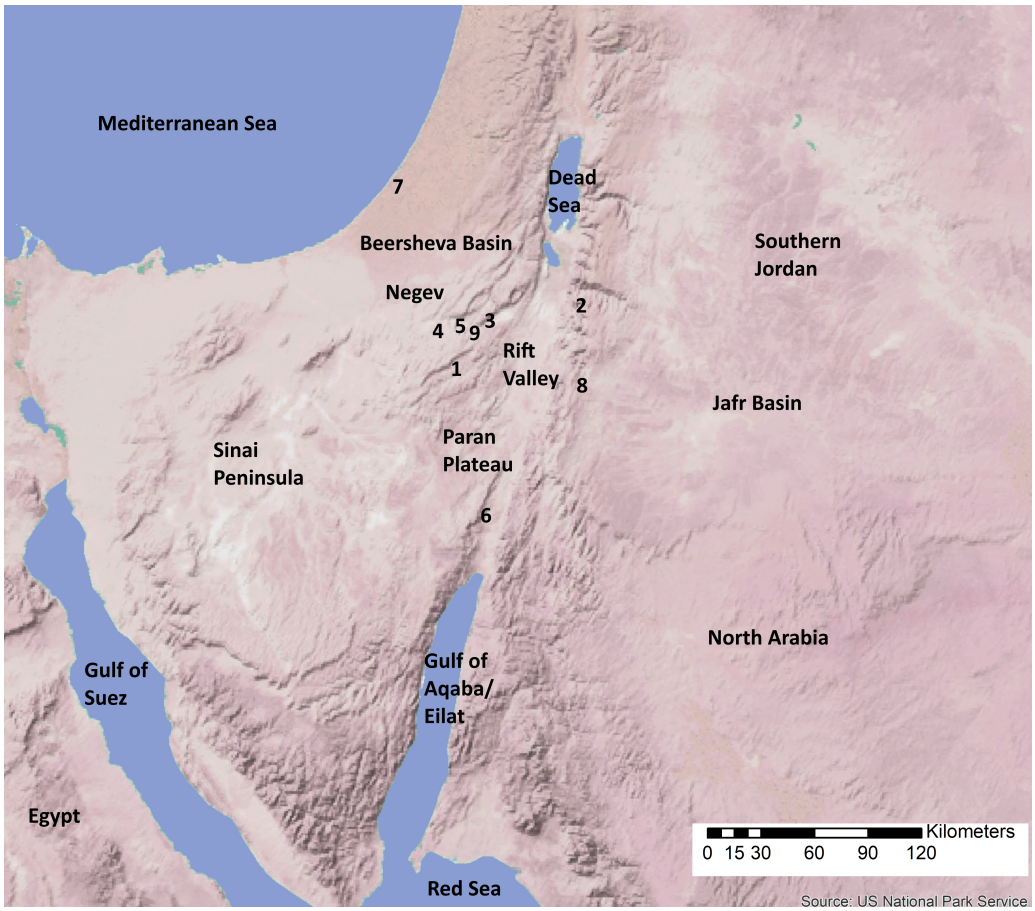

Figure 1: Map of the Negev with areas and sites mentioned in the text. 1. Ramon Crater/Ramon I Rock Shelter, 2. Faynan, 3. Ein Ziq, 4. Be'er Resisim, 5. Sede Boker, 6. Timna, 7. Gaza, 8. Petra, 9. Avdat. The Spice Road runs roughly between Petra (8) through the Ramon Crater (1), to Avdat (9) and up to Gaza and the Mediterranean coast.

originates both in distance from the Mediterranean cyclone systems and from topographical features. Enzel et al. (2008) have demonstrated that the structure of the Mediterranean coast impedes the penetration of cyclone systems southwards, amplifying the effect of distance. Topographically, the higher regions of the central Negev receive somewhat more rainfall than a simple distance function might suggest. The Rift Valley graben lies in the rain shadow of the western hills, essentially receiving no rainfall; the presence of springs, a consequence of the geology of the graben, ameliorates

the scarcity of rainfall. Yearly variation in rainfall is great. Vegetation follows the rainfall, with Mediterranean vegetation in the north grading into Irano-Turanian steppe and Saharo-Arabian desert vegetation communities moving south. Patches of Sudano-Deccanian tropical vegetation are found around the springs of the Rift Valley. Temperatures vary considerably depending on season and location; for example, in the Negev of Highlands there is a difference of 18° centigrade between the average temperatures of the hottest (26° C) and coldest months (8° C.) (Rosenan and Gilead 1985). Like most deserts, yearly fluctuations in rainfall and temperature are marked.

The Negev is a rocky desert, sand dunes present only in the northwest. In the north, Pleistocene loess plains are dissected by western flowing ephemeral streams, wadis. Five parallel synclines/anticline hills running NE-SW characterize the Negev Highlands, with peaks up to 1000 mamsl. Large erosional cirques (craters), the *makhteshim*, are prominent features of the region. Farther south, the Paran plateau drains most of the southern Negev towards the Rift Valley and the Dead Sea.

Although environmental and climatic fluctuations can be traced over the course of the Terminal Pleistocene and Holocene in the Negev, Enzel et al. (2008) have demonstrated that the lesser scale of these changes compared to those of the Mediterranean zone, and correlations are not linear. Thus, for example, although the semi-arid steppe zone contracted and expanded at different times (e.g., Goodfriend 1990), and episodes of increased aridity or amelioration occurred (Rosen 2017a: 71-89 for summary), with the exception of the transition from the Terminal Pleistocene to the Holocene, the scale of climatic an environmental change was limited. Specific changes can be noted for their impact on human systems. For example, in the western Negev, shifting dunes during the late Pleistocene blocked drainage, creating seasonal lakes and ponds which served as foci for seasonal encampments (e.g., Goldberg 1984; Vardi et al. 2018). The ameliorated episode following the cold and dry Younger Dryas enabled hunter gatherer expansion into the region in the PPNB; strangely, the preceding period, the PPNA, is virtually devoid of habitation, in spite of a relatively mild climate. The 8.2 kya event, closing the period of amelioration, is usually interpreted to be one of increased aridity in the desert. Paradoxically, it coincided with increased herding of goats in a distant pasture pattern (Landau et al. 2020; Rosen 2021). An episode of increased rainfall at the end of the 5th millennium BCE resulted in active stream flow in Nahal Beersheva (Goldberg and Rosen 1987), the apparent enabling factor for the Chalcolithic settlement

fluorescence of the region. The cultural impact of this episode is not evident archaeologically farther south, although the end of the episode seems to be the cause for the abandonment of the northern Negev Chalcolithic system. Later fluctuations were, for the most part, of a lesser order, but even small-scale changes may have affected, for example, spring flow and winter/spring growth patterns; these would have, in turn, influenced the patterns of mobility. However, the large annual variability in rainfall itself dictated adaptive flexibility among the inhabitants of the region. This flexibility undoubtedly mitigated the impact of relatively small-scale changing climates. An important point to be emphasized is that no direct correlation can be traced between changing climatic regimes in the desert and fluctuating demographic patterns (Rosen 2017b).

Finally, the issue of human impact on the landscape, and its effect on mobility patterns, also needs to be addressed. Although Kohler-Rollefson (1992) and Rollefson (1996) have suggested that the adoption of goat herding and overgrazing caused environmental degradation very early in the history of animal husbandry in the region, this is to overstate the demography of these early periods, and to attribute to ancient nomads the impact of modern peoples. The long evolution of pastoralism in the desert was accompanied by an evolution of plant communities resulting in a form of symbiosis (Perevoletsky 1995). The degradations of modern over grazing are very much a modern phenomenon. Beyond this, however, the long-term accumulation of infrastructure in the desert, cisterns, wells, dam systems, and even habitation structures, created foci for short term and long-term exploitation (e.g., Meraiot et al. 2021).

3.2 Hunter-gatherer mobility (ca. 15000 - 7000 BCE) (Table 2)

Goring-Morris (1987: 417) demonstrated the basic structures of seasonal mobility for the Terminal Pleistocene Epipaleolithic societies of the Negev and Sinai. Based on geography, site size, and lithic assemblage configuration, Geometric Kebaran, Mushabian, and Ramonian (ca. 15000 - 12000 BCE) mobility patterns can be characterized as those of residential mobility, a circular pattern incorporating seasonal altitudinal movement, but only small-scale variability in group size and composition, site size (directly connected to group composition), and the mix of activities. Mobility patterns of the succeeding late Epipaleolithic Natufian and Harifian cultures contrast significantly, showing large aggregate sites with stone architecture

and a diverse range of material culture in the uplands and only small, dispersed sites with smaller and more limited material assemblages in the lowlands. Goring-Morris (1987: 417, 436-442) suggests that the upland sites represent spring summer habitations and the lowland sites, winter (*per contra* Scott 1977). The pattern represents a complex mix of logistical and residential mobility. Henry (1995: 328-331) reconstructs a similar sequence (if somewhat different in its details) of changing patterns of mobility for the Epipaleolithic of southern Jordan, based on similar variables.

Hunter-Gatherer Mobility Patterns				
	Seasonal movements	**Long-term cyclicity**	**Exchange systems**	**Displacement**
PPNB Neolithic	upland-lowland aggregation/dispersal, ecological factors, mix of residential and logistical mobility	not evident	reciprocal/small scale, desert ↔ settled zone, intra-desert,	colonization of desert
Harifian/ (late) Natufian *Late Epipaleolithic*	upland-lowland aggregation/dispersal, ecological factors, mix of residential and logistical mobility	territorial shifts between Ramonian, early Natufian, late Natufian, Harifian	reciprocal/small scale, limited desert ↔ settled zone, intra-desert trinkets	late Natufian colonization
Ramonian/* Mushabian/ Geometric *Kebraran Early Epipaleolithic	upland-lowland, small-scale aggregation/dispersal, ecological factors, residential mobility	territorial shifts between Mushabian and Ramonian	reciprocal/small scale intra-desert trinkets	Mushabian colonization from Egypt (?) Geometric Kebaran colonization from Mediterranean zone

Table 2: Hunter-gatherer mobility patterns. The Egyptian source for the Mushabian is from Bar-Yosef (1987).

It is difficult to reconstruct territorial fluctuations for these early periods, although differences in site distributions hint at such dynamics. Long-term displacement seems to be reflected in abandonments and colonizations. For example, Bar-Yosef (1987) suggested that the Geometric Kebaran represents a migration from the Mediterranean zone during the ameliorated climate of the Bølling-Allerød episode, and the Mushabian, a parallel migration originating in Egypt. Given the virtual absence of early Natufian in the Negev, Goring-Morris (1987: 436) suggests that the Negev Natufians also represent a displacement from the Mediterranean zone. Exchange systems were limited, reflected primarily in the movement of shells and shell beads (Bar-Yosef Mayer 1997), and would seem to be attached to residential movements, or perhaps those of hunting bands. They were essentially reciprocal in character.

Patterns of mobility among Neolithic hunter-gatherers in the southern Levantine deserts seem similar to those of the late Epipaleolithic. Bar-Yosef (1984) for Sinai, Simmons (1981) for the Negev, and Balasse et al. (2014) for southern Jordan, all suggest upland-lowland seasonal movements attached to patterns of aggregation and dispersion. As per the late Epipaleolithic, these can be characterized as a mix of logistical and residential mobility. Data are insufficient to reconstruct cyclicity of territorial shifts, but long-term displacement is evident in all three regions in the apparent colonization by PPNB groups following an absence of sites attributable to the preceding PPNA (that is, a chronostratigraphic gap following the Harifian culture). On the other hand, exchange systems, both within the desert and between the desert and the settled zone, based on shells and minerals (and often transformed into beads), became more established and systematic, and perhaps less opportunistic, reflecting identity and status (Wright and Garrard 2003). Speculating, it is possible to imagine the beginnings of an agent-based exchange system.

In general, models of hunter gatherer mobility have been based almost exclusively on ecological/geographic factors. Although most models acknowledge the role of social needs in these settlement systems, they are grafted onto these subsistence requirements.

3.3 The earliest goats in the PPNC (7th Millennium BCE)

In eastern Jordan, goats were introduced in the early to middle 7th millennium BCE (Martin 1999; Martin and Edwards 2013), but numbers varied, gazelle hunting still playing a major role in subsistence. In north Arabia, the appearance of desert kites in the late PPNB and PPNC suggests aggregation patterns tied to communal hunting. Goring-Morris (1993) suggests that goats were introduced into the Negev in this period as well, with the Tuwailan culture, a local equivalent of the PPNC, as the agent of change; however, there is little direct evidence for domesticates in the Negev in this period. In the scarcity of data, it is difficult to reconstruct patterns of mobility for this period, although material continuities with the preceding PPNB may suggest similar mobility patterns. The assumed small numbers of goats suggest a pattern of residential mobility, with small groups of goats accompanying the band on its cyclical migrations. The speculative nature of this reconstruction must be stressed.

Other aspects of mobility are even more difficult to reconstruct. The tabular knives, characteristic of the Tuwailan culture, were clearly exchange items, but the structure of this system cannot be established.

3.4 The Timnian Culture Complex (6th millennium - 3rd millennium BCE) (Table 3)

A layer of goat dung, 10 to 20 centimeters thick, documented in the Ramon 1 rock shelter, and dated 6200-5000 BCE (Rosen et al. 2005; Rosen 2017a: 116), is the first direct evidence for the presence of domestic goat in the central Negev. Both morphological study of the pellets (Landau et al. 2020), and DNA analysis (D. Bradley, C. Rossi, and K. Daly, pers. comm.) indicate domestic goat, in fact a Levantine variant. Chemical study of the dung pellets, along with phytolith analysis, indicate a late winter early spring occupation. Considering the depth of the deposit suggesting substantial herds of goats, the absence of nearby habitation camps dating to this period, and the absence of domestic debris, the deposit represents distant stabling, and the fission of groups into residential groups and professional shepherds during the late winter/early spring (Landau et al. 2020; Rosen 2021). This in turn reflects a major change in mobility patterns, undoubtedly the consequence of herding large numbers of goats for the first time in the desert.

Mobility Patterns of the Timnian Culture Complex				
	Seasonal movements	**Long-term cyclicity**	**Exchange systems**	**Displacement**
(Middle Bronze Age)	regional abandonment			general population shift
Terminal Timnian (Intermediate Bronze Age)	externally initiated large permanent sites in addition to earlier system		intensified copper trade cessation tabular scraper trade	
(Early Bronze Age) **Late Timnian**	↑ clear upland-lowland dispersion aggregation/	territorial shifts (e.g., EB III settlement gap)	intensified tabular scraper trade, expanded desert ↔ settled zone, donkey bulk goods	
(Chalcolithic) **Middle Timnian**	↑ assumed upland-lowland aggregation/ dispersion	↑ possible territorial shifts ↓	↑ early copper trade ↑	
(Late Neolithic) **Early Timnian**	distance herding (stabling rock shelters) seasonal cult aggregation		early tabular scraper exchange, limited desert ↔ settled zone, intra-desert, trinkets	

Table 3: Mobility patterns of the Timnian Culture Complex.

The construction of monumental shrines, accompanied by large cairn fields, is also dated to 6th millennium BCE (Porat et al. 2006). The shrine alignments with the setting sun of the summer solstice suggest aggregation for cult purposes in the late spring/early summer.

Rosen (2017a: 159-166) has suggested that the rise of centralized and monumental cult can be tied to the social changes associated with large scale herding of goats. In terms of seasonal patterns of mobility, the social fission of distant herding in the late winter/early spring and the group aggregation focusing on shrine and cairn sites around the summer solstice are new features in the seasonal migratory patterns of desert dwellers. Distant herding reflects a change in basic social structure, a form of division of labor. Aggregation around cult sites suggests that ideology also played a role in patterns of mobility. The construction of large cairn fields probably reflects increasing tribal territoriality, which may also play a role in the structure of mobility.

Over the course of the millennia-long Timnian Culture Complex, territorial shifts and demographic expansions/contractions are evident (Rosen 2017b). In the 4th and 3rd millennia BCE, some of these shifts are associated with increasing exchange with the settled zone, most likely spurred by the rise of copper metallurgy with sources in the desert (Kempinski 1989; Ilan and Sebbane 1989; Amiran et al. 1973). Desert trade outposts/entrepots (e.g., Khalil and Schmidt 2009; Amiran et al.1973; Beit-Arieh 2003) served as exchange foci structuring parts of the indigenous mobility system. Beyond the copper, these exchange systems, also including milling stones, tabular scrapers, minerals such as hematite, and a range of shells, beads and trinkets (e.g., Rosen 2017a: 179-199) traded from the desert into the Mediterranean zone, constitute a considerable expansion beyond the identity and status functions of the earlier periods. The adoption of domesticated donkey into the desert (Fujii 2011; Quintero et al. 2002; Manclossi and Rosen 2022; 86-88) undoubtedly facilitated the development of these trade systems; it was perhaps in fact a necessity. The structure of these exchange systems is more difficult to reconstruct. The apparently small-scale exchange in milling stones suggests that they were attached to the general seasonal round of pastoral bands. Although the early stages of the tabular scraper trade were on a similar small scale, by the Early Bronze Age, the late Timnian, the large scale of the trade suggests a dedicated exchange system (e.g., Abe 2008; Müller-Neuhof 2013).

The copper trade is more complex. Copper extraction activities in the hyper-arid Rift Valley sites are assumed to be seasonal, tied to water availability in the winter months (Ben-Yosef 2016). In the absence of Middle Timnian (Chalcolithic) sites in Faynan, at least in the meantime, and the incontrovertible evidence of copper from Faynan moving into the settled zones (e.g., Shugar 2018), one should assume exploitation by small groups of dedicated copper miners/traders (cf. Knabb et al. 2018; Goren and Rosen 2023). Similar to the organization of the tabular scraper trade, these traders should be seen as specialized subgroups of the larger Timnian economy. By the mid-4th millennium BCE, copper production in Faynan would seem to be controlled by sedentary outposts (e.g., Genz 2000). Nevertheless, nomads were still engaged in the copper trade (for the late Timnian, e.g., Segal and Rosen 2011; for the Terminal Timnian/Intermediate Bronze Age, e.g., Saidel 2002)[1]. A parallel argument has been made for nomadic involvement in the South Sinai copper trade (Avner 2002: 64).

Long term displacement is difficult to document. The demographic decline at the beginning of the second millennium BCE, essentially an abandonment of the central Negev, can be interpreted as some kind of displacement, although we cannot ascertain to where the desert tribes moved.

From another perspective, although the basic ecological factors dictating patterns of mobility still obtained for the Timnian culture in the 4th and 3rd millennia BCE, the increasing impact of other economic factors, production and exchange systems and external markets, is evident. The continuing use of shrines and cairn fields (Galili et al. in press), apparently tied to specific seasons (e.g., the summer solstice) also affected patterns of mobility.

3.5 The Iron Age (terminal second millennium/early first millennium BCE)

Although the character of settlement in the central Negev in the Iron Age has been strongly debated, including basic chronology (e.g., compare Cohen and

[1]The very large sites dated to this period, such as Ein Ziq and Be'er Resisim, lie on an east-west axis from Faynan, apparently toward Egypt. Superimposed on a pastoral system, these sites seem to reflect an external phenomenon. This is reflected not only in site size and unique architecture, but in the association with crescent helmeted rock art figures, a motif foreign in origin to the Negev (Schwimer and Yekutieli 2021; also see Haiman 1996 for the fundamental contrasts between these large sites along the east West axis, on the smaller pastoral sites on the periphery).

Cohn-Amin 2004; Bruins 2007; Aharoni 1967; Shahack and Finkelstein 2008; Eitam 1980), it nevertheless contrasts in all particulars with earlier mobile systems. Comprising site types including hilltop forts, four room houses (also referred to as pillared houses), large open cisterns, other structures, including possibly runoff irrigation systems (e.g., Bruins 2007 versus Shahack and Finkelstein 2008), and a material culture corpus deriving in great extent from the northern (or eastern?) settled zones, it shows no precedents in any local cultures. In fact, evidence for systematic habitation in the central Negev in the second millennium BCE, the Middle and Late Bronze Ages, is profoundly absent. Although some scholars (Finkelstein and Perevolotsky 1990; Eitam 1980; Ben-Yosef 2019) have suggested the presence of hyper-nomadic peoples whose archaeological signatures cannot be traced, invisible nomads, such reconstructions are untenable (e.g., Rosen 2017a: 53-70).

It is beyond the scope of this paper to enter into the debates concerning the nature of Iron Age settlement in the Negev. Patterns of mobility revolved around permanent settlements, probably including seasonal pastoral elements and exchange systems. These were most likely associated with the copper trade originating in the Rift Valley, at Faynan, and perhaps Timna. Long term displacement is evident both in the settlement of the region after a long gap of almost a millennium, and in the abandonment of this settlement system following the Iron Age IIa, or perhaps the Persian period (Cohen and Cohen-Amin 2004). Cohen (1979) attributes the abandonment/destruction of this system to the Egyptian campaign of the pharaoh Shishak, in the late 10th century BCE.

3.6 The Classical Nomadic Complex (ca. 100 BCE - 800 CE) (Table 4)

The initial Nabatean presence in the Negev evolved from the trans-desert caravan route, the "Spice Road", toward the end of the first millennium BCE, with associated caravanserai (e.g., Meshel and Tsafrir 1975; Cohen 1982; Zayadine 2007), to the Roman *Limes Palestina*, to the urban and agricultural Byzantine frontier, and ultimately to the early Islamic aggregated village system. A mobile pastoral system evolved concomitantly beyond the edges of the developing sedentary agricultural/urban zone (Rosen and Avni 1993). Discussion here will focus on that pastoral system.

Classical and Recent Patterns of Mobility				
	Seasonal movements	**Long-term cyclicity**	**Exchange systems**	**Displacement**
Recent (Bedouin)	aggregation/ dispersion, upland/ lowland movement, distance herding, urban markets, agricultural practices	territorial shifts, internecine wars, external political pressures	desert ↔ settled zone, intra-desert	gradual recolonization forced displacement to reservations (ca. 1950 CE) colonization of central Negev (ca. 1700 CE)
Late Antiquity (Byzantine, Early Islamic)	aggregation/ dispersion, limited upland/lowland movement, agricultural Scheduling, urban Market influences	territorial shift westward	limited trans-desert trade desert ↔ settled zone intra-desert	post-Ummayad contraction/ abandonment central Negev
Nabatean	presumed upland/ lowland movment tied to trade stations?		Spice Road caravans Trans-desert trade Intra-desert exchange	colonization of central Negev

Table 4: Classical and recent patterns of mobility.

Unlike the Timnian Cultural Complex, extending into southern parts of the northern Negev, the primary habitation areas of tribal groups in the Classical era were considerably farther south, the aggregation zone to be found in and south of the Ramon Crater. This southward shift of primary pastoral presence undoubtedly had to do with the expansion of the Roman/Byzantine Empire deep into the Negev Highlands, based at least partially on the technologies of runoff irrigation agriculture.

The seasonal mobility of nomads in the classical era has been reconstructed to include the following features: 1. Aggregation south of the Ramon crater, as reflected in the high density of larger campsites (Rosen 1987; Rosen and Avni 1993), best associated with late winter and spring (Rosen 1992). These movements were timed to tie into the spring growing season, and the greater availability of water, 2. Dispersion into smaller subgroups into the agricultural hinterland of the desert urban system, avoiding conflict with farmers and presumably fertilizing fields. Urban markets, for sale of pastoral products (e.g., animals and animal products) and acquisition of manufactured goods (e.g., pots, metal implements, imported grinding stones) was probably attached to this pastoral round. Wage labor may have played a role here, to judge from ethnographic analogies (e.g., Cole 1975: 24, 27). The presence of agricultural terrace systems in the higher, western areas may have required the presence of at least some portions of the population during the sowing and reaping seasons. The virtual absence of such systems in lower, eastern areas with the presence of aggregation sites, suggests complex patterns where some elements of the pastoral population are essentially sedentary, others more mobile. Tensions between the settled zone inhabitants and nomads are also evident in historical texts (e.g., Parker 1986, 1987; Mayerson 1989), although

much less so in the archaeology (but see the presence of Roman fortresses in Jordan, interpreted by Parker [1986] as defense against nomadic tribes); they, too, may have had a role in scheduling mobility. The combination of ecological factors with external economic and political factors is to be noted.

Territorial fluctuations among classical desert pastoral populations are evident. For example, the center of gravity of Nabatean site distribution exhibits high densities in the east, seemingly focusing on areas closest to the Spice Road. By the Byzantine and early Islamic periods, the center of gravity had shifted westwards (compare Rosen and Avni 1993 to Rosen 2007). Given the continuities in the ceramic assemblages from one period to the other, and based on ceramic data from field survey, it is difficult to reconstruct other shifts, for example between the Byzantine and early Islamic periods. However, the decline of urban markets in the early Islamic Period, a focal point for nomadic exchange, most certainly had an impact. Adjustments must have been made, both on the seasonal scale and the territorial.

The presence of trade routes, both trans- and intra-desert, is a well-established feature of desert societies in the Classical era (e.g., Meshel and Tsafrir 1975; Crone 1987; Zayadine 2007). However, there was a clear dynamic to the ebb and flow of these trade routes. The routes themselves shifted, and their relative importance changed (e.g., Crone 1987). While the specific impact of these dynamics on the pastoral systems cannot be ascertained, it is hard to imagine that there was no impact. In fact, the above-mentioned shift from east to west, from Nabatean to Byzantine/early Islamic, should at least partially attributed to the eclipse of the Nabatean Spice Road.

Long term displacements of pastoral tribal groups are most obviously evident in the initiation and cessation of the Classical Nomadic Complex. Prior to Nabatean campsites, there is no evidence for a systematic pastoral system in post-Iron Age times (nor, for that matter, in the Iron Age). Similarly, in medieval times (ca. 10th through the 17th centuries CE), there is no evidence in the central Negev for systematic pastoral presence (Rosen 2017b). On a smaller scale chronologically, Haiman (1995) and Avni (2014: 281-285) suggest that the early Islamic village aggregate system, centering especially around Sede Boker (Nevo 1985, 1991), was the result of sedentizing Muslim pastoralists, both a form of displacement, and a functional shift from nomadic pastoralism to village sedentism with animal husbandry. The continued presence of large pastoral camps in the south-central Negev suggests that if such a displacement took place, it affected only part of the nomadic population.

Summarizing Classical Period pastoral mobility in the Negev, the impact of non-ecological factors is to be stressed. That is, in addition to maintaining animal herds with requisite pasturage and water access, the settled zone urban markets, located deep in the desert, were a focal point for nomadic economic activities, both sale and acquisition of goods, as well as a locus for wage labor. Given the overlap between the dispersed component of the pastoral round and the agricultural hinterland of the urban settlements, pastoral movement had to be coordinated so as not to interfere with farming. Exchange systems and pilgrimage routes traversing the desert offered nomads employment as guides.

3.7 The recent Bedouin (circa 1700 CE - current) (Table 4)

Like the second millennium BCE, there is virtually no evidence for systematic habitation by nomads in the central or southern Negev in the period ca. 900-1700 CE. Like the second millennium BCE, this gap has been interpreted by some (e.g., Finkelstein and Perevolotsky 1990) to be evidence of increased mobility, a mobility so intense that sites did not form, and that the hyper-nomads could not accumulate a material culture corpus sufficiently rich as to be detected by archaeology (for discussion, Rosen 2017a: 53-70). Obviously, in the absence of habitation, the question of mobility patterns is moot, except, perhaps, for the idea of displacement, evident in this case in absence.

Recolonization of the central Negev by modern Bedouin tribes seems to have occurred in the 17th and 18th centuries CE, as based upon the presence of Gaza ware pottery (Rosen and Goodfriend 1994), dated campsites (Saidel and Erickson-Gini 2014), and Bedouin oral traditions (Bailey 1985). This recolonization constitutes a form of displacement. This displacement/migration continued on to the Nile Delta region for some tribal elements (e.g., Murray 1935: 271, maps pp. 247, 285; Bailey and Shmueli 1977).

Systematic archaeological investigations of Bedouin archaeological sites in the region are limited (e.g., Saidel and Erickson-Gini 2014; Avni 1992; Avner 2007; for Jordan, Banning and Kohler-Rollefson 1992; Simms 1988; Simms and Russell 1997) and do not permit a reconstruction of patterns of mobility prior to the 20th century. Meraiot et al.'s (2021; Meraiot 2011) analysis of processes of sedentarization around Avdat show a dynamic trajectory beginning with infiltrations into the region from Jordan in the

18th and 19th centuries, and a gradual transition from mobile pastoralism to semi-sedentary farming by the 1930s and 1940s. The presence of relict infrastructures, terraced dam systems, cisterns, and wells, was integral to this transition. By this period, herding has become a secondary activity and the movement of small herds to distant pastures in the spring is undertaken by specialist goat and sheep herders. Marx (1967: 75-76, 91-94) documented a parallel pattern for tribes from the northern Negev where tenant farmers and subservient groups remained on site to maintain agricultural fields, but the Bedouin themselves accompanied their large flocks on spring pasture migrations.

Adjacent regions show different patterns, especially in the absence of agriculture. The long distance, horizontal nomadism of the Ruwalla in eastern Jordan, based on camels, has no parallel in the Negev. Similarly, the goat nomadism of Sinai, tethered to wells in the summer and also lacking an agricultural component, contrasts with Negev patterns. The presence of seasonal wetlands in the Harrah, in eastern Jordan, created structures of mobility which included opportunistic agriculture (Meister et al. 2019), again contrasting with the Negev.

The political disruptions of the 20th century, including two world wars, the Israel war of Independence, and successive wars between Israel and its Arab neighbors, also impacted mobility patterns. For example, the imposition of a border fence between Egypt and Israel in the northwest Negev prohibited the previously free movement of flocks from Sinai into the Negev. The contraction of Bedouin settlement in the central Negev to higher interior regions following the imposition of Israeli resettlement policies into reservations in the 1950s resulted in similar changes in patterns of mobility. Chemical analysis of dung pellets from stabling rock shelters attributed to recent Bedouin suggests much longer stays in the rock shelters, and perhaps foddering, contrasting considerably with earlier archaeological patterns (Landau et al. 2020).

Beyond these political impacts, the effect of external markets and connections with the settled zone also affected indigenous patterns of mobility. Seasonal trips to the animal markets of Gaza and Beersheva were integrated into the annual round. Cisterns and wells deep in the desert were refurbished by companies based in towns in the settled zone, hired by the local tribes (Meraiot 2011:111-112). These infrastructures, especially those based on water, structured mobility. General shops, supplying various kinds of goods (pottery, metal goods, sweets, etc.) were established in tribal areas and served as foci for economic activities (Meraiot 2011: 182).

The greater resolution, geographic and chronological, evident in the ethnographic and ethnohistoric record of the Bedouin is a cautionary tale for archaeologists. The geographic mosaic of different patterns of mobility over relatively short distances, 300 kilometers from the Jafr Basin, in Jordan, to central Sinai, and a time span of less than 200 years, seems to render our archaeological models crude. Although one could argue that rates of change have been greater in recent times, this is a fig leaf covering the ultimate limitations of the archaeological record as we have it today. Short term social and political fluctuations occurred in the past just as in the present.

4 Discussion and conclusions

This brief overview of changing patterns of mobility in the desert is intended to highlight trends and issues, rather than to provide an in-depth explication of each period. These trends and issues can be divided into two basic categories, those specifically tied to trends in the archaeological and historical sequences, and those tied to scholarly perceptions, or misperceptions. With respect to historical trends, and beginning with the hunter-gatherer cultures of the Terminal Pleistocene, the ever-increasing impact of social, political, and economic factors on patterns of mobility, beyond seasonal cycles of resource availability and fixed geographic patterns, is evident. If Pleistocene hunter-gatherers and the earliest pastoralists in the desert can be characterized as essentially autonomous, that autonomy declined over the long term with the development of exchange systems and markets in the settled zone. Increasing integration between the desert and the sown, ultimately resulting in asymmetric economic relationships (Rosen 2017a: 188-199; cf. Khazanov 1984), changed the structures of seasonal mobility. The nomads became tethered to the markets, *sensu lato*, of the settled zone (cf. Black-Michaud 1986: 47-56, 186; Salzman 1972).

The territorial expansions of the settled zones, beginning with outposts in the fourth millennium BCE, but culminating in full scale desert urbanism by the Classical era, should be seen as a long-term process, and not as a set of isolated episodes. That is, the contraction of nomadic space over the long term, even given fluctuations of expansion and contraction, of necessity changed the structures of nomadic mobility. The virtual demise of traditional mobile pastoralism in the Negev (e.g., Meir 1997; Meraiot et al. 2013), and elsewhere (e.g., Fernandez-Gimenez and Le Febre 2006), in

recent times is the culmination of long-term trends, and not only the result of modernity.

Directly tied to the effects of settled zone expansions, the cumulative nature of infrastructures built in the desert fundamentally changed the structure of resources, especially water. For example, the construction of cisterns in the Iron Age provided water resources for later nomads which were unavailable in earlier periods. Similarly, the introduction of donkeys and, later especially camels, tied to the sedentary zone and exchange systems, fundamentally changed the structures of pastoral mobility. Bulk trade systems are impossible without pack animals, and the classic and almost stereotypical horizontal nomadism of the Near East is predicated on domestic dromedaries, a late introduction.

Of course, the very introduction of goats, and later sheep, into the desert demanded adjustments in patterns of mobility. It is worth noting that these changes were not restricted to the ecological demands of herding. They had social ramifications, reflected in changes in the structures of desert society; I have characterized these elsewhere as the rise of tribal organization (Rosen 2017a: 159-166). The seasonal aggregation around centralized cult and mortuary sites, tied to increasing territoriality, in the 6th through 4th millennia BCE, is one example of the impact of those social changes on mobility patterns.

With respect to archaeological perspectives and preconceptions about nomadism, although ethnography has long recognized the great variability inherent in the adaptation we call pastoral nomadism, archaeology has lagged behind (Rosen 2017a: 1-9). As with early approaches to the transition to agriculture, viewing it as a threshold event, archaeological studies of mobile pastoralism have tended to flatten the phenomenon, focusing on the domestication and adoption of herd animals, as if once achieved, variability was limited within the parameters of modern local nomadic/Bedouin practice.

The limitations of such a perspective should be clear. Based exclusively on analogies drawn from recent ethnography, archaeological reconstructions of ancient patterns of mobility amongst Near Eastern nomads are thus constrained to models based on modern contexts. However, modern environments, markets, geopolitical contexts (including the ever-increasing asymmetries of power between the tribe and the state), and technologies have all had great impact on the mobility patterns of recent nomads. If the basic needs for water and pasture, and consequent mobility, are shared by both modern and ancient nomads, a myriad of other factors demand that

these models be adjusted to account for the fundamental and deep differences between the modern and ancient contexts. By way of example, it is not clear that risk reduction, an important strategy among modern pastoralists linked to modern markets (e.g., Cribb 1987; Redding 1984), played the same role in the early stages of the adoption of herd animals into the desert. Similarly, the rise of nomadic states and empires (e.g., Kradin 2008) was predicated on the context of the prior existence of sedentary states; simplistic analogies (Ben-Yosef 2019) are not useful. Analysis of archaeological remains, as opposed to ethnographic or historical analogy, or speculations based on vague texts, constitutes the only means of understanding the richness of desert cultures.

Looking at mobility as but one aspect of desert pastoral societies, the diversity and complexity of patterns of movement belie the idea of primitive cultural stasis. Beyond offering a *deus ex machina* for the explanation of cultural changes in the settled zone, especially destructions and abandonments, the archaeological analysis of mobile peoples offers insights into larger pictures of the human career.

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