



Polylinear incursions and autochthonous adaptations: Neolithisation and sustainable sedentarisation of the Arabian Peninsula

Hans Georg K. Gebel 

Institute of Near Eastern Archaeology, Freie Universität Berlin, Berlin, Germany

Correspondence

Hans Georg K. Gebel, Institute of Near Eastern Archaeology, Freie Universität Berlin, Fabeckstr. 23–25, 14195 Berlin, Germany.

Email: hggebel@zedat.fu-berlin.de

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This contribution's broad and in parts essayistic approach to Arabia's Neolithic is less a discussion of findings than an explicit advocacy for future holistic research strategies. Based on the contribution's meta-theoretical inputs, it suggests two sets of theses to be tested by the hitherto gained fragmentary information and future research on Arabia's Neolithic. It aims to encourage an "emancipation" of Arabia's early to mid-Holocene research from conceptions developed outside its regions, and to identify the Neolithic elements and developments of the Arabian lands by distinguishing incursions from primarily autochthonous and/or autonomous adaptations in their own right. It is suggested that productive lifeways are considered to be the only crucial parameter to testify a Neolithic status. In our view this is the case, provokingly enough, for the productive foraging management of natural resources which attests surplus and pre-planning strategies and contacts with established Neolithic socio-economies. Polylinear incursions and autochthonous adaptations are discussed as the two poles between which early to mid-Holocene developments in Arabia took place. A set of basic and a set of trajectory hypotheses on Arabia's neolithisation and finally sustainable sedentarisation (reliance on oases economies) is presented, offered as a possible framework for future multi-/ transdisciplinary research.

KEYWORDS

Arabia, holistic and epistemic research framework, Neolithic, productive lifeways, sedentarisation

1 | ADVOCACY FOR A HOLISTIC AND EPISTEMIC RESEARCH FRAMEWORK

In their cautionary assessment, Crassard and Drechsler (2013) evaluated the basic obstacles and fallacies current Arabia's Neolithic research is concerned with. In an earlier account, Uerpmann, Potts, and Uerpmann (2009) elaborated on the regional complexity for eastern Arabia, illustrating these basic problems from another perspective: Apart from the specific

natural detriments (preservation and accessibility of Arabia's Neolithic sedimentary environments), Neolithic research is mainly handicapped by: (1) hitherto dispersed fragmentary information from regions of different natural conditions; (2) restricted and rather new field research; and (3) persistent preconceptions influenced mainly by perspectives from the Levant and the Neolithic Package model. These issues lead to an underestimation of Neolithic Arabia's capacities to have undergone their very own trajectories, reduced the chances to identify cultures as developments in their own right; they

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even can alter or fake their (pre-)historic visibility, and hinder an overall supra-regional understanding and approach for Arabia. As examples to avert such pitfalls, we mention here the RASA Project of McCorrison and others (McCorrison, 2013) in the Hadramawt as well as the study by Méry and Charpentier (2013) as paradigmatic identifications of a regional Arabian Neolithic suitable for an integration into a holistic supra-regional approach.

This contribution is an advocacy to structure arid Arabia's future Neolithic research along guiding holistic ideas/principles and epistemic procedures.¹

1. The understanding of Arabia's Neolithic should refer to the unique characteristic of the Neolithic—productive lifeways²—only. Sedentarisation is not a primary and relevant characteristic unless its productive lifeways sustainably established permanent settlements; this happened—according to current research—for Arabia only in post-Neolithic times by the focus on oasis habitats in the fourth millennium BCE (Gebel 2013, 2016, 2017a). Implicit and explicit perspectives from the Fertile Crescent on Arabia's Neolithic are to be controlled or excluded.
2. Trajectories are seen as developing between the poles of polylinear incursions and autochthonous adaptations, influencing the socio-economic and cognitive behaviour of interacting mobile non-local and local late hunter-gatherers, long-distance pastoralists and other productive resident or otherwise philopatric groups.
3. Neolithic research demands ever-updated holistic perspectives and frameworks on Arabia's Neolithisation without which regional Neolithic trajectories and adaptations cannot be identified or described for their “blend” of

Neolithic and non-Neolithic characteristics and their role in the supra-regional development.

4. Since fragmentary information must be processed to form the necessary holistic framework, formal epistemic procedures must guarantee the testability, traceability and management of the result's growing complexity and that of revised hypotheses. Preferably, this is done by a system or set of constantly updated and tested hypotheses, constantly amended by new data and allowing testing of new information. To start, two preliminary and yet simple theses sets are suggested at the end of this contribution.

In the following, we discuss these guiding holistic principles and epistemic procedures in more detail.

2 | ARABIA'S EARLY PRODUCTIVE LIFEWAYS

The highly diversified vastness of arid Arabia today offers 39 natural, or to be precise, physiographic distinct regions, hosting some 162 sub-regions in its five major geographic zones (Abdulsalam, 1988). While the early to mid-Holocene climate regimes, hydrology and steppe/desert landscapes were much different from today, these figures give an idea of how any Neolithic evolution must have been governed and diverged by the local and regional blends of natural potentials and deficits. Needless to say, (1) the higher natural sensitivity of the Arabian lands demanded other forces and more flexible mechanisms of permanent adaptation within their habitats, and (2) these conditions excluded many substantial ingredients of the Fertile Crescent's “Neolithic packages”.

As even the more favoured early Holocene environments of Arabia could not host “Neolithic package” developments as in Anatolia, the Zagros or the Levant, we should try to identify those Neolithic productive lifeways (Gebel, 2014) suitable to establish at least temporarily in refugia or to connect to Neolithic core zones by corridors: it appears that steppe economies such as (mobile) caprine pastoralism and niche agriculture—both demanding suitable hydraulic behaviour in landscapes (Gebel, 2013, 2016, 2017a; Gebel & Wellbrock, 2019)—were practised with temporal success during favoured climate periods.

Most interesting are productive modes that do not fit to the foraging–food producing dichotomy but appear to be characteristic of the Arabian Neolithic: the productive management of natural resources such as migrating ungulates (e.g. the kite economies of the steppes: Abu-Azizeh, 2019; Abu-Azizeh, Tarawneh, Crassard, & Sánchez Priego, forthcoming), hunter-gatherers “familiar” with domestic animals (e.g. Maiorano et al., 2019; Zarins, 2013), (shell-)fish grounds (e.g. the early Holocene coastal shell middens), or of runoff and aquifer waters (e.g. water harvesting systems at the potentially arable

¹Suggestions presented here are also based on research results gained through own field projects (Mazyad Archaeological Project, Abu Dhabi Emirate: 1979–83; Eastern Jafr Archaeological Project, Kingdom of Jordan: 2001–2014; Saudi–German Rajajil/Standing Stones Joint Archaeological Project, Kingdom of Saudi Arabia: 2012–2016) and participation in fieldwork at Ras al-Hamra 5/10 (1979), Hili 8 (1979–1980) and Lizq (1981).

²For the author's terms “Neolithic productive socio-economies”, “territoriality”, “habitus societies”, etc., and other understanding of the Middle Eastern Neolithic, see Gebel (2014, 2017b), and publications quoted therein. Primary characteristics of Neolithic productive lifeways are: sustainably available and sustainably used and managed biotic (domesticated and abundant natural protein resources) and abiotic (arable land/steppes, aquifers/runoff catchments/lakes, mineral raw material) resources; evidence for surplus production and a planning economy; related processes of socio-economic growth including the development of social hierarchies and progressive population dynamics, sustainable wealth. Sedentism, storage, and other, would belong to the secondary characteristics of productive lifeways. It should be noted explicitly that the author's recent holistic approaches to Middle Eastern neolithisation, reacting to the many recent findings not fitting to the prevailing dogmatic understanding of the Neolithic, has highly influenced this contribution.

land: Abu-Azizeh & Tarawneh, 2015; Fujii, 2018; Marcucci et al., 2014 and references there). Especially when abundant and reliable resources allow sorts of sedentary life based on predictable and reliable subsistence strategies without substantial storage and/or even surplus production, they already should be addressed as of Neolithic character. In all this, philopatric behaviour may occur or even be a strong factor, especially when central burial grounds are “supportive” or “instrumental” for territorial claims and behaviour (Fig. 1). Can we expect that habitation sites’ chipped stone technologies and tool kits are more characterised by opportunistic (ad hoc) and non-formal primary production and limited shares of “style tools”, while specialised sites may testify more standardisation in primary production, tools and tool kits, including the use of non-local raw material (observations made at own surveys near Sakakah, the south-eastern Badia, and near al-Ain, Abu Dhabi)? It may turn out to be misleading to understand some of the evidence as indicating “outposts” (e.g. Fujii, 2018; Fujii, al-Mansoor, Adachi, al-Khalifa, & Nagaya, forthcoming) rather than comprehending them as autonomous local/regional adaptations. Certainly, the latter were subject to polylinear incursions of technologies (e.g. Fig. 2 or Crassard et al., 2013), subsistence strategies, magic or ritual behaviour, or other paradigms. We should never forget that “incursions” also work in the opposite direction, as in the *badia* chert exports to settled Late Pre-Pottery Neolithic B (LPPNB) areas in the Jordanian Highlands, or the first

(formal?) trilith recently found in LPPNB Ba‘ja (Gebel et al., 2019: fig. 15).

The permanent establishment of sedentary life associated with a sustainable productive subsistence mode, an important but not crucial key characteristic of the Neolithic, appears by the “oasisisation” (Gebel, 2013, 2016) of the Arabian Peninsula in post-Neolithic times (fourth millennium BCE). In our view, the oasisisation needs to be part of Arabia’s Neolithic debate as its sedentarisation represents a finally successful autonomous and autochthonous act that usually is considered a characteristic of the Neolithic Package: Neolithic “efforts” in sustainable sedentarisation on the Peninsula with elements of the Neolithic Package appear not to have been successful. However, and in general, due to Arabia’s limited water resources and rather restricted commodification and consumption triggers, its cultures appear to have developed more conservatively in terms of innovations; long-distance networks may not have influenced this in sustainable ways.

The inland fringes beyond Arabia’s coastal strips, where rich marine sources allowed productive shell-fishing/fishing, as well as productive hunter-gatherer cultures in the semi-arid fringes of the Fertile Crescent’s settled zones, were contact areas with Arabia’s inland hunter-gatherers. For example, in the *badia*, recent research by Abu-Azizeh and by Rollefson et al. may show evidence for such contacts with indigenous foraging cultures (Abu-Azizeh, 2019, Abu-Azizeh et al., forthcoming; Rollefson, Rowan, & Wasse, 2014: 299).



FIGURE 1 Wadi Sahab al-Asmar 8 north of Jabal at-Tubaiq, southeastern *badia*. Human representation (height: 35 cm, columnar basalt) found in the rubble of multi-chambered D-shaped cairn of the Rajajil Cultures (either late fifth/early fourth millennium BCE or—for its stylistic features—“recycled” Neolithic statue). (Eastern Jafr Archaeological Project; photo: H. G. K. Gebel) [Colour figure can be viewed at wileyonlinelibrary.com]

3 | POLYLINEAR INCURSIONS AND AUTOCHTHONOUS ADAPTATIONS

The concept that Arabia’s early to mid-Holocene trajectories resulted from these interacting developmental forces appears justified and obvious from the evidence we have so far; the theses sets, see below, are guided by this concept.

Polylinear incursions are understood as single or combined penetrations from outside of technologies, ideas, paradigms, and/or populations, triggered by natural and cultural processes. Polylinearity is chiefly caused and promoted by inland and marine corridors as well as the webs of favoured (mostly hydrologically or biotic) or special (mostly ritual sites and abiotic resources, e.g. the Fig. 3 evidence) localities they create and connect. Polylinearities may shift within the limits “granted” by climate oscillations, migrating ungulates, natural and artificial water access, all causing shifts in the territorial behaviour of people; they host both advancing and retreating incursions. In our understanding, incursions should not be mixed up with colonisations or outposts (*sensu* Rollefson, Rowan, & Wasse, 2014; Fujii, 2018; Fujii et al., forthcoming) as the latter more represent translocations still maintaining socio-economic ties or dependencies with their



FIGURE 2 ‘Ainab 1, Structure A, close to Jabal ‘Ainab, southeastern *badia*: Helwan points from an EPPNB megalithic hunting camp hosting a bidirectional primary production: Just representing a techno-stylistic incursion? (second half of the ninth millennium BCE). (Eastern Jafr Archaeological Project; photo: C. Purschwitz) [Colour figure can be viewed at wileyonlinelibrary.com]



FIGURE 3 Mazyad sites panoramic view in 1980 from Jabal Hafit, Abu Dhabi Emirate: Ephemeral dwelling at flint mining sites with surplus foliate production (sixth–fifth millennium BCE). (Mazyad Prehistoric Project; photo: H. G. K. Gebel) [Colour figure can be viewed at wileyonlinelibrary.com]

original cultures. However, for much of the evidence in the fringe areas, it might be difficult to understand the overlapping features of both.

Autochthonous and/or autonomous adaptations are understood as results of inside adaptive processes of localities or regions which basically are expected to result from environmental shifts; it is also expected that these adaptations dealt conservatively with any incursive elements. There is a need to distinguish between the autochthonous (local and regional) and autonomous (self-reliant, self-contained) aspects in the adaptive processes. For example, the kite economy of

around 7000 BCE appears to reflect autochthonous triggers while representing an autonomous socio-economy.

Most of Arabia's early to mid-Holocene trajectories are the result of both forces; however, the vastness and the potential deficits of the Arabian lands appear to have conditioned conservative developmental paces with restricted innovation. It can mean that—in tendency—polylinear incursions always were less influential and less sustainable than autonomous and autochthonous adaptations, especially in the societal sectors (e.g., the general conformities we see in regional burial practices throughout millennia).

4 | HOLISTIC RESEARCH PERSPECTIVES AND FRAMEWORK ON ARABIA'S NEOLITHIC

Thus far, segmentary approaches characterise Arabia's Neolithic research. Much understanding is still based on regionally and chronologically restricted evidence, often still dominated by special expertise (chipped lithics, malacology, geoarchaeology, archaeozoology). While water is crucial for the understanding of Arabia's (pre-)history, no real archaeo-hydrological (only hydroarchaeological!) work was carried out (Gebel & Wellbrock, 2019). Quite unique is the predictive and supra-regional approach of Drechsler (2009). Of course, much of the past research development is a result of the pioneering character fieldwork has and of its political frameworks, seemingly not allowing much epistemic input and structuring so far.

In short: It is seen that the hitherto achieved body of data justifies and imperatively demands an integrated effort for a holistic perspective and concept on Arabia's Neolithic. It should be characterised by

1. using a testable holistic and supra-regional framework which
2. coordinates all disciplines already involved while further including archaeohydrological and etho-ontological studies,
3. trying to establish trans- or at least multidisciplinary research agendas.³

The instrument to link these intentions by a jointly shared working basis meeting basic standards of testability and traceability could be these sets which are proposed in the next section.

5 | BASIC AND TRAJECTORY HYPOTHESES ON ARABIA'S NEOLITHISATION AND SEDENTARISATION (NINTH TO FOURTH MILLENNIA BCE)⁴

There are not many testable procedures in humanities to deal with fragmentary information serving a holistic approach

³For climate-sensitive environments, like Arabia's early Holocene grasslands, a broad multidisciplinary scientific input appears more important to reach guiding and meaningful results than enlarging the body of archaeological samples. However, the hitherto neglected specific sociobiological and cultural behaviour (etho- and ontological studies) of humans in potentially water-deficit regions has to become the subject of research agendas.

⁴This contribution has chosen a pragmatic way (i.e. the presentation of initial theses) for urgently dealing with the need to structure Arabia's Neolithic research and return to a basic discussion of what is Neolithic with Arabia's Neolithic. At this stage of discussion, it cannot accomplish a reviewer's demand to "identify different expected patterns of data ... giving regional researchers an instruction to understand which data would eliminate which hypothesis". This is more an urgently needed matter of a mutual multidisciplinary brainstorming at special gathering than an individual's effort limited by a word count.

from the beginning. For a similar research situation, concerning the North Arabian mid Holocene pastoral well cultures and proto-oases, we successfully used constantly tested and amended these sets (Gebel 2013, 2016, 2017a); the same procedure is suggested for Arabia's Neolithic.

The following theses needed to be separated into two sets: four hypotheses deal with basic research demands, and seven hypotheses reflect Neolithic/sedentarisation trajectories. New evidence will demand constant testing and updating, splitting and extending the theses sets. Most statements of the following theses are elaborated in more detail in the referenced publications by Gebel and other literature mentioned there. Potentially important, but as yet unclear driving forces (such as gulf marine transgressions and Afro-Arabian interaction spheres) have been omitted from thesis building for the time being.

Basic Hypothesis 1. *Only certain elements, including their lithic styles, of the so-called Near Eastern Neolithic Package could establish or were established temporarily in Arabia's early Holocene steppe-lake and coastal environments.*

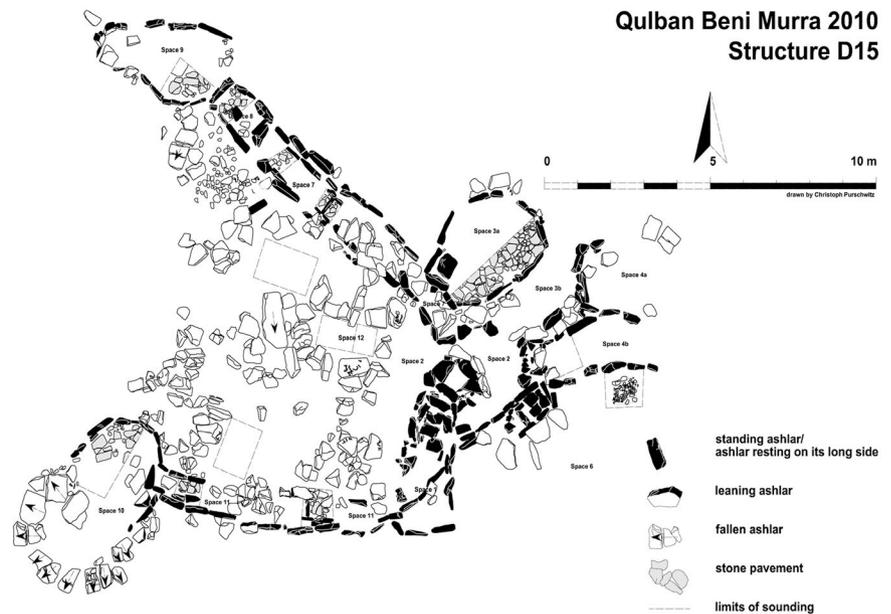
Basic Hypothesis 2. *The Neolithisation of the Arabian Peninsula resulted from interacting with partly disconnected polylinear incursions and autochthonous adaptations of their own right, and was not a continuous polycentric process like in the regions of the Fertile Crescent. Specific blends of driving forces characterise the individual incursion and adaptation events in which climate and water played crucial roles.*

Basic Hypothesis 3. *More than in the Fertile Crescent's regions, Arabia's socio-economic and cultural-cognitive developments in the early to mid-Holocene were directly steered by climatic oscillations. Water availability and management as well as hydraulic technologies, and the "natural webs" of water-favoured corridors and locations until the fourth millennium BCE, were crucial for the establishment of Arabia's Neolithic and post-Neolithic inland cultures mainly making appearance as dispersed landscape cultures.*

Basic Hypothesis 4. *The different natural capacities and furnishings of Arabia's highly diverse and sensitive early to mid-Holocene physiographies created different conditions and shares for productive lifeways. This must have resulted in diversified Neolithic adaptations, including adaptations and mixed socio-economies occurring between indigenous late hunter-gatherers and groups bringing in Neolithic elements.*

Trajectory Hypothesis 1. *Arabia's late tenth and ninth millennia BCE are dominated by local foraging economies and their specific lithic traditions. Increasing signals of interaction, especially by lithic styles and technologies, testify to limited but increasing contacts along land*

FIGURE 5 Qulban Beni Murra north Jabal at-Tubaiq, southeastern *badia*. Canal-type trough system fed by a well typical for the pastoral Rajajil Cultures (late fifth millennium BCE). (Eastern Jafr Archaeological Project; photo: H. G. K. Gebel; plan: C. Purschwitz) [Colour figure can be viewed at wileyonlinelibrary.com]



*incurring elements; and/or aspects of all or several of these.*⁵

Trajectory Hypothesis 4. *From the latest LPPNB/PPNC onwards, mobile pastoralists of all sorts and their incipient webs of hydraulic landscapes and migration routes became the conservative and autochthonous backbone of Arabia's developments, helping access and stability to temporary occurrences of Neolithic sedentism and other kinds of philopatric land use (such as niche agriculture, a possibly continuing "outpost" phenomenon?). By the seventh millennium BCE, they started to oust and alter the*

Peninsula's remaining late inland hunter-gatherers who, however, survived until sub-recent times in coastal areas if linked to (shell-)fishing in areas such as the coastal strips of the Red and Arabian Seas and the Gulf.

Trajectory Hypothesis 5. *During the RCC interval of the seventh millennium BCE, culminating in the 8.2 ka cal BP Event, we have to expect a retreat of mobile pastoral and (semi-)sedentary systems to Arabia's more water-favoured areas (higher aquifers) that constituted hot spot areas (cf. the Fig. 4 evidence) within overall retreating population dynamics; probably Central Arabia became uninhabitable, at least unsuitable for productive socio-economies. Biophysical and social vulnerability/stress finally consolidated the deeply relational social structures of the habitus type which appear to fit mobile pastoral communities and may have originated in the social legacy of the LPPNB.*

Trajectory Hypothesis 6. *During the sixth and fifth millennia BCE, until the 6.2 ka cal BP Event, fully developed mobile and partly megalithic pastoral well cultures (the*

⁵They could have entered steppe territories as far as south-central Arabia (e.g. al-Magar, a seemingly autochthonous Late PPNB and PPNC culture: Harrigan, 2012) or simply were regional imitations/variants of outside technological traditions and styles by indigenous cultures (e.g. Charpentier and Crassard, 2013; Inizan, 1988; Uerpmann et al., 2013). However, evidence for autochthonous cultural traditions prevail, including lithic traditions like the trihedral and Fasad Points.

Rajajil Cultures; cf. the Fig. 5 evidence) again flourished across the Peninsula due to humid conditions and high water tables on the Peninsula's steppes (as well as in the an-Naqab/Sinai and Maghreb regions), assisting the development of proto-oasis open land horticulturalism from the mid-fifth millennium onwards at water-favoured locations as assumed for Rajajil and attested for Tayma (Dinies et al., 2016).

Trajectory Hypothesis 7. *The final sustainable, while permanent, establishment of sedentary life and food production in Arabia's landscapes based on oasis economies started at the onset of drier conditions from 4200 BCE onwards (the 6.2. ka cal BP Event), most likely representing an autochthonous as well as autonomous polycentric process initiated and promoted by Arabia's proto-oases during the second half of the fifth millennium BCE, expanding further in the fourth millennium BCE with the introduction of crops from outside Arabia. The deeply relational social structures of the habitus type (Gebel, 2017b), the burial practices and the hydraulic technologies of the mobile well cultures became the foundations of the incipient oasis socio-economies, and one of the greatest and sustainable socio-economic achievements of Arabian cultures until present times. From the onset of drier conditions in the late fifth millennium BCE, most regions established Arabia's persistent and characteristic economic dualism, that of mobile pastoralism and sedentary horticulturalism.*

In terms of research, work in Arabia's early and mid-Holocene demands significantly different research questions, project designs/strategies and field competency compared with those developed for the favoured Neolithic regions, including essential and more scientific input, especially archaeohydrological and geoarchaeological input; awareness for real multi- or transdisciplinary cooperation and methods; competence in deflated land geomorphology and horizontal stratigraphy; and migration archaeology, for example. In terms of research strategies, it requests that archaeo(hydro)logical research necessitates strictly sub-regional approaches and perspectives to evaluate the regional contributions forming the overall Arabian Neolithic trajectory in early and mid-Holocene times.

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ORCID

Hans Georg K. Gebel  <https://orcid.org/0000-0003-1315-6576>

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