Spatial patterns of Rock Art at El Rum Oasis, Bayuda/Sudan

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Summary

Their distribution patterns are rather inhomogeneous, indicating their direct connection with different cultural-historical landscape elements and archaeological sites. This paper will focus on rock art sites of different periods (prehistoric, ancient, and medieval) entangled with the micro-oasis of El Rum, which is at the moment subject to comprehensive landscape-archaeological investigations. The paper will show the different spatial distribution patterns of rock art motifs, and their spatial correlation as well as functional contextualization with different land use strategies developing diachronically in and around the oasis of El Rum, and its immediate hinterland. Different rock art categories (in regard of their date as well as motifs) correlate with specific concepts of rangeland economies, forming a differentiated and integrated model of land and water resources management, closely entangling intensified oasis agri- and horticulture with pastoral production strategies making use of un-arable rangelands. Rock art depictions of different livestock, associated with long and middle range pastoral mobility, can be interpreted chronologically and functionally. The aim of this paper is to demonstrate the potential of rock art analysis for the general reconstruction of these subsistence and land use strategies in terms of spatial and landscape archaeology.

Riassunto (Modelli spaziali e arte rupestre nell'Oasi di El Rum, Bayuda/Sudan)

Quando i modelli di distribuzione dell'arte rupestre appaiono piuttosto disomogenei, possono suggerire una loro connessione diretta con gli elementi del paesaggio storico-culturale e con i siti archeologici. Questo articolo si concentrerà sui siti di arte rupestre, di diversi periodi (preistorico, antico e medievale), della micro-oasi di El Rum, che è attualmente oggetto di approfondite indagini paesaggistiche e archeologiche. L'articolo mostrerà i diversi modelli di distribuzione spaziale dei soggetti di arte rupestre e la loro correlazione spaziale, nonché la contestualizzazione funzionale con diverse strategie di uso del suolo che si sviluppano diacronicamente all'interno e intorno all'oasi di El Rum e al suo immediato entroterra. Diverse categorie di arte rupestre (diverse per datazione e soggetto) si correlano con concetti specifici di economia dei pascoli, formando un modello differenziato e integrato di gestione della terra e delle risorse idriche, intrecciando strettamente l'agricoltura e l'orticoltura delle oasi con le strategie di produzione pastorale che utilizzano le terre non coltivabili. Le rappresentazioni di arte rupestre di diversi allevamenti, associati alla mobilità pastorale a lungo e medio raggio, possono essere interpretate cronologicamente e funzionalmente. Lo scopo di questo lavoro è dimostrare il potenziale dell'analisi dell'arte rupestre per la ricostruzione generale di queste strategie di sussistenza e di uso del suolo in termini di archeologia spaziale e paesaggistica.

1. Introduction

The Wadi Abu Dom is situated in the central Bayuda region in northern Sudan. During the archaeological survey project "Wadi Abu Dom Itinerary", altogether over 8300 archaeological sites were documented along the banks of the wadi and its immediate hinterland (Karberg & Lohwasser, 2018a).

Among the discovered archaeological features are 217 rock art panels. Their distribution patterns are rather inhomogeneous, indicating their direct connection with different cultural-historical landscape elements and archaeological sites (Karberg, 2020). This paper will focus on rock art sites of different periods (prehistoric, ancient, and medieval) entangled with the micro-oasis of El Rum (Fig. 1 & 2), which is currently subject to comprehensive landscape-archaeological investigations (Karberg *et al.*, 2020). The paper will show the different spatial distribution patterns of rock art motifs, and their spatial correlation as well as functional contextualisation with different land use strategies developing diachronically in and around the oasis of El Rum, and its immediate hinterland. Different rock art categories (in regard of their date as well as motifs) correlate with specific concepts of rangeland economies, forming a differentiated and integrated model of land and water resources management, closely entangling intensified oasis agri- and horticulture with pastoral production strategies making use of un-arable rangelands. Rock art depictions of different livestock, associated with short- and middle-ranged (pastoral or non-pastoral) mobility, can be interpreted chronologically and functionally.

The aim of this paper is to demonstrate the potential of rock art analysis for the general reconstruction of these subsistence and land use strategies in terms of spatial and landscape archaeology.

2. Methodology

2.1 Geostatistics

Analysis of spatial clustering and patterns is mainly done with GIS-based kernel density estimation (Connolly & Lake, 2010, pp. 175-178). For general spatial distribution pattern analysis covering the whole course of the Wadi Abu Dom, spatial cells of 5000 by 5000 m

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proved useful. For more detailed investigations of smaller areas of interest (like the immediate vicinity of the oasis of El Rum) archaeological feature density was estimated in spatial cells of 350 by 350 m till 750 by 750 m. For indicating different relations of production in the archaeological record, it is assumed that indicators of social mobility can be correlated with pastoral production strategies (Khazanov, 1994, pp. 16-17), while indicators of sedentarism relate to agri- and horticultural production as major source of subsistence. Multi-room stone constructions and kraal-shaped clusters of round huts are estimated as indicators for sedentarism, while camp sites and solitary, open shelters are interpreted as temporary installations and therefore indicators for mobility.

2.2 Chronology

One major flaw of the data acquired in the Wadi Abu Dom Itinerary archaeological survey is the fact that – as usual in archaeological surface surveys – only a minor part of the documented archaeological record is clearly datable. In some cases datable surface finds are clearly related to anthropogenic installations (Karberg & Lohwasser, 2018a, pp. 43-47); in few cases test soundings revealed organic material capable of radiocarbon dating (Karberg & Lohwasser, 2018a, pp. 32-36). Most of this datable material indicates a peak of human activity in the lower Wadi Abu Dom in late antiquity (late Meroitic and Post-Meroitic period) and the Middle Ages (Christian medieval period until early Islamic Funj period). In some parts of the lower Wadi Abu Dom, comparably stable cultural landscapes can be reconstructed over longer timespans, while in other parts (especially at the fringe towards the middle Wadi Abu Dom) a fluctuating cultural landscape with regular shifts between agricultural and pastoral relations of production has to be considered (Karberg & Lohwasser, in print). Some of the rock art documented in the lower Wadi Abu Dom correlates to this rough dating estimations, since crosses and other Christian symbols obviously date to the Christian medieval period, while dating camel depictions to the same period corresponds to the general assumption that the introduction of *camelus dromedarius* as widespread domestic animal in north-eastern Africa took place at the fringe between late antiquity and the early medieval period.

Besides these few chronological evidences, the – in general – still rather diffuse internal chronology of the majority of archaeological record documented along the Wadi Abu Dom causes some difficulties, which hopefully can be clarified by intensified field research in future. Nevertheless, the recognizable spatial patterns between the different categories of archaeological record imply their mutual structural interdependency.

2.3 Land cover analysis

For estimating stable or fluctuating land use strategies on a long-term basis, multispectral satellite data in context with geostatistical evidence from the archaeological record was used. The correlation between the development of irrigation schemes and wells dating at least from the medieval period was investigated recently, and showed that the western part of El Rum Oasis (around the settlement of Umm Ruweim) had a comparably stable land use character over longer periods, while the eastern part (around Quweib and Umm Khafour) at the edge towards the rangelands of the middle Wadi Abu Dom has to be interpreted as a fluctuating cultural landscape (Karberg, in print). Analysis of the development of land use patterns, especially irrigation schemes and natural pasture, was carried out using raster data cluster analysis using ERDAS Imagine software provided by the Institute for Geoinformatics of the University of Muenster, based on the standardized *Normalized Difference Vegetation Index* (Tucker *et al.*, 2005).

3. Categories of Rock Art around El Rum Oasis

The majority of rock art sites along the Wadi Abu Dom – 151 panels – is situated in the lower Wadi Abu Dom around the oases of El Rum and Ghazali (Fig. 3). The predominant motif categories consist of depictions of cattle, camels, human beings, crosses, and geometric motifs.

Most elaborate abstract geometric rock drawings concentrate at a narrow passage along a tributary khor; this rock art station most probably dates back to the Neolithic period (Karberg, 2014). Since there are no indications that the role of the oases of El Rum and Ghazali as ecologically favoured zones date back to this time, this specific rock art station is not further integrated into the analysis this paper is based on.

Cattle depictions are predominantly (21 out of altogether 25 panels) found at on single rock outcrop at the southern bank terrace of the Wadi Abu Dom downstream the oasis of Ghazali; the other four rock art panels depicting cattle are situated in its immediate vicinity (Fig. 4 & 5). Camel depictions are more widespread within the whole Wadi Abu Dom, but also concentrate predominantly in the lower wadi. Most camel depictions are found along pathways leading from the Wadi Abu Dom southward towards Wadi Barkol (Fig. 6 & 7). Depictions of crosses and other Christian motifs (including short inscriptions, cf. Tsakos, 2018) are distributed in two different ways along the lower Wadi Abu Dom: First, these Christian religious symbols are concentrated around the monastery of Ghazali, and obviously connected with the specific religious landscape defined by the monastery. This includes a small shelter ("Michael's hermitage") in some distance from the monastery, most probably the habitation site of an anchorite which depended to the monastic organization (Karberg & Lohwasser, 2018a, pp. 71-77; cf. also Eger *et al.*, 2019). Besides these concentrations of Christian rock art motifs clearly connected to monastic life at Ghazali, another agglomeration of cross depictions and some other Christian motifs (but without any accompanying inscriptions) is found south of El Rum oasis. Closely connected with camel depictions are rock drawings of human beings. Many of them form integrated scenes with the camels (human beings are depicting tending or riding the camels), but solitary depictions of human beings are also in many cases

closely related to camel depictions. Other depictions – like giraffes, dogs, bows, or sandal prints – are found only singularly within the rock art corpus of the Wadi Abu Dom. They can be compared to similar motifs in other regions (Karberg, 2018), but their low distribution over the study area makes it inappropriate to incorporate them into a quantitative analysis.

4. Spatial distribution of rock art

4.1 Distribution patterns

Especially the depictions of camels and cattle, typical livestock associated with pastoral production modes, seems to imply that rock art in this part of the Sudan was primarily an artistic statement of mobile pastoral social groups. The spatial distribution patterns of rock art panels, however, seem to contradict this assumption to some extent.

During the survey in the Wadi Abu Dom, different archaeological features indicating either sedentary-agricultural or mobile-pastoral relations of production turned out to be clearly differentiated from each other. Temporary camp structures and long-term sedentary habitation sites correlate spatially to wells, irrigation schemes, or natural pasture. Spatial distribution patterns of both archaeological indicators define "land for mobility" and "land for settlement" in and around the lower Wadi Abu Dom. Compared to the distribution patterns of rock art depictions, the allocation of typical pastoral motifs like livestock with mobility indicators in the archaeological record could be expected. When analysing at the data, however, it turns out that such an anticipated spatial allocation cannot be observed – on contrary, in many parts of the Wadi Abu Dom rock art – surprisingly especially motifs with a pastoral connotation like cattle and camels – are spatially correlated to archaeological indicators of sedentary-agricultural relations of production.

When spatially comparing the distribution of rock art in the whole of the Wadi Abu Dom with patterns of mobility and sedentarism in the archaeological record in general, it is obvious that the lower Wadi Abu Dom (with the oases of El Rum and Ghazali) is dominated by sedentarism indicators, while the middle and upper Wadi Abu Dom are dominated by mobility indicators with only some few regional clusters of archaeological features indicating sedentarism. Rock art clusters are, however, predominantly found in the lower wadi, with only one single larger cluster in the upper wadi south of the Jebel Sultaniya – interestingly not far away from a small cluster of permanent habitation sites dating to the medieval period (Fig. 8).

Also, when focusing on the lower wadi with its oases, no spatial correlation between rock art clusters and small-scale density kernels of archaeological mobility indicators are visible (Fig. 9). Indeed, rock art clusters are rather found in spatial context with specific path networks, and the course of the main wadi itself. Remarkably, the vast majority of rock art in the lower Wadi Abu Dom is found between the oasis of Ghazali and the western part of El Rum oasis (Fig. 10), where irrigation was more stable on a long-term basis as in the eastern part of the oasis (Karberg, in print). Additionally, the fact that the vast majority (97%) of rock art panels in the lower Wadi Abu Dom are found at the southern wadi bank or its hinterland – the areas north of the main wadi are almost empty of rock art.

When looking at different categories of rock art, specific spatial distribution patterns become even more obvious. First of all, the concentration of almost all cattle depictions at or at least around one single spot is obvious. This spot is not directly associated with the oasis of Ghazali, but situated west of it only 13 km away from the Nile. Camel depictions are in most cases not associated with dense kernels of archaeological features indicating pastoral mobility (as it might be assumed), but merely with linear path remains leading away from the oases of the lower Wadi Abu Dom. Christian motifs and depictions of human beings are either associated with the specific cult landscape around the monastery of Ghazali, or otherwise in most cases found in close relationship to camel depictions.

4.2 Alignment of rock art, other archaeological features, and cultural landscape elements

The mutual alignment of spatial distribution patterns of the different categories of rock art with each other (Fig. 11) as well as with archaeological features indicating sedentarism and mobility show that in the Wadi Abu Dom rock art cannot be assumed to be a pastoral concept of art. On the contrary, no spatial relations between rock art (especially of motifs like cattle and camels which could have been associated with pastoral relations of production) and "zones of mobility" defined by dense kernels of archaeological features indicating mobility. This is true on a short-ranged as well as a middle-ranged level: When looking at the course of the Wadi Abu Dom as a whole, it turns out that most rock art is concentrated in the lower wadi dominated by oases, and declines rapidly in the middle and upper wadi which was in most periods dominated by pastoral relations of production (Karberg & Lohwasser, 2018b). On a short-ranged level, when analysing density kernels of mobility indicators on the basis of 750 by 750 m spatial cells and comparing them to clusters of rock art, also no direct alignment can be stated for the lower Wadi Abu Dom in particular.

Interestingly, especially cattle depictions do not correspond at all not only with general archaeological indicators of mobility (and therefore pastoral production), but also with archaeologically testified evidence for cattle keeping. In the pastoral society of late antiquity in the middle and upper Wadi Abu Dom, cattle keeping and beef consumption at least by a local elite can be derived from archaeozoological material from the elite settlement complex of El Tuweina (Morgenstern, in preparation). This pastoral cattle keeping system reconstructed from the archaeological record does not correspond to any cattle depictions in rock art in this part of the wadi. On the contrary, the only cattle depictions in the Wadi Abu Dom are neither aligned with the zone of pastoral economy nor with the oasis landscape of the lower wadi, but exclusively close to the wadi mouth into the Nile. This direct connection with

the immediate hinterland of the riverine zone might indicate that the cattle depictions do not result from a (oasis-based or pastoral) wadi economy, but was socio-economically connected to the riverine zone.
Concerning camel depictions, the close mutual alignment of density kernels of camel drawings with depictions of human beings as well as Christian motifs is evident. All these rock art conglomerates are neither spatially aligned with archaeological indicators of pastoral mobility, nor with areas of natural pasture deduced from multispectral satellite imagery analysis. Interestingly, the only major category of archaeological and landscape data to be spatially connected to this joint clusters of rock art depictions of camels, human figures, and Christian symbols are path relicts leading southward from the oases of the lower Wadi Abu Dom; the rock art clusters are situated near some passages through a rocky ridge delimiting the immediate hinterland of the wadi banks to the south.
Other clusters of rock art depicting Christian motifs and human beings are closely connected to the monastery of Ghazali, which can be assumed to be merely an exclave of Nile-valley based Christian culture, and not closely connected to the religious life of the indigenous inhabitants of the Wadi Abu Dom and the Bayuda rangelands in general (Eger *et al.*, 2019).

5. Conclusions

In general, the spatial distribution patterns of different categories of rock art in the Wadi Abu Dom do not indicate a close entanglement of this artistic genre with socio-economic patterns of the inhabitants of the wadi oases of the lower, or the pastoralists of the middle and upper Wadi Abu Dom. Cattle depictions are exclusively found in the immediate hinterland of the riverine cultivation zone of the Nile valley, downstream of the oases of the lower Wadi Abu Dom. This might indicate that these cattle depictions were not created by local inhabitants, but by Nile-valley based herders who drove cattle on a short-ranged level upwards from the cultivated land along the riverbanks in order to make use of the natural pasture of the immediate hinterland of the river. Socio-economic relations with the indigenous wadi dwellers remain unclear, further blurred by the indetermined date of the cattle depictions.
Camel depictions and directly associated drawings of human beings and Christian symbols are commonly aligned with linear pathway remains rather than archaeological pastoral mobility indicators or areas of periodic natural pasture. The linearity of these pathways might indicate their role in middle-ranged communication, while network-shaped path remains closely associated with density kernels of archaeological features and zones of periodic natural pasture are to be connected with short-ranged, local communication patterns (Karberg & Lohwasser, 2018a, pp. 80-83; 102-104). The style and motifs of some of the camel depictions, indicating riders or cargo payloads, further indicate a connection of these rock art stations with middle-ranged communication patterns rather than a pastoral or semi-pastoral transhumant lifestyle of the local inhabitants (Fig. 12).
Finally, other clusters of Christian motifs and depictions of human beings associated with Christian inscriptions are connected to the specific cult landscape around the monastery of Ghazali, especially along the route between the monastic centre and religious satellite sites, i.e. "Michael's hermitage". Also in this case some connection with external cultural influences on the Wadi Abu Dom seems likely: First because some general indications that the monks inhabiting the monastery of Ghazali came from outside and were not recruited among the wadi dwellers (Eger *et al.*, 2019), and second because of the presence of Christian rock inscriptions among the rock art stations only in the vicinity of the monastery, while in other parts of the wadi inscriptions on rock or other material are lacking completely in the archaeological record, indicating that the local indigenous population was largely illiterate.
In all this cases, the spatial distribution patterns of rock art point to external sources (also giving an explanation for stylistic similarities between rock drawings in the Wadi Abu Dom and other rock art stations in some distance, cf. Karberg, 2014). Rock art, in general, does not seem to be an artistic expression of the indigenous inhabitants of the Wadi Abu Dom and the central Bayuda, but introduced by outsiders.

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Fig. 1 – The oasis of El Rum. Photo: Baldur Gabriel

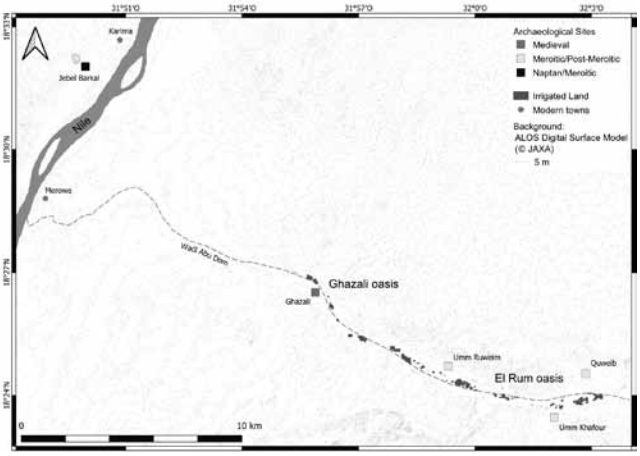

Fig. 2 – The lower Wadi Abu Dom (topographical overview). Map: Tim Karberg; Data Source for topographic contour lines: ALOS DSM © JAXA

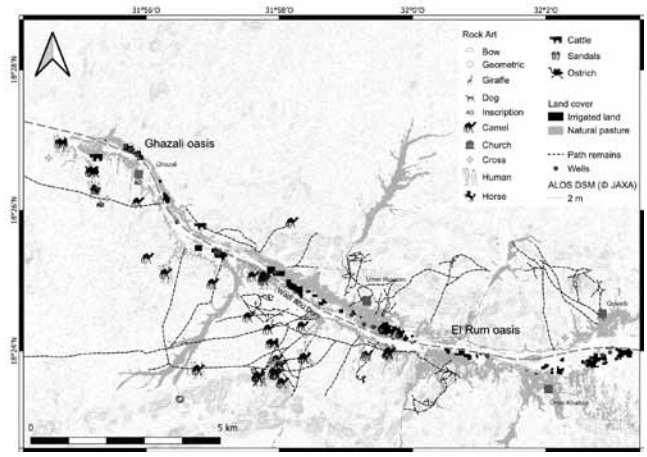

Fig. 3 – Rock art and land cover in the lower Wadi Abu Dom. Map: Tim Karberg; Data Source for topographic contour lines: ALOS DSM © JAXA

Fig. 4 – Cattle depictions west of Ghazali. Photo: Tim Karberg

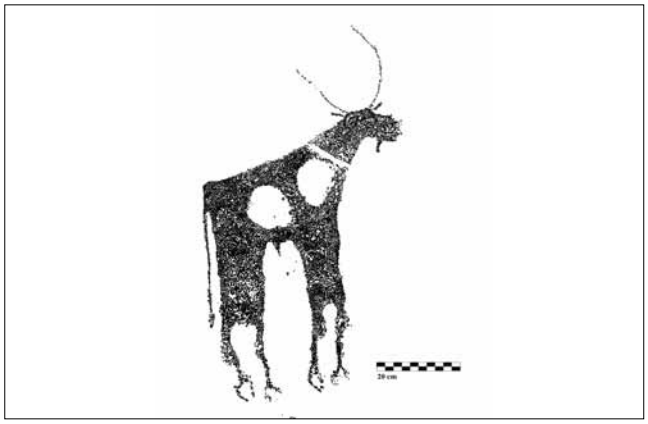

Fig. 5 – Cattle depiction west of Ghazali. Drawing: Tim Karberg

Fig. 6 – Camel depictions south of El Rum. Photo: Laura Haupt

Fig. 7 – Camel depictions south of Ghazali. Photo: Tim Karberg

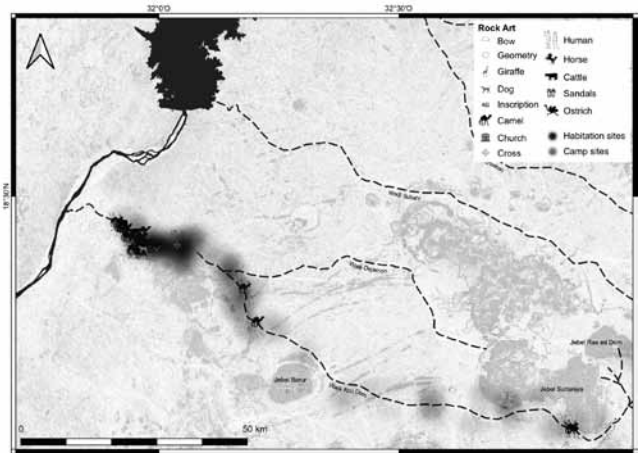

Fig. 8 – General distribution of rock art in relation to archaeological features indicating sedentarism (habitation sites) and pastoral mobility (camp sites). Map: Tim Karberg; Data Source for topographic contour lines: ALOS DSM © JAXA

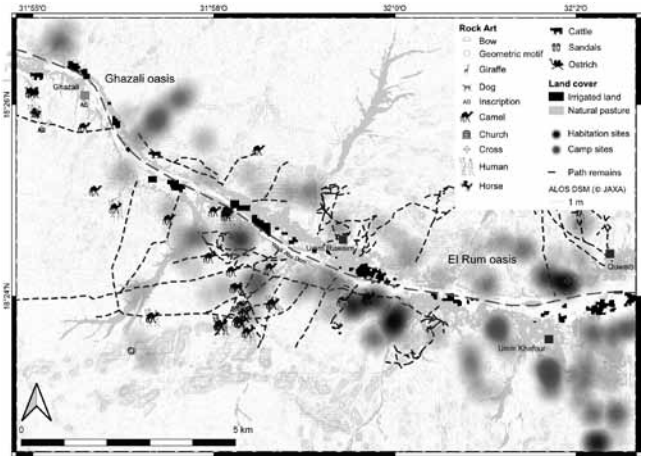

Fig. 9 – Distribution of rock art in relation to archaeological features indicating sedentarism (habitation sites), pastoral mobility (camp sites), path remains, and land cover in the lower Wadi Abu Dom. Map: Tim Karberg; Data Source for topographic contour lines: ALOS DSM © JAXA

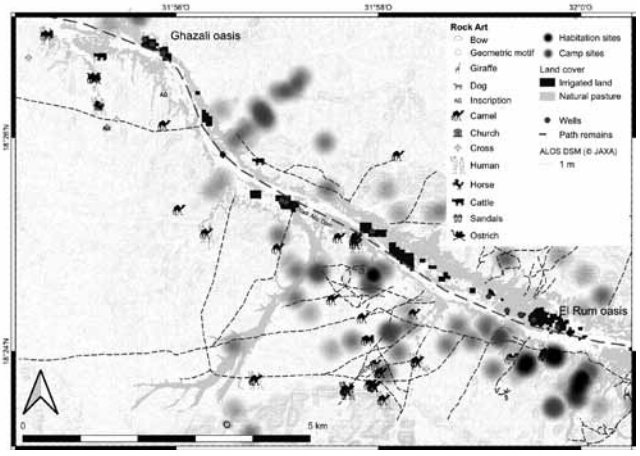

Fig. 10 - Distribution of rock art in relation to archaeological features indicating sedentarism (habitation sites), pastoral mobility (camp sites), path remains, and land cover between Ghazali and the western part of El Rum oasis. Map: Tim Karberg; Data Source for topographic contour lines: ALOS DSM © JAXA

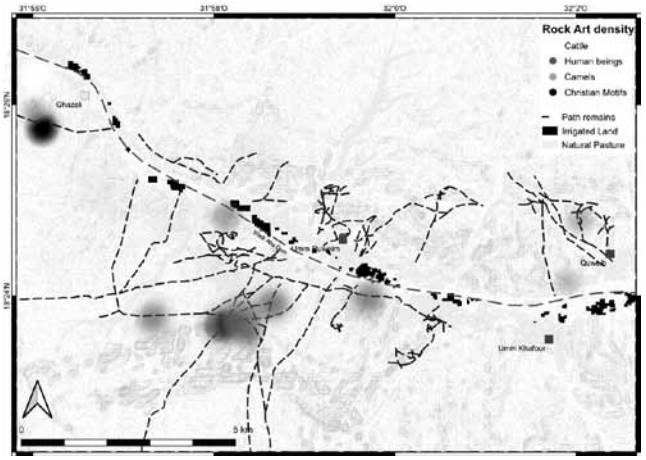

Fig. 11 – Rock art kernel density analysis in relation to path remains and land cover in the lower Wadi Abu Dom. Map: Tim Karberg; Data Source for topographic contour lines: ALOS DSM © JAXA

Fig. 12 – Modern camel mobility around El Rum. Photo: Angelika Lohwasser