Journal of Arid Environments xxx (xxxx) xxx–xxx

Contents lists available at ScienceDirect

Journal of Arid Environments

journal homepage: www.elsevier.com/locate/jaridenv

The identification of pathways on *harra* surfaces in north-eastern Jordan and their relation to ancient human mobility

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ARTICLE INFO

Keywords:
Black desert
Arabia
Paths
Human mobility
Archaeology
Remote sensing

ABSTRACT

This paper calls attention to the presence of countless ancient paths on the basalt-covered surfaces characteristic of *harra* landscapes in north-eastern Jordan. These paths have developed over the course of at least the last two millennia, and potentially prior to that, by trafficking of nomadic peoples and animals. These paths facilitated movements through terrains that were otherwise difficult to traverse. Paths can be recognised on high-resolution satellite imagery, which allows for systematic documentation and the reconstruction of potential routes through the landscape. The identification and mapping of these paths is important for better understanding mobility patterns of nomadic peoples who inhabited these desert landscapes in antiquity.

The desert regions of the *Harrat ash-Sham* volcanic field stretch from southern Syria through north-eastern Jordan and northern Saudi Arabia. Its western name – the Black Desert – derives from the dense surface cover of basalt clasts that formed through volcanic eruptions between roughly 8.9 and 0.1 million years ago (Bender, 1968: 106). Due to a near-complete lack of permanent water sources and limited precipitation, today the Black Desert looks like a bleak environment poorly suitable for human inhabitation. Nonetheless, the region hosts an extraordinary rich archaeological record consisting of countless stone-built features, artefact assemblages, and concentrations of rock art that have been exceptionally well preserved, often above-ground. After a long period of relative obscurity, this record has received renewed attention from archaeologists since the 1980s through field surveys and excavations (e.g. Akkermans et al., 2014; Betts et al., 1998, 2013; Müller-Neuhof, 2014; Richter, 2017; Rowan et al., 2015) and remote sensing studies (e.g. Kempe and Al-Malabeh, 2010; Kennedy, 2011; Meister et al., 2018). This research has indicated that the Black Desert has been inhabited between prehistoric times until recently – although perhaps not continuously – by communities who largely relied on mobile subsistence strategies. These were initially mobile hunter-gatherers whose presence has been attested at Epipalaeolithic and Early Neolithic sites (Betts et al., 1998; Richter, 2017; Yeomans et al., 2017). Pastoralism was introduced in the Late Neolithic (Rollefson et al., 2014) and mobile pastoralism probably continued to be an important subsistence practice during the Chalcolithic and Early Bronze Age despite the emergence of a limited number of permanent settlements in the region (Müller-Neuhof, 2013; Müller-Neuhof and Abu-Azizeh, 2016). After a period of seeming abandonment during the 2nd and early 1st millennium BC (Akkermans and Huigens, in press), the Black Desert was inhabited again between the Hellenistic and Early Islamic periods, this time by pastoral nomads who are best known for the Safaitic inscriptions and pictorial carvings they left behind on basalt rocks. These carvings are conventionally dated between the 1st century BC and the 4th century AD (Macdonald, 2000). Other surface features from this period include large, monumental burial cairns and short-lived campsites (Akkermans and Brüning, 2017). The region continued to be episodically visited by pastoral nomadic communities up to this day, while a few small towns were established in the region only from the early 20th century onwards (Akkermans and Huigens, in press).

The history of the Black Desert is thus dominated by mobile communities of hunter-gatherers and pastoral nomads, and studying patterns of mobility and movement is therefore important for gaining a better understanding of such communities. However, in their endeavour to explore ancient mobility in the Black Desert, archaeologists have thus far overlooked an important aspect of the *harra* landscapes: numerous pathways run through these landscapes that facilitate movement through an otherwise poorly accessible terrain. Already in the late 19th and early 20th century European travellers who visited the Black Desert reported the presence of such paths (e.g. Bell, 1907; Von Oppenheim, 1899), which were used at the time by Bedouin for travelling. This paper discusses the way in which these paths may be identified, when and how they developed, and how their presence may be informative about past human mobility in the Black Desert. This is based on archaeological research in the Jebel Qurma region, which is situated in the Jordanian part of the Black Desert and has been under archaeological investigation since 2012 (Akkermans et al., 2014;

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https://doi.org/10.1016/j.jaridenv.2018.03.003
Received 31 January 2018; Received in revised form 26 February 2018; Accepted 4 March 2018

Akkermans and Huigens, in press; Akkermans and Brüning, 2017; Huigens, 2015).

Tracing the movements of ancient mobile communities such as hunter-gatherers and pastoral nomads through archaeological methods has been problematic for a long time. Reconstructions of such movements have often been based on modelling techniques, including least cost path analysis, that are largely based on natural features of the terrain such as surface cover and slope degree (e.g. White and Surface-Evans, 2012), while actual archaeological evidence for routes used by mobile communities to move through the landscape has remained highly elusive. The relatively stable nature of archaeological landscapes in desert environments, characterised by Wilkinson (2003: 151) as "landscapes of survival", provides circumstances in which ancient routes can be preserved. In the steppes of northern Mesopotamia, for example, road systems associated with Bronze Age settlements have been attested (Wilkinson, 1993; Ur, 2003), and several cases in a recent volume on 'desert road archaeology' (Förster and Riemer, 2013) offer archaeological evidence for trails of trade caravans in the Egyptian deserts. However, only very few studies (e.g. De Laet et al., 2015; Zboray, 2013) have tried to identify smaller and less formal road systems in desert landscapes, such as trails used by mobile pastoralists.

Such studies have not been carried out for the Black Desert either. The 'circular paths' that have been identified through remote sensing (Kempe and Al-Malabeh, 2010, 59) may be seen as an exception in this respect, but these are localised features that could not be used to traverse the landscape. Other than that, the identification of informal road systems in the Black Desert has not been reported, even though the region provides excellent circumstances of preservation. Today it receives between 150 and 200 mm of average annual rainfall in the north to less than 50 mm in the south, which makes it an arid to hyper-arid region (Al-Homoud et al., 1995: 58). Even though environmental conditions in the Black Desert may have been different in the past through climatic fluctuations (Cordova, 2007), overall the region has only to a limited degree been affected by large-scale agriculture or settlement. As a result, relict landscapes of past human occupation have been well-preserved in the Black Desert. Furthermore, the basalt clasts that constitute the *harra* surfaces have provided suitable materials in the past for the construction of stone-built features as well as for the creation of rock art (Betts et al., 2013; Huigens, forthcoming; Kennedy, 2011; Rowan et al., 2015).

The Jebel Qurma region is situated in Jordan on the fringe of the Black Desert, close to the modern town and oasis of Azraq. The centre of the region consists of a basalt-covered *harra* upland of up to 80 m high surrounded by a landscape of rolling gravel plains, or *hamad* (Fig. 1a). The slopes leading up to the plateau are very steep — especially on the south and west sides, with slope gradients of up to 20°. Both its stony surface cover, which is highly dense in most places, and the steepness of the slopes leading up to the plateau make the basalt landscape difficult to access, whereas movement in the surrounding plains is much less restricted. Numerous wadis and associated valleys run down from the basalt plateau in several places. The plateau itself is not flat, but consists of hillocks, ridges and depressions. These depressions are natural basins in which runoff water from local rainfall may collect. Alluvial sedimentation in these basins has resulted in the formation of mudflats, which nowadays stand dry for large parts of the year.

Despite the fact that few people venture into the Jebel Qurma region today, both its central plateau and the surrounding plains are very rich in archaeological and epigraphic remains, which have been under investigation since 2012. Stone-built features, rock art, and artefacts from prehistoric and more recent times have been widely documented in the region, in an attempt to reconstruct its occupational history and the development of desert communities through time. Attested periods of inhabitation thus far include a prehistoric phase from Palaeolithic period until the Early Bronze Age, a Hellenistic to Early Islamic phase, and a Mamluk-period to early modern phase (Akkermans et al., 2014; Huigens, 2015; Akkermans and Huigens, in press). A mobile mode of existence is characteristic for all these phases of inhabitation, and the study of mobility patterns on various scales is therefore an important part of this research. The identification of ancient paths and routes through the landscapes is highly relevant in this respect.

The presence of potential paths in the Jebel Qurma region – mainly in its basalt landscapes – was first revealed by a study of high resolution satellite imagery. These observations were checked on the ground during subsequent pedestrian surveys carried out since 2012. For the identification of paths use was made of Ikonos satellite imagery, which has a spatial resolution of ca. 80 cm. Numerous lightly coloured linear traces were observed on the imagery that run through the dark basalt surface cover. Four types of such traces were identified on the basis of satellite imagery and observations made on the ground. The first are wadis — or seasonal water courses — which appear on the satellite imagery as fairly broad and curvilinear features (Fig. 1b). They are usually mottled in colour, and shrubs that often grow in them appear on the imagery as larger dark spots. They run perpendicular to the contour lines of the terrain. Second, concentrations of narrow lightly coloured stripes were recognised that run over steep slopes parallel to the contour lines of the terrain (Fig. 1c). They normally do not intersect, and do not occur on flat terrain. These features seem to be the result of slope processes — either through wetting-and-drying cycles (e.g. Cooke and Warren, 1973: 129–35) or through soil creeping. Third, a small number of anthropogenic linear features were observed that are the result of the removal of stones to create walls. There are a number of so-called desert kites in the Jebel Qurma region, which are large prehistoric hunting installations comprising low stone walls of up to several kilometres in length (Akkermans et al., 2014). Basalt boulders were picked up from the surface to construct these walls, leaving a narrow patch of soil directly next to the created walls. These lightly coloured 'negatives' of kite walls are very easily discernible on satellite imagery (Fig. 1d). Fourth, there is a large number of lightly coloured linear features that were identified as paths. These features appear on the imagery as narrow lines, often diverging from- and converging to each other (Fig. 1e). They are normally not wider than ca. 1.5 m, and can run parallel to contour lines or perpendicular to them. They are mostly somewhat curved and in a few cases, especially when running up a steep slope, they follow a zigzag pattern — thereby forming a switch-back path. They are sometimes found in isolation but usually in concentrations. In some cases, they originate and/or terminate at other anthropogenic features such as stone structures or clearings. Hundreds of such paths were traced from Ikonos satellite imagery and stored in a Geographic Information System.

The occurrence of paths is not confined to the basalt landscape. Paths were also recognised during pedestrian surveys carried out in the *hamad* plains to the south of the basalt upland (Huigens, 2015: 190). However, these paths are difficult to recognise on Ikonos imagery because of a lack of visual contrast between the paths and the surrounding terrain. Paths could therefore only be systematically mapped in the basalt landscape, and only in areas for which high resolution satellite imagery was available.

The paths recognised on satellite imagery and during pedestrian surveys in the Jebel Qurma region are relatively simple. There are no cases in which, for example, paths were paved or steps were created in paths leading up steep slopes. There is no direct evidence for the deliberate creation of paths by people, although it is not implausible that people sometimes intentionally made effort to increase their accessibility by removing rocks. This may be the case with paths that are relatively broad or completely free of stones. In most cases, however, it seems more likely that most of the paths are the result of prolonged trafficking through the landscape by both people and animals who occasionally kicked aside stones in their way. In time, this process resulted in the development of paths. It is important to realise, in this respect, the potential contribution of wild animals to this process. Although nowadays large ungulates are hardly present in the Black Desert, pictorial and textual sources have shown that, in the past, the