Hunters and herders: Exploring the Neolithic transition in the rock art of Shuwaymis, Saudi Arabia

Maria Guagnin *, Richard P. Jennings, Laine Clark-Balzan, Huw S. Groucutt, Ash Parton, Michael D. Petraglia

Research Laboratory for Archaeology and the History of Art, University of Oxford, Dyson Perrins Building, South Parks Road, Oxford OX1 3QY, United Kingdom

ARA-00010; No of Pages 14

Article history:
Received 13 May 2015
Received in revised form 6 August 2015
Accepted 6 August 2015
Available online xxxx

Keywords:
Neolithic transition
Neolithisation
Arabia
Rock art
Dispersal
Autochthonous
Pastoralism
Hunting

ARTICLE INFO

ABSTRACT

In Arabia the transition to a Neolithic economy is thought to be characterised by a shift to mobile pastoralism, rather than the traditional icons of the Neolithic such as sedentism and crop cultivation. However, in the absence of detailed archaeological research, the Early Holocene prehistory of central, northern and northwestern Saudi Arabia remains largely unknown. Here we use the engraved rock art recorded on 254 panels in Shuwaymis, Ha’il Province, and in particular depictions of hunting and herding scenes, to identify evidence on the character of the Neolithic transition in the region. Due to high levels of erosion it was not possible to carry out spatial analysis of the sites. However, the content and stratigraphic relationship of hunting and herding panels, re-engraving events, and cultural markers related to human figures were analysed. The results show that the engravings can be divided into an exclusive hunting period, where equids are frequently being hunted. Domestic cattle are often placed over and integrated into existing hunting scenes by re-engraving parts of the scene and turning hunting figures into herding figures. Cultural markers associated with human depictions such as headdresses and possible penis sheaths continue across both periods. The evidence in the rock art indicates that herding was adopted by local hunters. Moreover, the rock art shows that herders identified with the depicted hunters and that ibex hunting remained part of the image repertoire, and potentially of the subsistence economy, throughout the Holocene.

© 2015 Elsevier Ltd. All rights reserved.

1. Introduction

Archaeological investigations in the Fertile Crescent have improved our understanding of the nature and timing of plant and animal domestication in the Ancient Near East. South of this region in the Arabian Peninsula the picture concerning the origins and spread of domestication is much less clear. In Arabia, it is argued that the transition from hunting and gathering to economies utilising domesticates centred on mobile herding rather than crop production. The origin of animal domestication in Arabia remains uncertain, as is whether domestic livestock was adopted by local hunter–gatherer societies or introduced by expanding herder populations (Crassard and Drechsler, 2013; Drechsler, 2007; Magee, 2014; Martin, 1999).

In the Arabian Peninsula, it has been suggested that livestock was introduced from the Levant. Sparsely dated faunal remains from sites along the eastern and southern fringes of the peninsula suggest that cattle, sheep and goat were probably introduced as a package between 6800 and 6200 cal BC (Drechsler, 2007: 95). Their assumed Levantine origin is based on the fact that domestication in the Levant pre-dates the earliest occurrence of domestic animals on the Arabian Peninsula and that archaeological sites in southern Arabia lie outside the natural range of the wild predecessors of domestic sheep and goat (Boivin and Fuller, 2009: 133; Crassard and Drechsler, 2013; Drechsler, 2007; Magee, 2014: 49). A different narrative exists for the south of the peninsula, where early pastoral contexts appear to show commonalities with cattle cults of early Holocene African herders (McCorriston and Martin, 2009).

The transition to herding in Arabia took place against the backdrop of a dramatically changing climate, characterised by a shift from arid to humid conditions and a subsequent expansion of vegetation in many regions. These changes, however, were neither temporally nor spatially uniform. Records from northern regions (e.g. Whitney et al., 1983; Parker et al., 2006; Preston et al., 2012) suggest that increased humidity occurred between ca. 8–7000 cal BC. However, at the Jubbah oasis in the Nejd, lake formation occurred as early as ca. 10,000 cal BC (Hilbert et al., 2014). These climatic conditions are notably contrasted with those of the Levant, where drier conditions persisted during the early Holocene (e.g. Enzel et al., 2008; Petit-Maire et al., 2010; Vaks et al., 2010). Therefore, while existing herder populations were assumed to have moved into new environments that were now rich in resources (Drechsler, 2007; 2009; Magee, 2014), the demographic spread of populations would likely have exhibited spatial and temporal variability.

Here, we demonstrate how rock art imagery from the north of the Arabian Peninsula can shed light on the nature of the transition from...
hunting to herding in this region. The Arabian Peninsula has a rich rock art heritage that spans several millennia and dates from at least the Early Holocene to the recent past (Jennings et al., 2013; Khan, 1993, 2007). While early images predominantly depict animals and human figures, often in herding or hunting scenes, later periods are dominated by representations of riders on horseback and camels. During the Iron Age, inscriptions became increasingly common and sometimes provide a commentary to figurative engravings (Anati, 1974; Khan, 2007; Macdonald, 2010).

Our research focuses on the rock art site of Shuwaymis, ‘Ha’il Province, Saudi Arabia (26° 9’8.51″N, 39°53’52.72″E), where an exceptionally large number of engraved panels is preserved (Fig. 1). Many are skilfully pecked and incised representations of wild and domestic fauna, often accompanied by human figures. An advanced degree of weathering and patination suggests an early age, although the absence of radiometric dates of rock art across the peninsula means that this is uncertain. The wealth of imagery and its longevity have led to the site being inscribed for UNESCO world heritage status (UNESCO, 2015; see also al-Saud and Khan, 2005; Bednarik and Khan, 2005). In 2013, part of the site was recorded on the request of the Saudi Commission for Tourism and Antiquities by a team from the University of Oxford’s Palaeodeserts Project using high-resolution geospatial surveying techniques (Jennings et al., 2014). A total of 254 individual rock art panels, many of which contain hunter and herder imagery, were recorded during this survey.

Although the rock art is likely to contain many layers of meaning that are no longer accessible to us, the images nevertheless do contain many elements of interest. For instance, depictions of hunting scenes and domestic animals provide evidence of subsistence economy and their stratigraphy mirrors the transition to a ‘Neolithic lifestyle’. The combination of animal and human depictions in scenes, and the physical characteristics, clothing and accessories of human figures capture elements of the engravers’ socio-cultural background. The aim of this paper is to present a new research approach, where evidence relating to the subsistence economy and cultural background of the engravers is identified. In the absence of other archaeological data the rock art can then be used to provide information on the nature of the Neolithic transition, and the identity of early pastoralists in northern Arabia. If pastoralism was introduced in a migration of herders we can expect to see a break in the rock art tradition. If, on the other hand, pastoralism was adopted by the hunters of Shuwaymis, we should be able to identify clear indications of cultural continuity.

2. The Neolithic transition in Northern Arabia

There is much debate about the origin of early domestic animals and the nature of their introduction in northern Arabia. A dispersal of Levantine herders across the Arabian Peninsula was suggested on the basis that cattle, sheep and goat appear more or less simultaneously in the archaeological record, and because some lithic assemblages of the early Neolithic have been argued to display similarities with Levantine Pre-Pottery Neolithic B (PPNB) traditions, which date between 8800 and 6900 cal BC. With the onset of moist conditions during the PPNB, Levantine herders are thought to have penetrated the Arabian Peninsula to exploit the newly established pastures (Drechsler, 2007; Magee, 2014). However, others have argued that the inclusion of domestic animals in the subsistence economy may have begun as a pioneering strategy where local hunter–gatherers began to herd introduced domestic livestock (Boivin and Fuller, 2009: 133; McCorriston and Martin, 2009: 248). In this scenario, herding became part of a broad subsistence economy that still heavily relied on the exploitation of wild resources and may be separated from full-scale pastoralism by as much as one thousand years (Martin, 1999; McCorriston and Martin, 2009: 238). A combination of both models is an additional possibility, as Neolithisation may have followed different patterns in different parts of the Arabian Peninsula (Crassard and Drechsler, 2013). However, the discussion is currently exclusively based on sites and dated faunal remains in Yemen, Oman, UAE, Qatar and Kuwait as well as the eastern and southern border regions of Saudi Arabia (see Drechsler, 2007). The archaeology of the early Holocene and the nature of the Neolithic transition in the centre, west and northwest of Saudi Arabia remain almost entirely unknown (Groucutt and Petraglia, 2012).

Analysis of faunal remains in the Levant suggests that the spread of herding among PPNB communities in the steppe of eastern Jordan was accompanied by continuity in the archaeozoological record (Martin, 1999). This indicates that local hunters must have adopted herding practices, because the alternative scenario of the arrival of herders from outside the area would be expected to have left a detectable imprint in the faunal and archaeological record (Martin, 1999, see also Byrd, 1992; Betts, 1993, 2013). However, others have argued that the spread of herding into the arid landscapes of eastern Jordan was the result of larger scale movements of herders who sought to relieve grazing pressure on fields around permanent settlements during the wet season. This model also proposes increasing reliance on dairy as a more efficient exploitation of steppe vegetation and an exchange system between agricultural and pastoral goods. In addition, hunting of gazelle is thought to have made caprine herding more sustainable (Köhler-Rollefson, 1988; Rollefson et al., 2014). In general, the Neolithic expansion into the arid regions of the southern Levant and eastern Jordan appears to have been based on a subsistence strategy that incorporated the hunting of wild animals, seasonal agriculture, and caprine herding (see for example Henry et al., 2003; Rollefson et al., 2014). This is in contrast to the Arabian model, where there is no evidence for crop cultivation or sedentism (Magee, 2014).

The recent discovery of el-Khiam and Helwan points similar to those from the PPNB at Jebel Qattar (QJ-101) at the Jubbah Palaeolake, in the southern Nefud Desert, indicates incursions from Levant, combined with a unique local manufacturing strategy (Crassard et al., 2013). Local populations may therefore have adopted styles and ideas introduced by indigenous Levantine producers.
by small numbers of people from the north. However, the extent and character of these cultural and demographic exchanges remain unknown, although on the basis of genetic evidence, it is clear that there are admixtures between populations in the Levant and Arabia, as well as introductions of people from the Levant (Fernandes et al., 2015). No structural features were found at the site, but the lithics suggest that mobile hunting populations repeatedly occupied it between 10,500 and 5000 cal BC (Crassard et al., 2013). Whether the site occupants practised herding is unclear.

While the archaeological record provides some evidence for introduction and for local development, the nature of the Neolithic transition in northwestern Arabia remains unknown. The rock art of Shuwaymis was created throughout the early Holocene and can be analysed for evidence of continuity or change, migration of herders or adoption of livestock keeping by indigenous hunter–gatherer groups.

3. Physical setting

Shuwaymis is located 190 km north of Medina, at the southern end of a valley that runs in a broad north–south direction and contains a number of relic wadis (Fig. 1). The area came to the attention of the Saudi Commission for Tourism and Antiquities as recently as 2001, owing to its remote location (Bednarik and Khan, 2002). In 2013, the Palaeodeserts Project precisely mapped a portion of the complex, resulting in the recording of 254 panels. These were located on the eastern side of the valley, on a sandstone escarpment that is 800 m long. Numerous boulders and low lying cliff faces line the lower slopes and the valley floor beneath the escarpment which rises to a plateau about 30 m high. Engravings were predominantly recorded on boulders along the lower slopes of the escarpment where they are easily accessible from the wadi floor. These boulders have probably formed as a result of erosion, which continues to weaken the escarpment and dislodge boulders, although tectonic activity has also been discussed (Bednarik and Khan, 2002; Jennings et al., 2014). In addition, the intensity of daily temperature contrasts in desert environments has been found to cause fractures in the rock (Cremaschi, 1998: 28). As a result many of the boulders have fallen throughout prehistory. This is particularly evident where boulders with engravings have tumbled off the escarpment and come to rest on the engraved surface or with the engraved panel lying upside down. Many of these surfaces were then re-engraved in later periods (Jennings et al., 2014).

4. Methodology and dataset

We used the 254 panels recorded by the Palaeodeserts Project to address our research questions. Each panel was photographed and a description of the panel was made in the field. The engraving composition on each rock surface was analysed, stratigraphic information was recorded, and scenes and re-engraving events were differentiated. To compensate for problems with lighting, particularly where panels were photographed against backlight, contrast was adjusted using Adobe Photoshop. The software maps the darkest pixels in the image to pure black and the lightest pixels to pure white, which increases the sharpness of the image and the visibility of any engravings. In addition, DStretch was used on some of the photographs to enhance subtle differences in colour (see Harman, 2008). This increased the visibility of engravings against the bedrock and also highlighted differences in patina and weathering. Where present, scenes from different engraving events were identified and their content was analysed. In addition, each animal engraving was assessed separately. Where possible the species was identified, the stratigraphic relationship to other engravings was noted and the level of erosion was determined. In addition, all human depictions were catalogued and physical characteristics, accessories, and the presence of hunting equipment such as bows were noted. This information was recorded in a database that links the information with photographs and was specifically designed to allow filtering for different types of images or traits of the physical engraving such as the degree of erosion.

The assessment of the panels’ content and stratigraphy forms the basis of a differentiation between hunter and herder imagery and the database facilitates a detailed analysis of the engraving content and depicted animal species. In total, on 254 recorded rock art panels 1902 individual animal depictions and 180 human figures were preserved and sufficiently visible to allow identification and analysis.

The dataset also allows an assessment of the level of preservation and potential taphonomic loss at the site. Spatial distribution is a common tool to assess continuity and change between different types of rock art, and in particular between hunter–gatherer and Neolithic rock art (see for example Cruz Berrocal and Vicent García, 2007; Guagnin, 2010; 2012). However, it is a methodology that requires a high level and uniform pattern of preservation. Based on the scale of destruction observed on some of the panels, where only few engravings remain along the fringes (Fig. 2) we must assume that a considerable amount of early engravings has been lost.

4.1 Preservation of rock art at Shuwaymis

The photographic record of the Palaeodeserts survey of Shuwaymis is of high quality and allows a detailed assessment of the level of preservation for each engraving. The engravings were grouped into six categories, classified by the impact weathering or erosion have had on the visibility of each petroglyph (Table 1). This desktop assessment had the added benefit that preservation categories could be checked against each other. While there will always be a small degree of overlap between categories, this ensured that the blurring between preservation types was minimized.

The level of preservation was found to be affected by the engraving method. Thin lines and shallow grooves were more prone to weathering and erosion, and coarse pecking was more likely to result in reduced visibility. Additionally, in some cases superimpositions were found to destabilise the rock surface and lead to increased erosion and loss of visibility. It was not possible to separate the effects of the engraving method and weathering. Nevertheless, the assessment shows a clear pattern. A total of 41% of the engravings are currently not at risk. However, 35% of the engravings are partly exfoliated or eroded and under immediate threat and in 5% of the engravings visibility has been compromised by weathering or erosion (Fig. 3).

Erosion appears to affect both ancient and recent engravings. This suggests that erosion is not only a function of time. Analysis of erosion patterns within the spatial clusters identified in Jennings et al. (2014) shows that clusters on promontories have suffered slightly higher rates of erosion. Although sample numbers are relatively small and therefore subject to a fair amount of variation, this indicates that erosion may be caused by exposure to wind. Additionally, given the degree of increased humidity during the early–mid Holocene, it is likely that earlier panels were subject to much higher rates of chemical weathering.

A small (1.3 m depth) test pit excavated next to a fallen boulder (Panel 165) revealed that the rock surface had been subjected to significantly different patterns of erosion above and below the modern sediment surface (Fig. 4). When excavated, the sediment backed against the boulder comprised nearly horizontal, slightly dipping, red sand layers occasionally interspersed with small stone clasts (1–2 mm or less). These clasts are likely weathering spall, which has fallen from the inclined boulder surface above. A ca. 5 cm layer (38–43 cm depth) with significantly more and larger spall (up to 1 cm diameter) indicates that the speed of erosion has fluctuated significantly. These rock fragments are spread uniformly in a horizontal layer underneath the overhanging boulder, which suggests that they have fallen from above and are not being eroded and transported through the sediment by sub-surface processes.

The accumulation of sand appears to have directly affected erosion. Dark surface patina, which can be seen on the boulder above, was either
abraded during the course of sand deposition, or was prevented from forming by the presence of sand. In addition, the surface underlying the current sand accumulation is heavily pitted. Modern day water content in both samples is less than 0.3%, as the sand drains relatively rapidly, and it is not expected to have been significantly higher in the past. It therefore seems likely that the erosion on Panel 165 was not caused by moisture but through salts contained within the sand or by mechanical wind abrasion during the deposition of the sand.

The excavated test pit also uncovered several engravings of cattle and dogs. Prior to its re-deposition, the panel was engraved with three ibex and a hunting scene, followed by the addition of a number of cattle around the fringes of the panel. The direction of the engravings found below the sand suggests that they may have been engraved after the fall and in the present position of the boulder. Despite a fair amount of weathering and patina formation, earlier engravings higher up on the boulder are much better preserved than those covered in sand.

Two sediment samples (66 cm and 116 cm depth) were collected for optically stimulated luminescence dating, which calculates the amount of time elapsed since mineral crystals in sediment have last been exposed to sunlight (Aitken, 1998). These were prepared and measured at the Research Laboratory for Archaeology and the History of Art, University of Oxford according to the method in Hilbert et al. (2014; minor changes noted in Table 2). An age of 370 ± 20 years was obtained for the sediment horizontally adjacent to the engraved cow (Fig. 5), while an age of 950 ± 70 years was calculated for the lower sample. These ages indicate that significant subsurface weathering can occur in a relatively short amount of time, and that fallen boulders are particularly at risk. In Shuwaymis East, 17 fallen boulders with a total of 28 engraved panels were recorded.

Table 1

<table>
<thead>
<tr>
<th>Level of preservation</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Well preserved</td>
<td>Engraving looks fresh and crisp, peck marks are clearly visible.</td>
</tr>
<tr>
<td>Moderately weathered</td>
<td>Outline and peck marks have faded but the engraving is still very crisp and clear; visibility of the image is not affected.</td>
</tr>
<tr>
<td>Heavily weathered</td>
<td>Engraving still clear but rock surface beginning to break down. Visibility starting to be affected.</td>
</tr>
<tr>
<td>Eroded</td>
<td>Visibility of the engraving is compromised by the loss of grains from the rock surface.</td>
</tr>
<tr>
<td>Partly exfoliated</td>
<td>The rock surface has exfoliated over part of the engraving.</td>
</tr>
<tr>
<td>Obliterated</td>
<td>The figure is completely covered by later engravings; visibility is usually heavily compromised.</td>
</tr>
<tr>
<td></td>
<td>For one rock surface no photographs were available and preservation could not be assessed.</td>
</tr>
</tbody>
</table>

Fig. 2. Shuwaymis East, Panel 17. The upper part of the panel is heavily exfoliated. On the upper left two eroded and patinated engravings of dogs are still visible. This type of engraving is typical for large hunting scenes.

Fig. 3. Level of preservation at Shuwaymis, actual numbers of affected engravings are given in brackets. Segments outlined in red represent engravings whose visibility is affected by weathering or erosion. For 12 engravings the level of preservation could not be assessed: 7 were obliterated by later engravings and 5 had insufficient photographic evidence. For a description of the individual categories see Table 1. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)
Further investigations of erosion causes will have to be tested through more detailed spatial analyses and geomorphological analyses in the field. The evident loss, however, of an unknown number of panels and the intensity of erosion on promontories and fallen boulders leave the rock art unsuitable for spatial analysis as a means of identifying patterns of continuity or change between hunting and herding imagery. Nevertheless, the rock art of Shuwaymis East contains a wide range of hunting scenes and a cross section of panels from a wide range of ages. It is therefore well suited for an analysis of the content, cultural markers and stratigraphic relationships that mark the transition from hunter to herder imagery.

Four key aspects of the rock art were analysed in order to investigate the transition from hunting to herding at Shuwaymis. First, the stratigraphic relationship between hunting and herding scenes was examined. Although only few panels contain a clear hunter–herder engraving sequence, superimpositions and the integration of older elements into the newly created scenes offer information on the engravers’ relationship with existing rock art. Secondly, hunting scenes were analysed with regard to the depiction of human figures and hunted animals in order to gain an understanding of rock art traditions and cultural contexts. This allowed us to further identify to what extent hunting scenes predate or overlap herding images. Thirdly, depictions of aurochs and domestic cattle were analysed. This identified the context in which wild predecessors and domestic livestock were depicted, clarified the domestic status and stratigraphic position of cattle depictions on hunting panels and secured the distinction between hunting and herding images. Finally, an assessment of the engraved human figures was made that focussed on stylistic and cultural markers of the depicted hunters and herders to identify elements of cultural continuity. If local hunter–gatherers adopted herding we should expect to observe a clear difference in stratigraphy and content between hunting and early herding images as well as markers of cultural continuity.

![Fig. 4. Panel 165 with test pit. A hunting scene with ibex is visible at the top of the panel and the rock surface is heavily patinated. In the excavated area stylised depictions of cattle can be seen on this photo.](image)

**Table 2**: Optically stimulated luminescence dating results. Samples were collected from excavation and measured via multigrain aliquots ~3–4 mm in diameter. a) Rejection criteria results and calculated equivalent doses. b) Dose rate values and calculated ages. Methods and calculations are described in Hilbert et al. (2014), with alterations noted below.

<table>
<thead>
<tr>
<th>Sample</th>
<th>Measured[#]</th>
<th>Signal/Tn error</th>
<th>Zero ratio[a]</th>
<th>Recycling ratio</th>
<th>IR depletion ratio</th>
<th>Accepted[#]</th>
<th>D<a href="Gy">e</a></th>
<th>Overdisp. (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SHU-OSL1</td>
<td>15</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>2</td>
<td>12</td>
<td>0.41 ± 0.02</td>
<td>-</td>
</tr>
<tr>
<td>SHU-OSL2</td>
<td>15</td>
<td>2</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>10</td>
<td>1.41 ± 0.09</td>
<td>17.6 ± 4.8</td>
</tr>
</tbody>
</table>

a) For sample SHU-OSL1, an aliquot was accepted if the zero ratio was within 2σ of zero, or if \(L_{zero}/T_{zero} = 0.3\) *LN/TN.

b) The equivalent dose was calculated for SHU-OSL1 via an unlogged common age model, due to zero overdispersion and the presence of aliquots with equivalent doses indistinguishable from zero. A standard central age model was used for sample SHU-OSL2. Both models are described in Galbraith et al. (1999).

c) In situ gamma dose rates measured with a Canberra Inspector 1000 gamma spectrometer.

d) Cosmic dose rates were halved to account for the effects of the adjacent boulder and escarpment.

e) As found water contents were ~0.3% (water/wet sediment) for both samples; ages were calculated with an average burial content of 1.5 ± 0.8% to account for changes in moisture content through time.

Please cite this article as: Guagnin, M., et al., Hunters and herders: Exploring the Neolithic transition in the rock art of Shuwaymis, Saudi Arabia, Archaeological Research in Asia (2015), http://dx.doi.org/10.1016/j.jara.2015.08.001
5. Results

5.1. Stratigraphic relationships between hunting and herding scenes

Due to the high level of erosion, hunter–herder stratigraphic relationships were only identified on four panels. The best preserved example was found on Panel 161A at Shuwaymis East (Fig. 6). A tracing of the engraved panel clearly shows the original scene (traced in white), which depicted three human figures, two of which can be seen holding bows, hunting an equid. In addition, 16 dogs were involved in this hunt. This is a common theme in Shuwaymis where equid hunts are often depicted with a large number of dogs. The human figures in the hunting scene were depicted with very narrow bodies, two long thin legs, and with thin arms holding a bow. Both arms are visible — the arm holding the bow as well as the arm pulling back the arrow.

Three cattle were added to the scene at a later date and are superimposed on dogs and human figures. The ox at the bottom of the panel is superimposed on two dogs, while the large ox on the right is engraved over a human figure and its horns clearly cut through another dog. (Note that the term ox is used in its historic form here to describe the singular of “cattle”). Three of the hunting dogs (traced in white and blue lines, between the right most ox and the equid) were re-engraved to fit into the newly created herding scene. In addition, the hunter in the centre of the panel was re-engraved with a slightly different human depiction, where shoulders are broad and no limbs are shown. This superimposed style of human depiction is very similar.
to the earlier figure in that the body shape is still very narrow, and the neck and head are depicted in a similar way. While the body was re-engraved to form the new body shape, legs, arms, and bow were not re-traced. This different shape is also visible in the human figure that was added with the herding scene and engraved over the equid and a dog. While it has broad shoulders and a simplified head, no arms are visible and the legs are merged with the tips of two feet. Interestingly, both the hunting figure on the left and the herder figure are shown with a feather like accessory on the head. At a later date both the hunting and the herding scene were superimposed with a number of camel and ibex depictions.

The re-use of hunting panels for the creation of herding scenes suggests a degree of cultural continuity. The act of integrating earlier images into the engraved scene indicates that they still carried meaning to the engraver. Rather than choosing a new rock surface, images were re-used, but the activity portrayed was changed from hunting to herding. Particularly the re-shaping of hunting figures into herding figures by re-working the body but omitting extremities and hunting equipment is striking and may indicate that the engravers identified with the depicted hunters.

The placing of hunting over herding scenes is also evident on two panels recorded by the Arabian Rock Art Heritage Project in Shuwaymis West, called ‘Shuwaymis West’ and ‘Shuwaymis West hunting party’ (Olsen and Bryant, 2015a, Olsen and Bryant, 2015b). Despite continued episodes of re-engraving and numerous superimpositions, the panels clearly show that cattle were engraved over an existing hunting scene. As on Panel 161A, some hunters and dogs were re-engraved when the herding imagery was added. Similarly, weathering and patina indicate that the superimposition of the herding scene may have taken place not too long after the hunting scene was created.

On the left of the ‘Shuwaymis West’ panel the original hunting scene is still clearly visible; a number of hunters are depicted pointing their bows at an equid and a leopard. An ox can be seen engraved over the top of the scene (Fig. 7). In addition cattle are engraved over a number of humans and dogs on the right of the main panel. Some of the humans were partly re-engraved to turn hunters into herders, in a similar fashion to panel 161A. While the body is re-shaped, arms and legs are not integrated into the new human depicton.

Superimposition of cattle over a hunting figure with bow and a leopard is also visible on the panel ‘Shuwaymis West Hunting Party’ (Fig. 8). However, the animal originally being hunted is no longer visible. Lines within one of the large ox depictions may indicate that an underlying image was erased in the process of its creation. Re-working is again visible on the main hunting figure, where the body was re-shaped to have broad shoulders and legs were merged, but the arms holding the bow clearly show darker patina and more advanced weathering.

The stratigraphy of the rock art panels in Shuwaymis clearly shows that there is a phase of hunting scenes that pre-date the herder imagery. This indicates that hunting scenes were created by indigenous hunter-gatherers before the introduction of domestic livestock.

Although panels with a clear stratigraphy of hunting and herding scenes are relatively rare at Shuwaymis, the existing examples suggest that re-engraving events and re-shaping of hunting into herding scenes were an integral part of the engraving tradition. The custom of placing herding over hunting scenes and the act of re-engraving and integrating the new images into the older scene (including the re-shaping of human figures) suggest continuity in the rock art tradition across an economic transition from exclusive hunting to herding. However, in order to secure this observed dichotomy between hunting and herding rock art, the content of the hunting scenes and the treatment of wild and domestic animals in the engravings need to be investigated further as discussed below.

5.2. Hunting scenes

Depictions of humans with bows were used to identify hunting scenes. Due to erosion some of these hunter figures may have been...
lost and it is possible that a number of other panels initially depicted hunting scenes. In the area surveyed at Shuwaymis East, human figures with bows were still preserved on 28 panels, and a total of 64 human depictions was directly associated with hunting scenes. These form the basis of an analysis of hunting scenes. Among the depictions with bows and arrows, humans are predominantly shown hunting equids (see Table 3). All equid hunting scenes are depicted in a semi-naturalistic style and show an advanced degree of patination, thereby indicating a fairly advanced age (Fig. 9). Two further scenes depict the hunt of lions and another one the hunt of a possible leopard. All three are similar in animal representation and patina to the equid scenes.

Ibex or (unidentified) antelopes are shown being hunted on seven and two panels respectively. However, there is a considerable variation in the representation of ibex and hunting figures and the patina of the depictions varies widely (Fig. 10). Based on stratigraphic position and absence of patina at least 52 ibex engravings are contemporary with later engravings of camel and domestic horse, and in two cases they are being hunted with bow and arrow. Ibex hunting scenes therefore span a wider age range and extend to later periods than equid scenes. On six panels the hunted animal is not visible, largely because areas of the panel have become exfoliated or have broken off (Fig. 11).

Cattle are only present in eight of these scenes (Table 3). On four panels cattle were engraved over the top of the hunting scene/figure.

<table>
<thead>
<tr>
<th>Panel</th>
<th>Content</th>
<th>Hunted animal</th>
<th>Cattle presence</th>
<th>Re-engraving</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>Hunting ibex with dog</td>
<td>Ibex</td>
<td>N</td>
<td></td>
</tr>
<tr>
<td>16A</td>
<td>Hunting equid with multiple dogs</td>
<td>Equid</td>
<td>N</td>
<td></td>
</tr>
<tr>
<td>23A</td>
<td>Hunting ibex with dog</td>
<td>Ibex</td>
<td>N</td>
<td>Y</td>
</tr>
<tr>
<td>32B</td>
<td>2 human figures and one hunter with cow over bow</td>
<td>Possible equid</td>
<td>Cattle on top (and behind back)</td>
<td>Y</td>
</tr>
<tr>
<td>32C</td>
<td>Hunting antelope with dog</td>
<td>Antelope</td>
<td>N</td>
<td></td>
</tr>
<tr>
<td>33</td>
<td>Hunter alone</td>
<td>Alone</td>
<td>N</td>
<td></td>
</tr>
<tr>
<td>34</td>
<td>Hunter alone — rest broken off</td>
<td>Alone (erosion)</td>
<td>N</td>
<td></td>
</tr>
<tr>
<td>35A</td>
<td>Hunter with dogs</td>
<td>Alone</td>
<td>N</td>
<td></td>
</tr>
<tr>
<td>35B</td>
<td>Hunter alone (with unfinished animal)</td>
<td>Alone</td>
<td>N</td>
<td></td>
</tr>
<tr>
<td>37D</td>
<td>Hunting lion, additional human figure under lion</td>
<td>Lion</td>
<td>N</td>
<td>Y</td>
</tr>
<tr>
<td>58</td>
<td>Hunter very eroded, not clear</td>
<td>Alone (erosion)</td>
<td>N</td>
<td></td>
</tr>
<tr>
<td>67A</td>
<td>Hunter aiming bow at leopard</td>
<td>Leopard</td>
<td>N</td>
<td></td>
</tr>
<tr>
<td>82A</td>
<td>Hunter with dogs and ibex</td>
<td>Ibex</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>83A</td>
<td>Hunting ibex or oryx with dog</td>
<td>Ibex (or oryx?)</td>
<td>N</td>
<td></td>
</tr>
<tr>
<td>83B</td>
<td>5 men with bows</td>
<td>Alone</td>
<td>N</td>
<td></td>
</tr>
<tr>
<td>96A</td>
<td>Hunter — equid and dog behind back</td>
<td>Equid</td>
<td>N</td>
<td></td>
</tr>
<tr>
<td>101</td>
<td>Hunter on equid panel with dogs</td>
<td>Equid</td>
<td>N</td>
<td></td>
</tr>
<tr>
<td>105</td>
<td>Hunting equid with dogs</td>
<td>Equid</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>134</td>
<td>Hunting equid and ibex with dogs</td>
<td>Equid + ibex</td>
<td>N</td>
<td></td>
</tr>
<tr>
<td>144A</td>
<td>Hunting lion with dogs</td>
<td>Lion</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>150B</td>
<td>Hunting ibex</td>
<td>Ibex</td>
<td>N</td>
<td></td>
</tr>
<tr>
<td>161A</td>
<td>Hunting equid</td>
<td>Equid</td>
<td>Cattle on top</td>
<td>Y</td>
</tr>
<tr>
<td>164</td>
<td>Hunting equid with dogs, another equid on top</td>
<td>Equid</td>
<td>Cattle on top</td>
<td>Y</td>
</tr>
<tr>
<td>165</td>
<td>Hunting ibex with dogs</td>
<td>Ibex</td>
<td>Cattle behind hunter</td>
<td>Y</td>
</tr>
<tr>
<td>166</td>
<td>Hunting equid with dogs, other humans on top</td>
<td>Equid</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>168B</td>
<td>Hunting figure with indistinguishable engravings</td>
<td>? (erosion)</td>
<td>Cattle behind hunter</td>
<td>Y</td>
</tr>
<tr>
<td>182</td>
<td>Hunting ibex with dogs</td>
<td>Ibex</td>
<td>Cattle on top</td>
<td>Y</td>
</tr>
<tr>
<td>190</td>
<td>Hunting antelope, cattle on top</td>
<td>Antelope</td>
<td>Cattle on top</td>
<td>Y</td>
</tr>
</tbody>
</table>

**Table 3**

List of hunting scenes from Shuwaymis East, indicating what species is being hunted, presence of cattle depictions on the panel, as well as re-engraving events.

Fig. 8. Tracing of ‘Shuwaymis West Hunting Party’ (traced from [Saudi-archaeology.com](http://www.saudi-archaeology.com) with kind permission from Sandra Olsen, Arabian Rock Art Heritage Project). The hunting scene is traced in grey and contains numerous superimpositions, re-engraving episodes and later addition of stick figures. Cattle engraved over the top of the original hunting scene are highlighted with blue lines. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)
5.3. Cattle domestication

With engravings of cattle, the distinction between aurochs hunting and cattle herding is primarily based on the identification of domestic traits such as horn shapes and coat colouration. In addition, the context of the wider scene is also taken into consideration. Two types of cattle depiction were observed in the early herding scenes discussed here. The most common type is a depiction with very large forward curving horns, which turn outwards at the tip in a lyre shape (Fig. 6). Moreover, the size and shape of the horns suggest a breed of long-horned cattle, possibly similar to the Watusi or Sanga cattle of East Africa (Grierson, 1991) and is significantly different from those proposed for aurochs (Fig. 13). The head in the engraved cattle is usually depicted with a rudimentary, small, round shape; ears protrude behind the horns, and eyes are occasionally indicated with two dots on either side of the head. While many of these cattle are depicted with uniform coat colour, a significant proportion is shown with a piebald pattern. Piebald coats are a common physiological change in domesticates (see for example Driscoll et al., 2009; Uerpmann, 1999). In addition, these cattle representations are never depicted being hunted, but are usually found superimposed onto or integrated into existing hunting scenes. A second type of cattle depiction is highly stylised with a thin long neck that includes the head and horns that curve backward and outwards at the tips (Fig. 6). These depictions may result from a twist in perspective, as horns in cattle do not curve backward. In fact, the horns display similar characteristic to the cattle described above (with lyre-shaped horns) but follow different conventions in their representation. Although these engravings are heavily stylised, they are frequently depicted with very detailed hide markings. It is likely that the depictions identify individual oxen, which may have been part of the engravers’ herds or been otherwise known to them. In total, 104 cattle depictions were identified at Shuwaymis (which includes both styles). Of these 48 have markings on their hide and all 104 depictions show horn shapes with the tips facing away from the head, which is considered to be a result of domestication.

The horn shape of the depicted domestic cattle is in strong contrast to the engraved aurochs reported from Kilwa, approximately 450 km north of Shuwaymis, where Horsfield et al. (1933) reported a number of prehistoric engravings in the 1930s (see also Khan, 1993: Plate 66). Studies of aurochs horn cores have shown that their horns always point forward relatively close to the forehead, leaving the tips of the
horns within sight (Rehkämper and Görlach, 1999; Uerpmann, 1999). This characteristic curve is usually captured in representations (Fig. 14; further examples can be found at Les Combarelles in France: Uerpmann, 1999: 98; Qurta, Egypt: Huyge et al., 2011; Messak, Libyan Sahara: Lutz, 2008) and is also present at Kilwa, where the animal is shown with horns curving forward and the tips of the horns ending near the eyes (Fig. 13). Moreover, this aurochs is shown being hunted. The hind leg is attached to a rope, which is tied around a large rock. These were employed as part of a trap, slowing the animal down and making it an easier target for hunters (Lutz, 2008). Depictions of aurochs are therefore clearly distinct from those of domestic cattle, and are depicted in hunting contexts.

The domestic status of cattle depictions in the herding scenes at Shuwaymis is therefore confirmed by the horn shape and coat colour of the animals. The identification is further secured by the marked contrast between aurochs, which are shown with trapping stones and hunting figures pointing their bows directly at them, and domestic cattle, which are never shown as being hunted, as noted above. The domestic status of the cattle confirms the relative sequence of the engravings in Shuwaymis and the division into earlier hunting and later herding (and hunting) rock art. If domestic cattle were introduced from the Levant, then it places the cattle depictions into a period after the late PPNB, when the spread of pastoralism is attested for the steppe communities of eastern Jordan (see Martin, 1999; Rollefson et al., 2014). Early hunting scenes can consequently be placed into the preceding periods. However, in the absence of direct dates for the rock art of Shuwaymis and archaeological investigation of early Holocene sites in the region, the beginning of the engraving tradition cannot be dated.

5.4. Human figures and associated cultural markers

The majority of the human depictions in both hunter and herder scenes are of a type that has been described as very typical for the rock art at Jubbah and Shuwaymis. These have been grouped into two different styles; naturalistic and detailed depictions have been associated with the Neolithic, and those with less detail have been tentatively linked to the Chalcolithic period (Khan, 2011, see also Khan, 1993, 2007). Many human figures have a very slim and elongated body. Both arms and legs are clearly depicted and usually very thin, the legs sometimes bent at the knee, with small feet. Where the stratigraphic

Please cite this article as: Guagnin, M., et al., Hunters and herders: Exploring the Neolithic transition in the rock art of Shuwaymis, Saudi Arabia, Archaeological Research in Asia (2015), http://dx.doi.org/10.1016/j.ara.2015.08.001
relationship between different types of human depiction is visible, slim humans with broad shoulders are often engraved over the top. These usually lack arms and legs and are more simplistic in their outline (Fig. 6). This suggests that there is a general trend within the human depictions where bodies are increasingly stylised and more and more of the detail is lost. However, within this trend differences between representations can be observed within the same scene. On Panel 16, which depicts the hunt of an equid, a hunter with narrow body and a hunter with broad shoulders both form part of the same composition; both are depicted with arms and legs (Fig. 15). Figures with and without arms were only observed in superimpositions, and do not appear to date to the same engraving event.

What links all of these human figures is that they are mostly depicted with a specific, feather-like headdress and ithyphallic, possibly depicting a penis sheath (Parr et al., 1978: 48). Despite the stylistic variation and the time depth evident in the superimposition of armless figures, cultural markers such as headdresses and ithyphallic depictions indicate continuity in the transition from hunting to herding rock art. Moreover, they are markedly different from the later, stick-like depictions of human figures such as the hunter in Fig. 10b, a style which Khan places into the Bronze/Iron Age (Khan, 2011). While the analysis of stratigraphic relationships, hunting scenes and cattle depictions showed a clear temporal difference between hunting and herding rock art, re-engraving events, integration of herding into existing hunting scenes, and in particular cultural markers visible on human figures also give a strong indication of continuity. The evidence identified in the rock art therefore clearly indicates towards the adoption of herding by local hunters.

Fig. 11. Graph showing the number of hunting and herding scenes in which the listed animal species were observed (the actual number of scenes is indicated above each bar). Animal species associated with hunting figures (28 panels) are shown in green; animal associated with cattle depictions (42 panels) are shown in blue. 'None' describes individual depictions of hunting figures or cattle. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

Fig. 12. Multiple engravings of camels superimposed on earlier depictions of an ox, ibex and a dog (Panel 44B).
6. Discussion

Our analysis of the cultural and zoological elements that are identifiable in the rock art of Shuwaymis shows that the images created by hunter–gatherers and early herders contain a wide range of evidence relating to the Neolithisation of the area. While the motivation and meaning underpinning the creation of the engravings at Shuwaymis remain unknown, and dating of the rock art is largely based on content, weathering and stratigraphy, we can nevertheless identify a strong signal for the adoption of herding. In the absence of archaeological research and dated faunal remains from the Early Holocene of Hail Province, or indeed central, western or north-western Saudi Arabia, rock art is the main source of cultural evidence.

The analysis of the content and stratigraphy of the rock art at Shuwaymis indicates that the images can be grouped into earlier hunting scenes, which are dominated by the depiction of equids being hunted, and later herding scenes with domestic cattle. Hunting continues to be depicted after the introduction of domesticates, although the rock art only shows the hunting of ibex. This suggests that hunting remained an important part of the economy even after the adoption of herding, and matches the archaeological record of the PPNB and Pottery Neolithic (PN) in eastern Jordan and of the wider Arabian Peninsula. However, neither the absence of wild equids in later hunting scenes, nor the complete lack of representations of domestic sheep or goat can be explained. It is tempting to suggest that the seemingly intensive hunting of equids in the rock art, often depicted with more than 10 hunting dogs and multiple hunters may indicate that over-hunting of equids coincided with the adoption of cattle herding. In the absence of early and middle Holocene faunal remains in the area this pattern cannot be correlated with the archaeological record and must remain a hypothesis in need of further investigation.

In light of the assumed links between the Levant and the Arabian Peninsula a striking difference can be observed between the rock art of Shuwaymis and the rock art of the Negev and eastern Jordan. While the rock art of Shuwaymis frequently shows interaction (and perhaps narrative) of humans and naturalistically depicted animals, the rock art north of the Nefud desert predominantly consists of stylised, stick animal like engravings. Moreover, it shows fewer species and particularly the absence of carnivores may indicate different cultural conventions in the representation of animals. Ibex on the other hand are common in the rock art throughout Arabia and the Levant (see for example Anati, 1981; Rollefson et al., 2008). However, while the early pastoralists in the arid regions of the southern and eastern Levant were caprine herders (Henry et al., 2003; Rollefson et al., 2014), the rock art of Shuwaymis is more suggestive of a specialised form of cattle herding and evidence of sheep and goat has yet to be discovered.

All cattle depictions at Shuwaymis clearly represent domestic animals and probably belonged to a long horn breed. No aurochs depictions have so far been identified. Although cattle were present in two hunting scenes they were placed behind the back of the hunting figure and were never shown being hunted. To date the only published depiction of an aurochs in Arabia comes from Kilwa (Horsfield et al., 1933), where it is shown with one hind leg in a trap and a hunting figure about to kill the animal (Fig. 13). The chronological and contextual distinction between hunting and herding scenes, wild and domestic animals confirms that the rock art of Shuwaymis does not reflect the imagery of a single hunting and herding population. Stratigraphic relationships, hunted animal species and depictions of domestic long horn cattle all point towards a body of hunting rock art into which herding was integrated at a later point.

Re-engraving of animals and the integration of new human and animal figures into existing scenes are common throughout the hunting and herding rock art recorded at Shuwaymis. This suggests a degree of cultural continuity, where older rock art panels still carry meaning for the engravers. In particular the re-use of hunting panels to create herding scenes, the re-engraving of hunting figures into herders, and the re-carving of hunting dogs into pastoral scenes all suggest that the engravers of herding panels still identified with the depicted hunters.

The strongest evidence of continuity can be found in the characteristics and attributes of the human figures. Although the recorded figures showed a degree of variation, hunter and herder figures clearly belong to a same type. Humans are always shown with slim, elongated bodies and tend to have broad shoulders. Arms, legs, bows and arrows are often shown with a fair amount of detail, and some panels even show the leads of the hunter’s dogs. In contrast, representations of the head are always extremely simplified and merged with the neck, and facial
features are never shown. However, in spite of this extreme simplification, the majority of the human figures are depicted with a form of headdress that resembles a feather or tassels and a penis sheath.

7. Conclusion

The rock art of Shuwaymis provides evidence for a distinct phase of hunting imagery that predates the adoption of herding. At the same time there are clear signs of cultural continuity across both phases and the re-engraving of hunting into herding figures suggests that early herders may even have identified with the hunters depicted in earlier scenes. This strongly suggests a pattern of Neolithisation where local hunter–gatherers began to practise herding. While this is in contrast to the Neolithisation model formulated to explain domestication in the east and south of the Arabian Peninsula (Drechsler, 2007, 2009; Magee, 2014), it is seemingly an extension of the continuity observed in the Neolithisation process in the steppe of eastern Jordan (Martin, 1999) and matches the blend of Levantine incursion and local adaptation, suggested for Jebel Qattar (JQ-101) at the Jubbah Oasis (Crassard et al., 2013).

The rock art of Shuwaymis therefore indicates that the Neolithic transition in north-western Arabia is as unexpected and informative as it is different from Neolithisation models developed for other areas of the Arabian Peninsula. Archaeological investigation of Early Holocene sites in the region are now needed to examine the significant cultural changes that occur at the transition between lifeways characterised by hunting and herding.

Acknowledgements

We thank His Royal Highness Prince Sultan bin Salman, President of the Saudi Commission for Tourism and Antiquities, and Prof. Ali Ghabban, Vice President, for permission to carry out the fieldwork at Shuwaymis. We wish to thank our Saudi colleagues, especially Jamal Omar, Abdullah Alsharekh, and Abdulaziz al Omari and the people of the Shuwaymis area for their support. The research was funded by the European Research Council (no. 295719, to MDP).

References
