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FROM BOKONI TO MARAKWET: 'ISLANDS' OF SPECIALISED AND INTENSIVE AGRICULTURE IN SOUTHERN AND EASTERN AFRICA

Tim Maggs

Talks on this topic to three branches of the South African Archaeological Society (Western Cape, Trans-Vaal and KwaZulu-Natal) developed from our recently published research in *Forgotten World: the stone-walled settlements of the Mpumalanga Escarpment*, written by Peter Delius, Alex Schoeman and myself. During this research we had the enriching experience of visits to two 'islands' of specialised and intensive agriculture in eastern Africa, Engaruka in Tanzania and Marakwet in Kenya, generously hosted by the British Institute in Eastern Africa.

Fig. 1: The structure of a Bokoni settlement with circular homesteads linked by walled cattle roads, in this view leading to pasture and water via a funnel-shaped entrance on the right. Terraced fields in the foreground and pasture in the distance. Photo: G Williams.

Our topic is not just of interest to archaeologists and anthropologists. In a recent article in the journal *Nature,* two Swedish specialists criticise the current emphasis on large-scale and high-tech development schemes aimed at providing food security for Africa (Rockstrom & Falkenmark, 2015). Instead they advocate more modest methods for conserving soil and retaining rainwater on the land: methods that have already been developed by many African communities in 'islands of specialised agriculture'.

What is such an 'island'? It is a limited area where the local community has deliberately decided to modify their agricultural system through extra labour inputs to achieve higher and more sustainable production in the longer term. Methods include the levelling of fields, terracing, the clearing of stones, the mounding or ridging of soil, irrigation, the application of manure, compost or mulch, crop rotation and the introduction

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OTHER FEATURES IN THIS ISSUE

We acknowledge with thanks the colour sponsorship by Prof. Francis Thackeray, Evolutionary Studies Institute, University of the Witwatersrand.

of new crops or crop varietals. Each island is surrounded by a 'sea' of lower productivity and less dense population.

Each island makes use of a combination of some of these methods, but we need to stress that each is unique. Superficially, islands may look alike but when studied closely it is clear that each has developed along its own lines and therefore has a distinct character of its own, as we shall see among the examples discussed here. We should also bear in mind that while archaeologists and other academics find them of great interest, they are also of increasing significance at a practical level as their potential is realised by agronomists and other developmental specialists.

This article looks at three islands, starting with the only South African example – Bokoni on the Mpumalanga escarpment. We then fly past Nyanga in eastern Zimbabwe to touch down at Engaruka in the Rift Valley of Tanzania and Marakwet in the Kenyan Rift. Bokoni and Marakwet, along with Tiv in Nigeria, are the focal points of the recently established African Farming Research Network with its web site at for those interested in further information.

Terracing system at Bokoni unique

Bokoni stretches for about 150 km north-south along the escarpment in Mpumalanga and is one of the largest islands. Being in a relatively high rainfall region, cultivation relied on rain, there being no evidence for irrigation. The origins are still not precisely known, but the evidence suggests a start around 1500 to 1600 AD, while the system came to an end early in the 19th century. The air photo (Fig. 1) shows the main elements in the massive landscape modification that characterises a typical settlement. The roughly circular structures are the homesteads that are linked by a network of walled roads, enabling livestock to be led from the central stock pens through the terraced, cultivated areas and out into pastures and watering points, in this case via a funnel-shaped entrance to the right in the photo. Our Swedish colleagues consider this to be one of the best preserved of all ancient agricultural landscapes and it is surely the most prominently visible footprint of any pre-colonial society in South Africa.

Our research has shown that the terracing system used here is unique. Where irrigation was employed, as at Engaruka, terraces had to be completed before cultivation could begin. But in Bokoni, terrace construction was a cumulative process. The initial stage was to establish a row of stones roughly along the contour, designed to trap soil and slow rainwater runoff. As cultivation continued, soil built up against the uphill side of the stones, while digging for cultivation on the downhill side tended to undermine the stones. If this process continued long enough, it became necessary to build a stone revetment, backed by rubble, up against the earth bank thus formed in order to support the original row of stones. On the other hand, if the uphill side of the stones were being covered by soil, a second row was sometimes added at a higher level, to prevent the soil from washing down slope.

Terracing made possible the cultivation of steeper slopes where, without terraces, soil erosion would have destroyed the agricultural potential after a short time. Some flatter areas were also cultivated; the presence of walled roads in such places demonstrates this because there would be no reason to build the walls unless there were crops to protect from passing cattle. The system allowed for the cultivation of much larger areas in this broken escarpment landscape than would have been possible with conventional hoe tillage.

Homesteads were highly variable in size and complexity but there was typically at least one livestock pen in the centre and a domestic outer ring, often with a surrounding wall. Larger and more complex homesteads often had a flower-like arrangement of stock pens where the central one had two entrances, one connecting with the outside and the other allowing animals to move through the centre and around into a ring of attached pens, each of which opened outwards towards the domestic space. This is a unique pattern among pre-colonial farmers in South Africa.

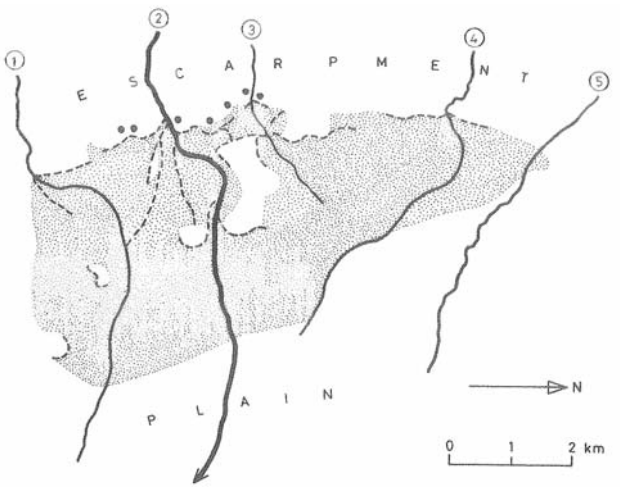

Fig. 2: John Sutton's map of Engaruka showing major canals, irrigated fields and residential nodes.

The domestic space is typically divided into compartments marked by rows of stones or low walls. We regard each of these compartments as the space of a household headed by an adult woman. The predominant pattern is one of many quite large homesteads, each comprising several households in an extended family, with major emphasis on the management of livestock – essentially cattle – in the centre. This pattern, familiar to us in southern Africa,

is quite different from the situation in agricultuaral islands found further north.

Artificial irrigation at Engakura, Tanzania

Engakura is in the Rift Valley of Tanzania, at the foot of the volcanic highlands north-east of Ngorongoro. To reach it we have over flown Nyanga on the eastern escarpment of Zimbabwe, where the agricultural island is well-known from the excellent researches of both Roger Summers (1958) and more recently Robert Soper (2002).

By contrast with Bokoni and Nyanga, Engaruka lies in a very arid zone where there is no chance of cultivation without artificial irrigation. It flourished during the 15th and 17th centuries, possibly starting earlier and coming to an end at the beginning of the 19th century. Much smaller than Bokoni, the area stretched only 8 km north-south along the foot of the Rift escarpment, extending onto the floor of the valley. Yet it is substantially larger than other patches of pre-colonial irrigation in this part of Tanzania.

As can be seen from John Sutton's map (Fig. 2), irrigation was very dependent on the Engaruka River, which is the only perennial river in the area. At times three other streams in the vicinity were also tapped but the main canal system comes off the Engaruka. This is a mountain torrent subject to periodic floods, so the take-off points would have had to be renewed from time to time. From here canals led off north and south along the base of the escarpment, following very gentle gradients so as to allow for the irrigation of areas as large as possible towards the valley floor. At one point a substantial aqueduct was built, while small ravines were crossed, probably using hollowed logs. Canals were lined with stones, which make it possible to map them in detail. Frequent take-off points enabled minor canals to irrigate the various sections of fields. Earlier, fields mainly towards the south were rectangular, with stone reinforced banks to allow for flood irrigation. Later a more sophisticated system of small parallelogram-shaped plots was developed towards the north. These were supported by low terrace walls made of cobble-sized stones, the suite of such plots forming a stepped profile to the cultivated area. The irrigation furrows brought down not only water but also a sediment of powdery volcanic soil to maintain fertility.

Residential spaces were strongly focused in a few places above the cultivated areas at the base of the escarpment (Fig. 2). Here houses were built on steep stone terraces in tightly nested clusters. By contrast with Bokoni and Nyanga, there were no livestock enclosures in these residential complexes. Some stock pens do occur close to and among cultivated areas but it seems that there was generally little emphasis on livestock at Engakura.

It is not certain who built this sophisticated irrigation system. From around the beginning of the 19th century the pastoralist Masai came to dominate the area and today they maintain substantial herds of cattle and small stock. They do some irrigation from the Engaruka River, but this is simple flood irrigation lower down on the valley floor and in much smaller areas than formerly.

Fig. 3: A canal on a raised embankment in Marakwet. The stone-work in the foreground shows a patch of recent repair that will soon be covered by vegetation.

Family ownership at Marakwet

Marakwet is again a Rift Valley escarpment and floor situation, this time in north-western Kenya. By contrast with Bokoni and Engaruka, it is still a flourishing community. The name Marakwet refers to both the people and the region they occupy. The beginnings of the island system of agriculture are not yet known. A date of around 1700 has been suggested but it may have been earlier. Although it the area has a higher rainfall than Engaruka, which allows for dry land cultivation, especially in patches of the escarpment, it is well-known for its long and complex canal systems that tap water from mountain torrents high up the escarpment.

Each canal is built by, maintained by and belongs to a family lineage that also owns the land to be irrigated from it. Close cooperation is called for as a great deal of work is involved; one recent canal took more than three years to complete before any benefit was realised. Each canal has a name and the families involved naturally takes a great deal of pride in their achievements.

About 40 canals are in use and they irrigate a total of about 4 000 ha. Canals are tapped off five main rivers in an area stretching about 45 km from north to south along the Rift escarpment. The largest concentration comes off the Embobut River, towards the north of Marakwet, where canals vary in length up to 15 km. The whole process of planning and building a canal requires great skill. At the take-off point a weir of rocks and brushwood diverts some of the water into the canal. This is a hazardous undertaking that often requires reconstruction after floods and it has cost lives. Long sections of the canal are built up on metres-high embankments made of stone and earth (Fig. 3). In places the water is directed under boulders that are too large to move. When the system negotiates cliff faces, the canal has to be raised on an aqueduct traditionally built of vertical and horizontal poles supporting a channel of brushwood lined with clay. Today cement and stone may be substituted for the traditional structure.

Fig. 4. Marakwet homesteads around the base of the Rift Valley escarpment. Larger cleared areas for irrigated fields lie further out on the valley floor.

Canal water serves the households it passes and may irrigate small fields on and at the base of the escarpment but most of the water is destined for the larger irrigated areas on the Rift Valley floor. Cultivated areas can be broadly divided into two categories: smaller and more permanent fields on or at the foot of the escarpment, which belong to and are often situated around the homestead of a particular family (Fig. 4), and large irrigated fields on the valley floor. The large blocks of irrigated fields are developed by the lineage, each family being allotted a share of the land and the water. But poor fertility allows for only a few years of cultivation before the land must be left fallow. A new block must then be cleared and developed.

Among the crops grown are traditional African cultigens as well as introduced species. Finger millet, *Eleusine coracana,* is prominent among the grains that include sorghum and maize while a variety of vegetables especially beans are grown. Around the homesteads are many fruit trees including mango, banana and pawpaw. A few goats may be kept but livestock farming is not a conspicuous part of the system. There is a long-standing pattern of exchanging crop products for meat with neighbouring pastoralists, especially the eastern Pokot.

Conclusion

This has been a brief tour of just three of the islands of specialised and intensive agriculture in southern and eastern Africa. Each one has its distinct character and each one can be seen to have developed independently through choices and commitments made by its particular community.

Agricultural Islands can support much higher densities of population than the 'seas' of unspecialised land use that surround them. For example, if we look at the Bokoni settlement of Rietvlei, where there were more than 300 homesteads, many of them consisting of extended families, today the area supports less than 10 families. The once intensively cultivated hill slopes are now given over to extensive grazing, while there are only small patches of plough cultivation in the bottom lands.

But the islands, because their communities are committed to complex relationships within their particular patch of land, may be vulnerable in turbulent times to more mobile and aggressive neighbours. Thus the Bokoni system had been overwhelmed by about 1820, particularly by the expanding Pedi kingdom to the north but also by militaristic Nguni groups: the Ngwane, Swazi and Ndebele. The reason for Engaruka's end is uncertain but it may have been helped on its way by the arrival of the Masai. As to the Marakwet, their relations with the eastern Pokot have been at times stormy, which has driven many families to build their homes on the steep slopes of the escarpment. As recently as a decade ago the Pokot were raiding them using automatic weapons that were presumably derived from the civil wars in South Sudan and Somaliland.

Acknowledgements

My thanks are due to our hosts at Engaruka and Marakwet, the British Institute in Eastern Africa, Matt Davies, Daryl Stump and Henrietta Moore, Eric and Heidi Johnson and the staff at Verlorenkloof, Peter Delius, Alex Schoeman, Mats Widgren and his colleagues from the University of Stockholm, friends and family as well as the National Research Foundation and the Lotto for funding.

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FORENSIC BOTANY AND HISTORICAL ARCHAEOLOGY IN THE CONTEXT OF EARLY 17TH CENTURY CLAY 'TOBACCO' PIPES

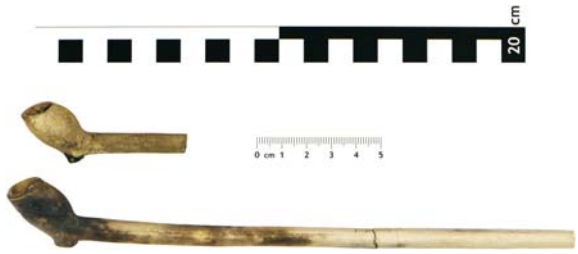
J Francis Thackeray and Suzanne MM Young

The chemical analysis of plant residues from archaeological or historical material falls within the scope of what we call 'forensic botany'. We have explored this in the context of historical archaeology relating to early 17th century clay pipes of the kind shown in the accompanying figure. Together with Nick van der Merwe from the University of Cape Town we have applied a highly sophisticated technique called gas chromatography mass spectroscopy (GCMS) to study the residues of material burnt in pipes from various parts of the world. These chemical analyses have been undertaken on pipes from Shakespeare's garden at New Place and elsewhere in the vicinity of Stratford-upon-Avon; from Amsterdam; and from the early 17th century Fort in Cape Town, settled by Dutch and then English colonists.

The extraordinary thing about these chemical analyses is that they demonstrate that a diversity of exotic plants was smoked by Europeans, not only *Nicotiana* tobacco from Virginia (USA), introduced to Europe by Sir Walter Raleigh and others, but also a range of other plants. For example, 'tobacco' was evidently combined with Asian cannabis (detected in eight out of 24 pipes from Stratford-upon-Avon), as well as plants that would have given an added taste or fragrance, such as vanilla, cinnamon and even camphor (Thackeray et al., 2001).

Sir Francis Drake visited Peru in the course of his circumnavigation of the world and it was perhaps he who brought leaves of Peruvian plants such as coca (*Erythroxylum*) to England, the availability of which is indicated by the fact that in some English pipes (*not* those from Shakespeare's garden) there is evidence of Peruvian cocaine (Thackeray et al., 2001). We suggest that coca leaves were not only chewed but also combusted in early 17th century clay 'tobacco' pipes. Also from the vicinity of Stratford-upon-Avon we found evidence of quinine, which is derived from another Peruvian plant, *Cinchona*, in 'tobacco' pipes.

Cannabis was detected in four pipes from Shakespeare's garden Perhaps this plant was associated with creativity because in Sonnet 76 Shakespeare writes about 'invention in a noted weed' (where 'invention' relates to creative writing). The absence of cocaine in pipes from Shakespeare's garden is significant because in the same sonnet Shakespeare seems to express a preference to turn away from 'compounds strange' (strange drugs). Is this an indication that he recognised cocaine to have mind-blowing properties, whereas 'a noted weed' (dagga) could (in moderation) stimulate creativity? We recognise that Sonnet 76 expresses complex wordplay, associated in part with clothing ('weeds', made from cannabis fibre) and a style of writing (Thackeray, in press).



Early 17th century clay 'tobacco' pipes excavated from Kaisergracht 485, Amsterdam. These are almost identical to pene-contemporary pipes from Stratford-upon-Avon in England, and to pipes excavated from the Dutch Fort in Cape Town. Photograph by Martin Hauesler.

Cannabis fibre was used for clothes and for ships' sails in the time of Sir Francis Drake, and also to make paper for the publication of the King James' Revised Version of the *Bible* and the *First Folio* of Shakespeare.

Forensic botany is especially interesting in relation to the analysis of clay 'tobacco' pipes from Amsterdam, which are almost identical to those from Shakespeare's garden and which indicate the smoking not only of nicotine but also of roses! Some people in Europe in the early 17th century were smoking flowers, as reflected by the presence of a chemical called rose furan, which we found in a Dutch pipe from Amsterdam obtained from the Pipe Museum.

Also in a pipe from Amsterdam is huoxiang zhengqi shui, which is a Chinese medicinal herb that is even sold today with fritillary plant compounds. At this stage it is not known whether *Fritillaria* plants were smoked, but in China they are used as medicinal drugs in small quantities, inter alia, as an anti-phlegmatic. In large doses the bulb of the plant has toxic effects.

In another early 17th Dutch pipe, this time from Cape Town, we have evidence of lauric acid, which is potentially associated with camphor and the laurel leaves of the plant *Laurus nobilis*. This evidence comes from a pipe catalogued as AR 83/10 NWJ 36.1.154, curated by Iziko Museums of South Africa and excavated from the Cape Fort, situated near Jan van Riebeeck's Cape Garden that hosts trees

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classified by Carl Peter Thunberg as *Laurus nobilis*.

Taken together, these results can be examined in the context of John Gerard's botanical encyclopaedia *Herball* (1597). Gerard refers to a kind of tobacco from Peru, described as 'the henbane of Peru'. We think this was probably cocaine. The Virginian tobacco (*Nicotiana*) reported by Gerard was evidently brought to England by Sir Walter Raleigh who, together with Drake, may have watched Shakespeare perform his plays in the court of Queen Elizabeth I.

Recently, Mark Griffiths (2015) has attempted to identify four individuals illustrated in the frontispiece to Gerard's *Herball*. He claims that the so-called 'Fourth Man' represents Shakespeare holding a corn cob and a fritillary flower, and wearing leaves of the laurel plant (*Laurus nobilis*). This has created a flurry of interest relating to botany and Shakespeare. However, Ward and Lee (2015) have raised the question as to whether the 'Fourth Man' represents Sir Francis Drake, especially since it was he who brought exotic plants to Europe from the new world, including corn and potatoes, quite apart from gold treasure raided from communities in Peru and from Spanish ships. Perhaps it is not surprising that the 'Fourth Man' is indeed a prominent and triumphant explorer such as Drake, who may have been perceived to be worthy of wearing a laurel wreath, the leaves of which may also have been smoked by Europeans in the 17th century. It would seem probable that for the Elizabethans, as for later eras, laurel was the reward for all kinds of victorious triumph.

'Tobacco' in Shakespeare's time was used not only for recreational purposes. Like fritillary plants, it was also used as an anti-phlegmatic, as prescribed by Dr John Hall, Shakespeare's son-in-law. Alexander Craig, a contemporary of Shakespeare, wrote a poem about a 'pype of loame' (clay pipe) in the context of 'flegm-attractive far-fett Indian smoke', which could refer to 'far-fetched tobacco' of the kind from distant countries explored by Drake and Raleigh. As Shakespeare wrote in Hamlet, 'There are more things in heaven and earth than are dreamed of in our philosophy'. This could apply to dreams associated with plants identified scientifically through forensic botany.

Acknowledgements

We are grateful to the curators of collections of the Shakespeare Birthplace Trust in Stratford-upon-Avon, the Pipe Museum in Amsterdam, G Abrahams-Willis and Iziko Museums of South Africa in Cape Town for access to early 17th century 'tobacco' pipes.

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LETTER TO THE EDITOR

Rock art custodians

Sir: In their article on rock art tourism in the Drakensberg (*The Digging Stick*, 32:1), Celeste Rossouw and Michelle Dyer report on the project by Amafa that has seen more than 60 rock art custodians trained. This is a praiseworthy initiative, but I am perturbed at what the custodians are telling tourists.

In June 2013 I visited Main Cave at Giant's Castle. The custodian told us she had been working there for 10 years, so she is presumably the one named in the article as 'one of Amafa's best custodians'. The article says, 'Guests will enjoy her lively interpretation'. She told us emphatically that the San had entered trance by eating mushrooms. She tells this to between 600 and 800 tourists a month! In April 2014 I met someone who had just returned from Game Pass Shelter at Kamberg, where the custodian had told him the same thing.

Where could the custodians have acquired this fantastic nonsense? They are not likely to have read ethnographic studies of the ingesting of hallucinogens on other continents, nor would they have communicated with each other, so they must have adopted it independently. I cannot believe that anyone in authority is telling them this. They must have been told it by visitors, chosen to believe them, and then incorporated it into their presentations, for whatever reason ignoring what they had been trained to say.

Is there not perhaps some way in which an occasional check could be made on what the custodians are saying? *Elwyn Jenkins*, ejenkins@mweb.co.za

ARCHAEOLOGY IN BRIEF

Bone flutes suggest a 9 000-year-old music tradition in China. Three rough and simple flutes made from bird bones found in a tomb in central China are evidence that remote ancestors played music long before they could write. Made of the bones of red-crowned cranes, the flutes were excavated at Jiahu in Henan province. The pipes, around 20 cm long with patterns carved on their surface, are believed to be the oldest heptatonic or multinote-scale instruments discovered. The Jiahu culture dates to the Stone Age 7 500 to 9 000 years ago, existing at the same time as the Tigris and Euphrates civilisation. *UPI, 04/11/2013*

ETHNOGRAPHIC INSIGHT INTO THE PREHISTORIC SIGNIFICANCE OF RED OCHRE

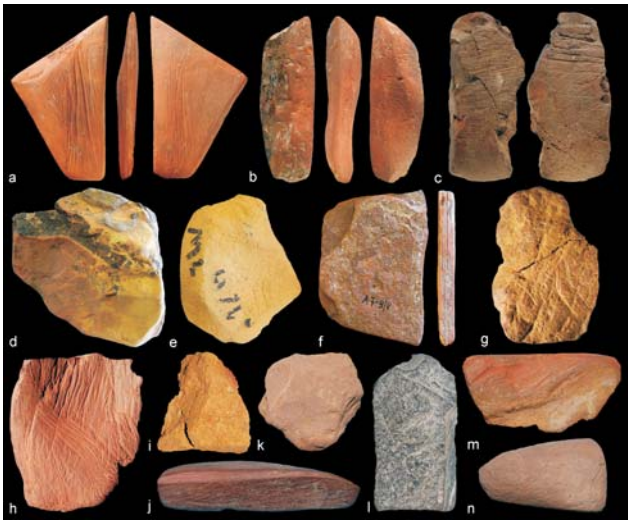
Riaan F Rifkin

The African Middle Stone Age (MSA) has long featured centrally in debates about the origins of symbolic and cognitively modern human behaviour. Archaeological sites dated to the MSA document human expansions into uninhabited ecological niches, the geographic patterning of artefact and artistic styles, the selection of variable lithic raw materials, a broadening of the human diet and the innovation of sophisticated hunting technologies (see Brown et al. 2009; Wadley 2010; d'Errico & Henshilwood 2011; Ziegler et al. 2013). The habitual exploitation of earth pigments or ochre, specifically red ochre, also becomes prevalent during the MSA. While not correlated directly with the emergence of anatomically modern *Homo sapiens*, these advances are significant because of their broad temporal and geographic coincidence with the evolution of our species. Many of these behaviours also closely resemble the cognitive and linguistic abilities of contemporary humans.

Following emergence of *H. sapiens* after 200 000 years ago (ka), a clear preference for red colourants emerges. Red is the colour of fire and blood, and is frequently associated with energy, anger, danger, power, determination and also passion, desire and love. Red is a colour of extremes and it is probable that our prehistoric ancestors attached significant connotations to red from an early stage in our evolution. Could this be why we still 'see red' when aggravated? Or why red lipstick has been used by women for decades as a means of attracting attention? In fact, when any of us think about sexiness, what colour first comes to mind? Red, of course. We visualise red roses, red lingerie and even the 'red light district'.

So, should we be surprised that red ochre features centrally in the first instances of human artistic expression and technological ingenuity? Examples include the use of red ochre to produce hafting mastics at 70 ka (Wadley et al. 2009), the engraving of abstract designs on red ochre from 100 ka (Henshilwood et al. 2009), and, at 100 ka, the inclusion of ochre as an ingredient in composite paints (Henshilwood et al. 2011) and the use of pyrotechnology to modify the colour of ochre to create the first red synthetic pigments (d'Errico et al. 2010).

Archaeologists use the term 'ochre' to designate any earthy materials comprising anhydrous iron oxide such as red ochre or hydrated iron oxide-hydroxide (brown goethite or yellow limonite) (Cornell & Schwertmann 2003). The fact that the term equates with the colour red can practically be assumed, despite the fact that a specific colour prefix is never provided. The exploitation of ochre is not limited to our species.



Ochre samples

The exploitation of ochre

The first ochre occurrences span the transition from the Early Stone Age (ESA) Acheulean to the MSA, with the initial exploitation of ochre reflected by isolated examples occurring during the Middle Pleistocene between 300 ka and 500 ka (Barham 2002; Beaumont & Vogel 2006). The processing of black manganese by Neanderthals (Soressi & d'Errico 2007) also indicates that, if manganese was used for symbolic purposes, the cognitive prerequisites of modern human behaviour existed before the emergence of biologically modern humans.

The exploitation of ochre is not restricted to modern *H. sapiens*, but the preferential selection of red ochre may well represent a species-specific trait. Ochre with a strong red hue predominates in MSA contexts from 100 ka (Henshilwood et al. 2009) to 143 ka (Watts 2009), and even 164 ka (Marean et al. 2007). Although partiality towards strong red colours remains debatable, the exploitation of red ochre has nevertheless been interpreted as evidence for colour symbolism (Watts 2002, 2009), as a proxy for the origin of language (Henshilwood & Dubreuil 2009; Watts 2009), as indicative of socially and cognitively complex behavioural capacity (Mithen 2014), and as an essential element of symbolic and fully modern

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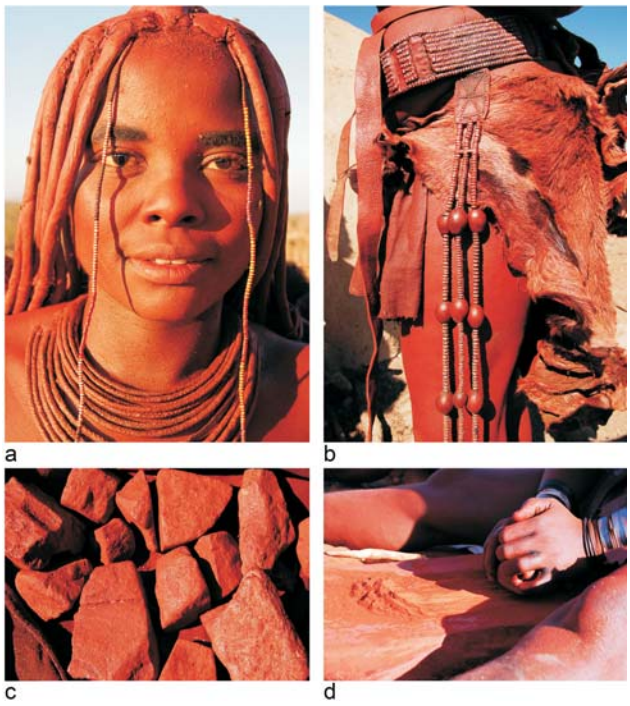
human behaviour (Henshilwood & d'Errico 2011). Traces reminiscent of abrasive processing methods frequently occur on archaeological specimens, signifying that the extraction of pigment powder was a key objective during prehistory (Fig. 1).

Precisely what the extracted pigment powder was used for also remains unclear. Current evolutionary hypotheses agree that ochre and the products of its processing played a key role in the adaptive strategies of *H. sapiens*, but that they differ markedly in the functions assigned to it. Symbolic interpretations (Knight et al. 1995; Power & Watts 1997) essentially draw on ethnographic and historical accounts of ochre use by extant hunter gatherer and pastoralist societies, and tend to focus on the use of red ochre to adorn the bodies of females or ritual participants. Tangible evidence for the use of ochre as a 'body cosmetic' comes from the discovery of red ochre residues adhering to shell beads at Blombos Cave (Henshilwood et al. 2004). As strung beads are most generally worn around the neck or the wrists, the ochre residues were in all probability transferred from human bodies onto the shells. Red ochre may, however, also have been deposited onto the shells accidentally, perhaps from rubbing against ochre-covered hide or from post-depositional contact with ochre in the sediment.

Ethnography and red ochre

In the absence of direct evidence for past human behaviour, archaeologists often rely on ethnographic analogies, whether implicit or explicit in their accounts, to infer that ochre served primarily as a material for the production of pigments used for symbolic body decoration. Ethnographic accounts illustrating the use of red ochre as a body cosmetic are abundant and have been reported for San hunter-gatherers, Khoe pastoralists and Tswana and Xhosa agro-pastoralists. Foremost modern examples of the habitual use of red ochre as a cosmetic comprise the Cushitic-speaking Hamar in southern Ethiopia and the Ovahimba of Angola and Namibia (Galton 1853; Tönjes 1911). Although ethnographic analogues are not directly applicable to prehistory, they do provide a basis for the formulation and assessment of research questions concerning the exploitation of the prehistory of cosmetic substances.

The Ovahimba form part of a complex socio-economic assemblage of hunter-pastoralists. They likely represent a former Herero community who remained in the Kunene region on a southward migration from the Central Lakes region, or the final settlers from a westward migration into the area after 1500 (Vedder 1928). Ovahimba women are renowned for habitually covering their bodies, hair and personal attire with a red ochre-based substance (Fig. 2). It is known as 'otjise' and is comprised of equal parts of red (*otjiserundu*) ochre powder and dairy-derived butterfat (*omaze uozongombe*). Ochre



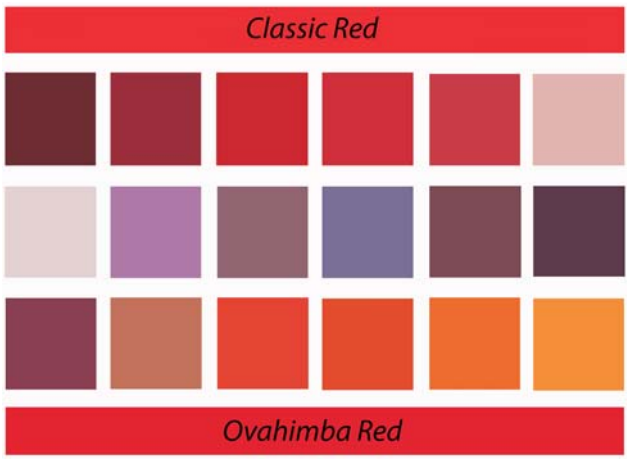
The application of ochre among the Ovahimba

powder is produced by grinding red ochre chunks between flat lower and round upper grinding stones.

Clarified butter is produced by boiling milk-derived fat in an iron pot above an open fire and extracting the greasy substance that floats to the surface. Ochre powder and clarified butter are traditionally stored in containers made from cattle horn and leather.

Upon inquiring about the reasons behind this customary cultural feature, Nakara from Otjongoro answered, 'It is our culture and our tradition. It makes us look and feel beautiful. And all can see that we are real Himba women... There are no Himba women who are not red. They do not exist.' Otjise also features prominently in male and female initiation ceremonies and is applied by men when they are to be wed or undertake extensive journeys. Otjise is also applied to

Ochre comes in a range of shades



human corpses prior to interment. Ethnographic interviews and Ovahimba oral testimony furthermore confirm that red ochre fulfils a number of secondary functional roles, including use as a sunscreen, a mineral supplement, an insect repellent and a hide preservative (Hepuite Venjakera, pers. comm. 2012; Nakara Tjimbosi, pers. comm. 2012; Rifkin et al. 2015; Rifkin 2011, 2015).

Why red ochre?

Because the systematic use of ochre is considered a non-linguistic phenotype related to the emergence of language (d'Errico et al. 2009), the explicit focus on red ochre renders the Ovahimba of great interest in terms of the seemingly similar emphasis on the 'red' during prehistory. Although linguistic studies provide evidence of differences in cognitive colour perception across language groups, concerns remain as to how representative data derived from remote communities may explain the significance of colour perception in prehistory. Whether language and cognition are linked or separate is also still contested (Wynn & Coolidge 2010). Results for colour-naming tests (Roberson et al. 2005) indicate that the five basic colour terms used by Ovahimba-speakers are used to categorise 86 per cent of colours. Regardless of a high degree of colour constancy, and a tendency to perceive and classify the colours of objects as unchanging regardless of varying lighting conditions, Ovahimba women have very specific criteria for the types of red ochre they prefer. Although hue and saturation are the most important, the quality of ochre is also measured according to grain size, with fine-grained pieces with no hard inclusions being the most desired (Fig. 3).

How did MSA humans perceive different colours? /Xam San hunter-gatherers distinguished dark red-maroon hematite or *//ka* from brighter red ochre or *ttò* (Bleek & Lloyd 1911). Bright specularite or *//hara* was valued as a black, sparkly powder for application to the hair and was differentiated from all forms of red ochre. In the MSA, red ochre is not ubiquitous prior to 200 ka. Then there is a gradual trend towards the selection of ochre with the strongest red hues appearing between 164 ka and 143 ka, and around 100 ka. The increased focus on red ochre occurred during a time of rapid population expansion between about 200 ka and 50 ka (Verrelli & Tishkoff 2004), and may perhaps relate to the emergence of fully modern human behaviour during the MSA.

In psychological terms, the colour red is generally associated with dominance in primates and is linked explicitly to sexual selection (Little & Hill 2007; Elliot & Niesta 2008). Red colour influences human emotion, expresses aggression and is a recognised element in signalling many social interactions. Colour has also been shown to affect the outcome of contests in humans, with red offering a significant advantage in terms of the achievement of victory (Hill & Barton 2005). In evolutionary terms, trichromatic vision is characteristic of all apes and humans. Primate trichromacy is widely viewed as an adaptation to detect ripening fruit against a background of mature foliage, linking the evolution of colour vision to diet (Dominy et al. 2003). It has also been interpreted as an adaptation to distinguish colour modulations in skin-based blood flow that serves to assess the temperament of other individuals. Primates with trichromatic vision are typically bare-faced and facial reddening signals aggression, confrontation and excitement (Little & Hill 2007).

So what about modern humans? A large proportion of human females possess more than the standard three classes of retinal photo-pigments (Jameson et al. 2001). Women with four and up to five photo-pigment genotypes are able to perceive much more chromatic appearances in comparison with male or female trichromats. Could this relate to the trend towards a preference for ochre with the strongest red hues after 200 ka? Compared with the presence of the long-wave 'red' opsin gene (OPN1LW) in chimpanzees, humans in general and sub-Saharan Africans in particular have an excess of genetic substitutes at this locus. These are significantly skewed towards the 'red-orange' visual spectrum, suggesting that changes in trichromatic colour vision among *H sapiens* occurred relatively recently, possibly well after 200 ka (Verrelli & Tishkoff, 2004).

Discussion

Since the debate concerning 'red ochre and human evolution' commenced more than three decades ago (Wreschner 1980), archaeologists have shown increasing awareness of the significance of ochre in terms of the emergence of fully modern human behaviour. Most interpretations are based largely on the perceived significance of a specific colour – red – and on the recently established association between engraved red ochre and the symbolic contexts in which these occur. The question of whether ochre served symbolic or functional purposes, or both, is unclear. Current interpretations regarding ochre use almost certainly represent only a glimpse of its actual use and application during the MSA.

It is therefore essential to demonstrate, rather than simply assume the specific uses of ochre in prehistory. What could the function of ochre have been in prehistoric technology and how might these have promoted and maintained social relations within early *H. sapien* societies? Archaeological evidence confirms that MSA humans possessed the ability to produce ochre-rich red pigment mixtures at least 100 ka (Henshilwood et al. 2011). The precise uses of these red compounds are not self-evident, so how can they be implicated in the emergence and persistence of modern human behaviour?

In the context of the Ovahimba, and in largely symbolic terms, the uses of ochre in the MSA almost

certainly functioned on two distinct social levels. One can imagine a scenario in which the symbolic use of red ochre by individuals operated in a principally decorative sense by visually enhancing the bodies, faces, hair and personal attire of individuals. Different decorative styles fulfilled an important role in the processes of information exchange about individuals, which in turn served in the formation and confirmation of personal identities (d'Errico et al. 2005). In collective terms, the symbolic use of red ochre may have fulfilled certain functions within a specific social group, or it may have served to distinguish different social groups. In the first instance, ochre would stimulate the formation of social and economic relationships, reinforce group solidarity and ensure cooperation. Or it would discern different statuses, achievements or affiliations amongst group members. On an intergroup level, the use of different ocherous shades, designs or patterns applied to different areas on the body or attire served as distinctive 'stylistic' features specific to members from a known but 'other' social or 'ethnic' group (Hodder 1982). Symbolic and stylistic differences are most effective for conveying messages to socially distant target groups, or the 'extended social network' (Gamble 1999). The symbolic use of ochre in the MSA should therefore also be viewed in terms of the dynamic of social interaction, which rests on the assumptions that style is a learned cultural trait (Wobst 1977). It reflects traditional norms about the appearance of an individual with similarities in style reflecting cooperating individuals who share norms. In both 'individualistic' and 'collective' contexts the symbolic implication of ochre is presumed to be based purely on the colorimetric properties and surface covering capacities of ochre.

The use of red ochre for symbolic purposes is therefore likely to have played an important role in mediating the increasingly complex social relations emerging during the MSA. As is the case in Europe between 40 ka and 30 ka (Strauss 2012), red ochre acted as a social signalling device and became essential for the maintenance of relationships by expressing identity in individual and intergroup terms. But besides the palpable symbolic connotations of ochre, the use of ochre as a hide-tanning ingredient, a sunscreen, a mosquito repellent, perhaps a form of mineral supplementation and detoxification agent must have played an important role in enabling humans to modify natural selection within their eco-cultural environments. This effectively permitted early modern humans to act as co-directors of their own evolutionary processes (Nettle 2009). The hypothesised and confirmed functional applications of red ochre should not be viewed as replacement theories for the use of ochre in symbolic contexts, but instead as indicative of the exploitation and application of a raw material with remarkable colourimetric, structural and chemical properties.

Conclusion

The information gained from studies of extant and historical people and their practices presents a stimulating basis for the formulation of research questions about the uses of ochre in the past. Historical records indicate that people often attached symbolic value to red ochre, but they do not confirm that red ochre functioned exclusively in symbolic contexts and do not explain how the symbolic use of ochre arose. If prehistoric human societies exhibited a similar range of variation to modern and historical hunters and gatherers, the fundamental structure of modern hunter-gatherer adaptations are likely to have been in place for a very long period of time (Kuhn & Stiner 2001). This notion is confirmed by genetic evidence affirming a shared ancestry of a number of populations who still practice a hunting and gathering lifestyle (Tishkoff et al. 2009).

Some social, symbolic and technological aspects of the hunter-gatherer way of life may therefore have remained largely unchanged, and the social and economic ways in which modern foragers conduct themselves may exemplify at least some of the characteristics of human life during the MSA. Current research certainly appears to indicate that MSA humans were not a markedly 'different sort of hunting and gathering hominin' (Kuhn & Stiner 2001) but instead that their social and economic conduct resembles at least some part of the manners and modes of contemporary and LSA hunter-gatherer behaviour. While this may indeed be true, disentangling the functional worth from the symbolic significance of ochre remains a challenging research topic, especially in terms of the exploitation of red ochre during the MSA.

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Additional information, including the cited references, can be obtained from http://wiredspace.wits.ac.za/ handle/10539/11832).

ARCHAEOLOGY IN BRIEF

Male ancestor emerged 209 000 years ago. Our most recent common male ancestor emerged some 209,000 years ago, earlier than many scientists previously thought. The pioneering study, conducted by Dr Eran Elhaik from the University of Sheffield and Dr Dan Graur from the University of Houston, also debunked the discovery of the Y-chromosome that supposedly predated humanity. Their findings put 'Adam' within the time frame of his other half, 'Eve', the genetic maternal ancestor of humankind. This contradicts a recent study which had claimed the human Y-chromosome originated in a different species through interbreeding that dates 'Adam' to be twice as old. 'We can say with some certainty that modern humans emerged in Africa a little over 200 000 years ago,' said Dr Elhaik.

University of Sheffield, 22/01/ 2014

Unlocking the scrolls of Herculaneum

Many artefacts have been recovered from the Roman cities of Pompeii and Herculaneum, buried in ash during an explosive eruption of Mount Vesuvius. But could even greater treasures, including lost works of classical literature, still lie underground? For centuries scholars have been hunting for the lost works of ancient Greek and Latin literature. In the Renaissance, books were found in monastic libraries. In the late 19th century papyrus scrolls were found in the sands of Egypt. But only in Herculaneum has an entire library from the ancient Mediterranean been discovered in situ.

On the eve of the catastrophe in 79 AD, the city was a chic resort town on the Bay of Naples where many of Rome's top families went to rest and recuperate during the hot Italian summers. It was also a place where Rome's richest engaged in a bit of cultural one-upmanship – none more so than Lucius Calpurnius Piso Caesoninus, a politician and the father-in-law of Julius Caesar. Piso built a seaside villa on a palatial scale – the width of its beach frontage alone exceeds 220 m. When it was excavated in the middle of the 18th century, it was found to hold more than 80 bronze and marble statues of the highest quality.

Piso's Villa of the Papyri, as it has become known, also contained the only library to have survived from the classical world. Its relatively small collection, some 2 000 scrolls, was nearly destroyed by the eruption, yet preserved at the same time. A 400 ºC blast of gas from the volcano carbonised the papyrus scrolls before the town was buried in a fine volcanic ash. When excavators and treasure hunters set about exploring the villa they mistook the scrolls for lumps of charcoal and burnt logs. Some were used as torches or thrown onto a fire.

But once it was realised what they were, possibly because of the umbilicus, the stick at the centre of the scrolls, the challenge was to find a way to open them. Some were simply hacked apart with a butcher's knife, with predictable and lamentable results. Later a conservator from the Vatican, Father Antonio Piaggio, devised a machine to delicately open the scrolls. But it was slow work. The first one took around four years to unroll. The fragments pulled off by Piaggio's machine were fragile and hard to read. 'They are as black as burnt newspaper,' says Dirk Obbink at Oxford University, who has been working on the Herculaneum papyri since 1983. Under normal light the charred paper looks a shiny black, while the ink is a dull black and sort of iridesces.

Reading it is 'not very pleasant', Obbink adds. On some pieces, the eye can make out nothing. On others, by working with microscopes and continually moving the fragments to catch the light in different ways, a few letters can be made out. Meanwhile, the fragments fall apart. 'At the end of the day black powder of the scroll would be all over the table.' This all began to change in 1999, when a scientists from Brigham Young University in the US examined the papyrus using infrared light. Deep in the infrared range it was possible to achieve a good contrast between the paper and the ink. Letters began to jump out of the ancient papyrus. Scholars' ability to reassemble the texts also improved massively. In 2008, a further advance was made through multi-spectral imaging. Instead of taking a single image of a fragment of papyrus under infrared light, the new technology takes 16 different images of each fragment at different light levels and then creates a composite image.

With this technique Obbink is seeking not only to clarify the older infrared images but also to look again at fragments that previously defied all attempts to read them. The detail of the new images is so good that the handwriting on the different fragments can be easily compared, which should help reconstruct the lost texts out of the fragments.

So what has been found? Despite being found in Italy, most of the recovered material is in Greek. Perhaps the major discovery is a third of *On Nature*, a previously lost work by the philosopher Epicurus. But many of the texts that have emerged so far are written by a follower of Epicurus, the philosopher and poet Philodemus of Gadara (c.110–c.40/35 BC). In fact, so many of his works are present (44), and in duplicate copies, that David Sider, a classics professor at New York University, believes that what has been found so far was in fact Philodemus's own working library. Piso was Philodemus's patron. Other works include a comedy in Latin by Caecilius Statius called Faenerator, or The Usurer.

Of the 2 000 scrolls or so having been recovered from the villa, some 1 600 to 1 700 have been unrolled. The balance have not been unrolled in the hope that it might eventually be possible to read them by unrolling them not physically, but virtually. In 2009, two unopened scrolls from Herculaneum belonging to the Institut de France in Paris were placed in a CT scanner normally used for medical imaging. It was hoped to use the machine, which can distinguish different kinds of body tissue and produce a detailed image of a human's internal organs, to reveal the internal surfaces of the scroll. But the task proved immensely difficult because the scrolls were so tightly wound and creased. 'We were able to unwrap a number of sections from the scroll and flatten them into 2D images. 'On those sections you can clearly see the structure of the papyrus,' says Dr Brent Seales, a computer science professor at the Univer-

sity of Kentucky, but the machine could not distinguish 'the chemistry of the ink from the chemistry of the paper', he says, as ancient ink contains no metal. Seales is continuing to analyse the data produced by the 2009 scan. He has also begun testing a new way of reading the scrolls, using a beam from a particle accelerator.

Others are more preoccupied with the idea that there may be more scrolls in the villa waiting to be discovered. Richard Janko, professor of classical studies at the University of Michigan, argues that since the villa belonged to Latin-speaking Roman aristocrats, there would have been a Latin library as well. Secondly, the villa was, not merely a holiday home but a *mouseion* – a museum-like place to show off a collection of spectacular works of art and literature. If this *mouseion* had literature to compare to its sculptures, something more impressive than the working collection of a minor philosopher should be expected. Thirdly, scrolls were found in various places in the villa. Although some were on shelves and in cabinets, others were piled on the ground and packed in the tubular boxes (*capsae*) in which scrolls were carried around. Could these boxes have been brought from another library?

Robert Fowler, professor of classics at Bristol University, points out that we have perhaps only some 10 per cent of the major works of classical literature. Most works in most genres are lost, for example:

- Aeschylus: only seven of his 80 plays survive
- Aristophanes: only 11 out of 40 plays survive
- Ennius: his epic poem Annales almost entirely lost
- Euripides: only 18 of his 90 plays survive
- Livy: three-quarters of his History of Rome is lost
- Sappho: most of nine books of lyric poems are lost
- Sophocles: only seven entire plays of 120 survive

The villa has three levels. Only the topmost has been substantially explored so far, but in the 1990s two other layers were partially revealed. In the middle floor, archaeologists have discovered a range of well-furnished rooms with views out to sea, some of which have been opened up while others remain closed.

The Italian authorities are reluctant to permit further excavation, arguing that this would be disruptive for residents of the modern town of Ercolano, built literally on top of Herculaneum. They also point out that 300 to 400 of the original rolls remain unread.

BBC, 20/12/2013

ARCHSOC TRANS-VAAL BRANCH

CALL FOR 2016 FUNDING PROPOSALS

The Trans-Vaal Branch of the SA Archaeological Society invites applications for funding by researchers and educators in the field of archaeology for 2016. South African archaeological research projects and educational programmes that promote knowledge about and an understanding of archaeology will be considered.

The deadline for applications is 30 November 2015.

Funding by the Trans-Vaal Branch may be split over more than one project and the branch committee's awards decision will be final.

Information to be included with applications:

1. The archaeological research or education proposal and the anticipated results or benefits, the project implementation schedule, the total budget estimate and the grant amount being applied for.
2. Should the project or programme for which funding is being requested form part of a larger project, information on how the part that needs to be funded relates to the whole.
3. Resources and facilities available for implementing the project or programme.
4. A breakdown of the amount applied for into discrete expenditure categories to permit an award to be made for specific cost items.
5. Biographical details of the applicant(s), including professional qualifications and experience.
6. Two references attesting to the quality and success of previous archaeological or educational project work.
7. Plans to publish the research results.

Successful applicants will be required to provide six-monthly progress reports and a final project report.

On completion of the project, an article on the project that has been funded may be requested for publication in *The Digging Stick*.

Applications should be forwarded to the Secretary,Trans-Vaal Branch, SA Archaeological Society, PO Box 41050, Craighall, 2024, or by e-mail to secretary@archaeology.org.za.

Enquiries may be directed to Reinoud Boers, fox@boers.org.za, tel. 011 803 2681.

PALAEOANTHROPOLOGY AND SIGMA TAXONOMY

Francis Thackeray

Hublin (2014) has highlighted a problem that is currently being discussed in the context of Plio-Pleistocene hominin fossils from Europe and Africa. This problem relates to 'the limits of a paleontological species'. This problem is central to palaeoanthropology as it is to other fields in the biological sciences. One must ask 'are there really clear boundaries between species?' The answer is: not always, especially where species have diverged relatively recently, as in the case of the common chimpanzee (*Pan troglodytes*) and the bonobo (*Pan paniscus*) in the forests of equatorial Africa.

The question that must be addressed in studies of human evolution is how to deal with problems of classification (taxonomy) when species of *Australopithecus* and *Homo*, for example, do not necessarily have clear boundaries. I have tried to address such questions by using a standard mathematical approach that allows one to explore degrees of similarity or difference without 'pigeon-holing' fossils into one or other species.

In the past, palaeoanthropologists themselves have been classified as either 'lumpers' or 'splitters'. Dr Robert Broom, the famous palaeontologist who worked in the Cradle of Humankind fossil sites between 1934 and 1951 while based at the former Transvaal Museum, was an 'arch-splitter'. He would look at relatively minor differences in the anatomy of two fossils and then use them as a basis for classifying the material into different species. In his lifetime he created as many as 300 species, although we now recognise only half of them as valid. Other palaeontologists could be considered lumpers, recognising certain differences in anatomy as an expression of variability within single species, rather than as differences between species.

I do not consider myself either a splitter or a lumper because both kinds of palaeontologists still assume that species can be classified into discrete species having clear boundaries, as if they were black or white. Instead, I advocate the need to explore variation in anatomy through evolutionary time and ecological space, in the context of 'palaeospectroscopy', a term coined by Thackeray and Odes (2013). Here I outline my mathematical method that has been applied to hominid fossils from South Africa and East Africa (Thackeray 1997, 2007; Thackeray et al, 1997), recognising that boundaries between species such as *Australopithecus* and *Homo* are not necessarily clear.

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The method uses pairs of measurements of skulls obtained initially from modern specimens of the same species, plotted against each other as in Fig. 1. We then use a procedure that mathematicians call 'least squares linear regression' to quantify the degree of scatter around a regression line associated with a general equation of the form y = x + c, where m is the slope and c is the intercept. Thackeray et al. (1997) reported a central tendency of the 'log-transformed standard error of the m-coefficient', known as 'log se_m', which is simply a way of quantifying the degree of scatter. For pairs of specimens of the same species, the degree of scatter is small, reflecting similarity in shape. By contrast, the degree of scatter is very large for comparisons of two specimens of different species.

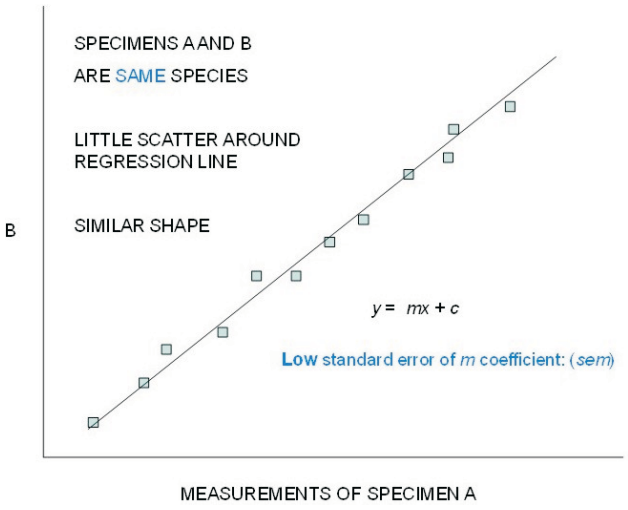

Fig. 1: A graph showing a comparison between measurements of two specimens of the same species, showing little scatter around the regression line. This degree of scatter can be quantified using a statistic called se_m.

The log se_m statistics have been calculated for many pairs of the same species, including birds, reptiles and mammals. We have found that when these statistics are plotted in a single graph, as shown schematically in Fig. 2, we obtain a mean log se_m value of -1,61, with a small degree of variation around that mean value (plus or minus about 0,1, based on recent analyses). Thackeray (2007) claimed -1,61 to be an approximation for a biological species constant (T), expressed through geographical space and evolutionary time, associated with a statistical (probabilistic) definition of a species.

Mean log se_m values have recently been calculated by Gordon and Wood (2013) using measurements from chimpanzees. Their results are as follows:

- -1,61 (female–female comparisons of *Pan paniscus*)
- -1,62 (male–male comparisons of *Pan paniscus*)
- -1,61 (female–male comparisons of *Pan paniscus*)
- -1,62 (female–female comparisons of *Pan troglodyes*)
- -1,60 (male–male comparisons of *Pan troglodytes*)
- -1,60 (female–male comparisons of *Pan troglodytes*)

These results are encouraging because they have independently confirm an average log se_m value of -1,61 for the comparison of skull measurements of the same species. The concept of a biological species constant (T) is upheld for modern species. But what about fossils?

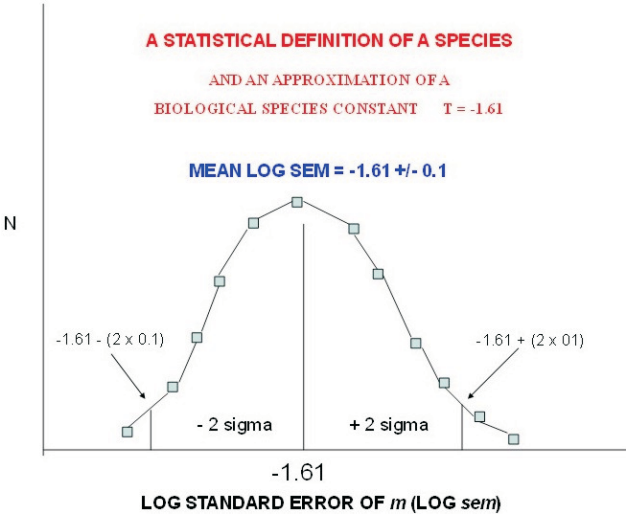

Fig. 2: A graph showing a normal (bell-shaped) distribution of log-transformed se_m values for comparisons between measurements of pairs of specimens of the same species. There is central tendency around an average value of -1,61. This value has been considered to be an approximation of a biological species constant (T).

Log se_m values have been calculated for pairs of Plio-Pleistocene African hominin fossil crania, including those attributed to *Homo erectus* (KNM-ER 3733 and KNM-ER 3883 from Kenya), *Homo habilis* (OH 24 from Tanzania and KNM-ER 1813 from Kenya), *Australopithecus africanus* (Sts 5 and Sts 71 from South Africa), and *Paranthropus boisei* (OH5 from Tanzania as well as KNM-ER 406 and KNM-ER 732 from Kenya). Even for these pairs of fossil specimens of the same species, an average log se_m value of -1,62 +/- 0,11 has been calculated. This is not significantly different from the mean log se_m value of -1,61 published by Thackeray (2007) based on comparisons of modern specimens of the same species.

This approach offers the potential to assess probabilities that two fossils are the same species, or whether they are different.

Thackeray (in press) has compared certain specimens attributed to *A. africanus* (Sts 5 and Sts 71) with others that have been classified as *H. habilis* (OH 24 and KNM-ER 1813) and are dated between 2,6 and 1,6 million years. The results are surprising since an average value of approximately -1,61 is obtained based on all possible combinations of these specimens. This raises the question as to whether *A. africanus* and *H. habilis* are part of a continuum, of the kind suggested by Thackeray and Odes (2013) in the context of 'palaeospectroscopy', recognising that there are not necessarily clear boundaries between Plio-Pleistocene hominin species. Perhaps *A. africanus* and *H. habilis* can be considered together as a chronospecies (Thackeray, in press).

It was just over 50 years ago that the hominin species *H. habilis* was described by Leakey, Tobias and Napier (1964) on the basis of early Pleistocene fossils from Bed I at Olduvai Gorge in Tanzania. Several palaeontologists have observed that the East African specimens attributed to *H. habilis* were similar to South African Plio-Pleistocene fossils attributed to *A. africanus* from Taung (described initially in 1925 by Raymond Dart), and from Sterkfontein (described by Robert Broom after 1936). Robinson (1965) claimed the specimens attributed to *H. habilis* should instead be considered to be australopithecines. This claim is supported by the log se_m statistics reported here.

Just as there are not clear boundaries between hominin species, so too there is no clear boundary between the genera of *Australopithecus* and *Homo*. A probabilistic approach to taxonomic definitions is called for. This is associated with what I call 'Sigma taxonomy' (Sigma stands for S, which relates to spectroscopy), as opposed to alpha taxonomy, whereby specimens are classified into discrete species, as if they were black or white.

Acknowledgments

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A LOOK AT ROCK ART OVERSEAS
First Palaeolithic rock art discovery in Germany

Wolfgang Welker

In 1992, Jürgen Weinheimer discovered a series of rock engravings on a wall of slate in the Hunsrück in Germany. Weinheimer and Arno Quirin, a local historian, later reported the find to the author. Since 2010, a study group from ARRATA working in conjunction with the Rhineland-Palatinate State Archaeology Office (GDKE), Koblenz has been examining the carvings. After a first appraisal by Gerhard Bosinski and an inspection with state archaeologist Axel von Berg, the site was visited by Antonio Martinho Baptista and Dominique Sacchi in 2011 and by Paul Bahn in 2013, who attributed the decorated panel to the Palaeolithic period. On July 1, 2014, the rock engravings were introduced to the public during a visit to the site by the Minister of Education and Cultural Affairs for the Rhineland-Palatinate, Doris Ahnen. To date Palaeolithic rock art in Europe has primarily been discovered in Portugal (1981), Spain, and France (Sacchi 1988; Bahn 1995; Baptista 2009).

Site topography

The engraved rock (Fig. 1), chiefly characterised by depictions of horses, can be found in a side valley of the River Moselle close to the village of Gondershausen, in the northern Hunsrück, which is part of the Rhenish Massif, bordered by the Moselle and the Rhine rivers. The engraving is in one of the V-shaped valleys typical of this area. The engraved slab of rock, in an exposed position on a small, intermediate plateau, can be geologically allocated to the Early Devonian period. It is distinguished by a number of slate layers at an oblique angle to the almost vertical surface of the carvings. This and the fact that the engraved wall of slate is at a slight slant and faces the hillside in a valley have provided good protection against weathering, such as damage by driving rain.

Deep traces of erosion leave no doubt as to the authenticity of the rock art. The engraved slab, which is part of a longer barrier of rock, is some 1,95 m high and 2,25 m wide at its base. The smooth image area, which measuresaround 1,2 m^2, is on the upper part of the boulder. 'Poster-like' rock surfaces such as these are chiefly formed by tectonic clefts in the rock and a relatively brief period of quaternary weathering. Comparable rock surfaces can be found throughout the valleys of the Rhenish Massif.

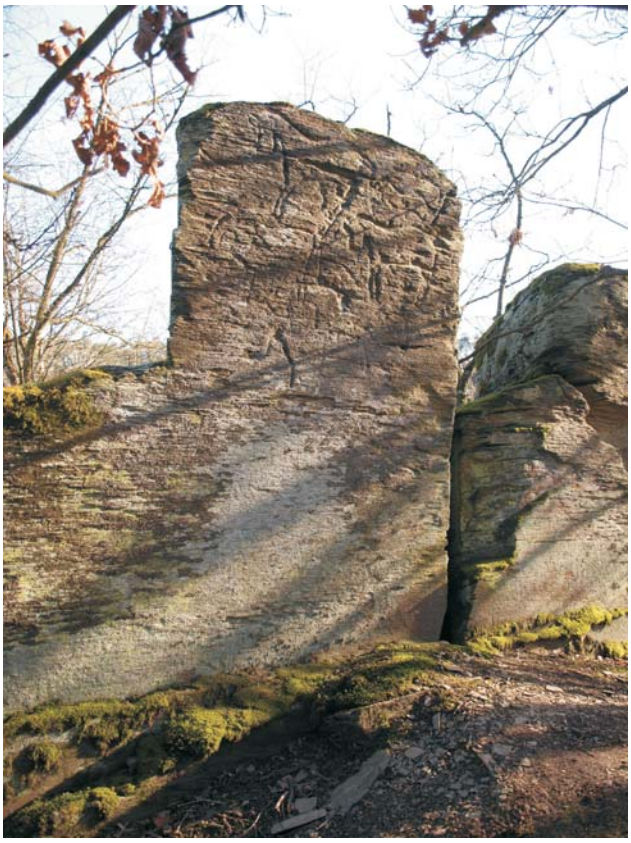

Fig. 1: The Hunsrück animal engravings in natural light (photo: M Schaffranski)

The animal images and the concept of space

Several periods of work can be defined, each marked by various techniques, motifs and degrees of weathering (Fig. 2). The pictorial ensemble with its depictions of animals derives from a first creative phase, during which the rock surface was intensively prepared by pecking, hammering and scratching. The main motif of the deep engravings represents two horses in profile (Fig. 2, Nos I and II), both facing left and around 0,5 m long each. They form an oblique axis along which the other engraved animals, also facing left, are evenly distributed. Unlike Horse II, Horse I is shown moving, judging from the inclusion of anatomical details lacking on the other animal figures, such as the bent foreleg and the hooves. This seems to polarise the two horses, which also feature a second hind leg in the perspective first described by Henri Breuil, where certain elements of an animal

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shown in profile are turned through an angle of up to 90° (Leroi-Gourhan 1981:32).

On the upper right of the image area the composition is embellished by a small horse (III) measuring approximately 0,25 m long and framed by the back line of an indeterminate animal (IV). On the lower edge of the axis there is a complete, indeterminate animal some 0,4 m long (V). It is markedly different from the stereotypical horses and characterised by its long, thin but otherwise rather unusual head. Some engraved lines that may represent horns (or antlers) are badly preserved and difficult to interpret. The clearly formed withers and angular rump would suggest a bovid or cervid-type animal .

What is remarkable is the close disposition of the animals, with the gaps between them less than 1 cm. However, they do not overlap. Regarding the use of space, the Hunsrück animals are distributed in an ordered and even manner that can be referred to as a symmetry of mass in the sense of Andre Leroi-Gourhan (1981:24f). Attempts have been made to suggest a third dimension. By surrounding the small horse with the contours of Animal IV the artist created a sense of depth, having the observer believe that the small horse is in the foreground, as seen in the Aurignacian Chauvet Cave in the Ardeche, France (Chauvet et al. 2001:106). With the same artistic device the observer is also given the illusion that the head of Animal IV is behind Horse I. This 'illusion of overlapping' is an artistic principle, used to create a sense of perspective.

The partial assemblage of the small horse and Animal IV, close to Horses I and II, also ultimately moves into the background compared to the two dominant horses. The image area is completed by a number of other deep engravings that can be interpreted as animals shown in an abridged form. A number of other abstract geometrical signs on the rock belong to a later creative period and are technically striking in that they consist primarily of fine incisions. Finally, more recent history has left its mark on the engraved wall of slate in the form of a chiselled '1' and the carved abbreviation 'AIG'.

Technique

The more heavily incised Palaeolithic animal engravings reach widths of up to 4 cm and absolute depths of around 1 cm. It is to be assumed that the rock around Horses I to III in particular was worked flat beyond the outlines of the animals, or that at least the partially convex surface of the rock was worked into the design. The relative depth between the bottom of the engravings and the inner area of the animals is over 2 cm in places. The especially strong carving of the neck/back lines of the horses with their asymmetrical grooves creates a natural three-dimensional design. This bas-relief technique makes the animal bodies stand out from the surface of the rock. In both natural and artificial light the illusion that this is a three-dimensional design is enhanced by the contrast between light and shade.

Style

The Hunsrück animal carvings are representative of a cautious naturalism in a schematic style. The contours of the virtually square heads with their V-shaped ears, the S-shaped line of the neck/back follow a fixed, repetitive pattern on all of the horses. The heavy overemphasis of the heads in both shape and size is particularly notable here; this in fact denotes the typical traits of Przewalski's wild horse with its comparatively large box-like head (Volf 1996: 47).

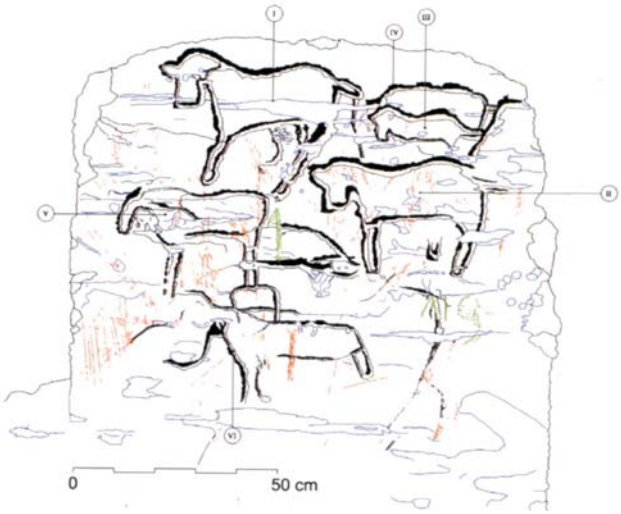


Fig. 2: The Hunsrück rock with its deep engravings (black), fine incision (red), other historical markings (green) and areas of natural disturbance (blue)
(Sketch: R Hecker and W Welker. Digital representation: A Schmidt and W Welker)

The general schematisation of the Hunsrück animal engravings are clearly distant from the naturalist style found in the Magdalenian in nearby Gönnersdorf, for instance. In Gönnersdorf, the pictures of various animals, including 79 horses, were engraved on portable slates (Bosinski 2007:218). However, the leg and stomach lines are treated differently on the horses, therefore making a clear distinction between them. Horse I features several marked details such as front hooves and tail hair, which is lacking on all the other engraved animals. The legs on Horse III are merely suggested and not fully formed. The leg/stomach line of Horse II, on the other hand, has a clear geometrical style and gives a static, 'hanging' impression. The line of the legs/stomach on indeterminate Animal V follows the same pattern.

The strongest parallels in style, subject matter and technique with the Hunsrück engravings are found in the Palaeolithic, in particular in the drawings on Panel

Continued on page 18

PROFESSOR DAVID LEWIS-WILLIAMS AWARDED THE ORDER OF THE BAOBAB IN GOLD

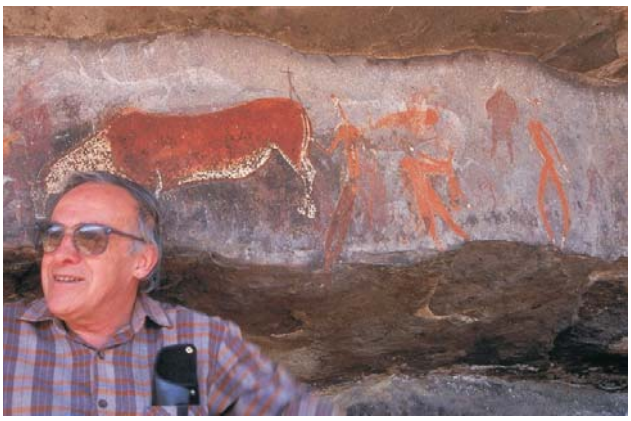
Emeritus Professor James David Lewis-Williams has been awarded the Order of the Baobab in Gold for his exceptional and distinguished contribution to the field of archaeology. The Presidency announced the recipients of National Orders on 17 April 2015. The motivation for his award reads as follows: 'His research on the rock art of the ancient people of southern Africa has contributed invaluable knowledge about their lives and times.'

National Orders are the highest awards South Africa bestows on its citizens and eminent foreign nationals who have contributed towards unity, reconciliation and building the nation. Various elements in the Order of the Baobab's design symbolise longevity, community support, contribution and prosperity in organic unity.

Prof. Lewis-Williams is one of South Africa's leading scholars with an A1 National Research Foundation rating. During his long academic career he has made a significant and internationally acclaimed contribution to understanding the rock art, cultural heritage and human rights of the San of southern Africa. In the 1970s he pioneered an authentic indigenous interpretation of San rock art, demonstrating the existence of a remarkably sophisticated belief system over a period of thousands of years.

His work on rock paintings in the Drakensberg was a major factor in establishing the cultural significance of the Maloti Drakensberg World Heritage Site. From the 1980s onwards, his insights – especially in the field of neuropsychology – have had a profound influence on the way rock art is interpreted not only in southern Africa but also by researchers in France, Norway, Turkey and the United States. His knowledge of the /Xam language, widely spoken by San hunter-gatherers in South Africa before colonial times but now no longer in use, provided a /Xam translation in place of Latin, as well as a rock painting, for the new South African coat of arms.

As a lecturer at the University of the Witwatersrand for more than 20 years, he trained most of the leaders in the rock art field who are active today, guiding them in recording methods and establishing the world-renowned Rock Art Research Institute. Although he retired from teaching in 2000, he continues to mentor and inspire researchers locally and abroad to apply appropriate theory and method derived from the descendants of the people who made the art. By advancing indigenous knowledge in the global arena in 20 internationally acclaimed books, participating in numerous documentary films and radio interviews, and publishing more than 200 academic articles in international and local peer-reviewed journals, he has created an understanding of how early religions and belief systems developed, and were illustrated in rock paintings and engravings for thousands of years before writing replaced them.



Exceptional milestones

1972–1989: Publication of his PhD thesis under the title *Seeing and Believing*, as well as a series of articles in peer-reviewed journals in South Africa and abroad. This revived interest in the 19th century /Xam San archive and drew attention to the similarities between the /Xam and other San groups in southern Africa. Key rituals and beliefs recognised in the San rock paintings of the Drakensberg demonstrated that the indigenous artists had been practising a sophisticated religion for thousands of years.

Similarities between San rock art and rock art in Europe and the USA were explained for the first time through recognition of similarities in the neuropsychology of all living people. The results of this research were shared with colleagues at universities in the Italy, the USA, Canada, the UK and Ireland at a time when South African academics were not always welcome. Prof. Lewis-Williams had, for the first time, demonstrated that rock art research, both in southern Africa and further afield, was worthy of serious academic investigation.

1990–2000: The position and stature of the Rock Art Research Institute at Wits University grew as a result of the publication of a series of excellent academic articles and books of general interest. As the Apartheid regime ended, David Lewis-Williams took the lead and not only attracted foreign students to study rock art at the university, but also attended conferences and gave lectures in many other countries, while he curated and gave the opening address at a major exhibition of San rock art at the Kennedy Centre in Washington DC in 1998. During this decade he received the Distinguished Research-

ers award at the University of the Witwatersrand, was elected a Fellow of the Royal Society of South Africa, was President of the South African Archaeological Society and served on the International Advisory Committee for Chauvet Cave in France. In 2000, he was invited by President Mbeki to translate the new South African national motto into the /Xam language.

2001–2014: After retirement as Professor of Cognitive Archaeology at Wits in 2000, he remained on the campus as a Senior Mentor and Emeritus Professor and was twice awarded an A1 research rating by the National Research Foundation. He also received several international honours and remains the only South African to have been awarded the prestigious James Henry Breasted Prize by the American Historical Association, and the award for Excellence in Archaeological Analysis from the Society for American Archaeology.

In 2006 he became the only archaeologist in South Africa to have received both an Honorary DLitt degree from the University of Cape Town and an Honorary DSc from the University of the Witwatersrand. His exceptionally popular book, *The Mind in the Cave: consciousness and the origins of art*, published in 2002, was a bestseller and has been translated into French, Japanese, Czech and Spanish. It was followed by two more internationally acclaimed books on the development of religion, namely *Conceiving God: the cognitive origin and evolution of religion*, and *Deciphering Ancient Minds: the mystery of San Bushman rock art* (with Sam Challis).

Prof. David Lewis-Williams has served on the Science Committee of the former National Monuments Council and has been a staunch supporter of the South African Archaeological Society. He has been generous in sharing his knowledge both in South Africa and abroad, having delivered over 100 invited lectures on San heritage and rock art. Without his leadership in this field over the past four decades, the international significance of our World Heritage sites at Mapungubwe and the Maloti Drakensberg would not have been recognised.

First Palaeolithic rock art discovery in Germany (continued from page 16)

1 at the small cave of Pair-non-Pair, attributed to the Aurignacian (Martinez & Loizeau 2013:100). The heavily pecked animal carvings found here use the natural rock surface to create a bas-relief impression in some areas (Delluc & Delluc 2013: 28, 32). Stylistic parallels exist in the reduced, schematic legs, among other aspects, which create a hanging, immobile impression. One of the motifs also shows a striking polarity between two horses, which face in the same direction and have been engraved one behind the other in different stances and in close proximity. The artist has also arranged all the other animals very closely together and attached great importance to the use of space by not making them overlap and integrating natural niches and cracks in the rock into the artwork. In addition to the animals shown in full, there are others depicted in an abridged form. This striking accumulation of similar characteristics in style, motif and technique points to a close cultural relationship between the rock art in the Hunsrück and the engravings in the cave of Pair-non-Pair.

Remarkable parallels in the Gravettian can also be found, in Pech-Merle for instance. The style of Pech-Merle's Black Frieze is dominated by schematic animal figures and animals also shown in abridged form that ironically betray an attention to anatomical detail (Lorblanchet 2010:431f). The existence of a stylistic relationship is corroborated by a direct comparison of Horse I from the Hunsrück with Horse 1 on the Black Frieze. The execution of the neck/ back line with the square head and V-shaped ears and the otherwise rather schematic depiction of the leg/stomach line, with a precise rendering of the front hooves are notable parallels.

There is thus much conformity in technique, style and subject matter with dated works of art from the older phase of the Upper Palaeolithic, thus probably indicating a dating before the last glacial maximum.

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Is this a new species of human?
They're not quite Neanderthals and not quite modern humans. They're something else, but no one is sure what. Newly-examined fossils suggest that an unknown species of human was roaming parts of northern China between 60 000 and 120 000 years ago. Alternatively, the fossils could be the result of interbreeding between two of the known species. We know there were as many as four other early humans living on earth when modern humans were still confined to Africa. The Neanderthals lived in Europe, the Denisovans in Asia and *Homo floresiensis* in Indonesia, plus there was from Eurasia that interbred with the Denisovans. The new findings suggest the picture is even more complicated.

The Chinese remnants, consisting of some skull fragments and nine teeth from four individuals. were first discovered in a cave in Xujiayao in 1976. A comprehensive analysis of the teeth has now been . María Martinón-Torres of the National Research Centre on Human Evolution in Burgos, Spain, looked at the size and shape of the crown and root system, the grooves, cusps and crests, and their positions relative to each other. These were then compared to a pool of over 5 000 teeth representing nearly all known hominin species. It was clear that the teeth did not resemble those of modern humans. Rather, they have several primitive features, some of which look like the older species *H. erectus*, while some look more like Neanderthals.

Nevertheless, Martinón-Torres is reluctant to claim that the teeth represent a new species: 'What we have seen is an unknown group for us. It's not *H. sapiens* and it's not *H. neanderthalensis*. They have a mixture of something very primitive, which is currently unknown. We cannot go further to say it's a new species because we need to compare it to other things. They could even be Denisovans. More bones would help. *American Journal of Physical Anthropology*

The sex lives of Neanderthals and early humans
A fossilised jaw bone of one of Europe's earliest modern humans, discovered in the Peştera cu Oase cave in Romania, has unveiled new evidence about what Neanderthals and humans got up to some 40 000 years ago. Geneticists have found that the individual , far more than any other modern human skeleton sequenced so far. Now that the , geneticists have begun to find a few rare fossils that contain a mixture of the two. The latest find of a male has been radiocarbon dated at 37 000 to 42 000 years ago.

The fact that this individual carried more Neanderthal DNA than any other anatomically modern human ever tested is surprising as it means that the mating between a Neanderthal and a modern human took place as recently as in his great-grandfather's generation. Surprisingly, in spite of the two populations being in contact for many thousands of years, there is no DNA evidence for interbreeding between Neanderthals and the ancestors of the Europeans living today. In fact, segments of Neanderthal DNA turn up in modern human DNA from East Asians and Native Americans far more than they do from Europeans. But if the anatomically modern human population of ice-age Romania did interbreed with Neanderthals, then why did the Neanderthal DNA signature not carry through to modern Europeans?

Analysis has revealed the Oase man was not a direct ancestor of modern Europeans. Instead, it was immigrant populations of early humans originating from the Middle East and south-east Europe that passed on their genes while sweeping through Europe, bringing farming and animal husbandry with them. Ancient skeletons of modern humans from Eurasia help flesh out the story of relations between Neanderthals and humans from the last ice age. A 36 000 to 39000-year-old individual from the Kostenki 14 site in western Russia . Meanwhile, a 45 000-year-old fossil skeleton from the Ust'-Ishim site in Western Siberia . The studies of the Kostenki 14 and Ust'-Ishim specimens show that gene flow from Neanderthals to modern humans at these sites occurred well before these individuals lived. In fact, the it could have been around a thousand years before the Ust'-Isham individual lived, much earlier than in Romania. *SAST, 22/06/2015*

How the Egyptians moved pyramid stones
How the ancient Egyptians pulled massive statues and pyramid stones weighing 2,5 t on large sleds has long been a mystery. New research shows that the addition of a small amount of water to sand significantly reduces sliding friction. An international team tested the sliding friction of dry and wet sand by pulling a weighted sled across the surface in a tray. With dry sand, a heap would form in front of the sled, hindering its movement. But as they added water, both the force needed to pull the sled and the amount of friction decreased. With the right amount of water, wet desert sand is about twice as stiff as dry sand, allowing the sled to glide far more easily. The amount of pulling force can reduced by as much as 50 per cent. The answer had been staring us in the face for a long time. A wall painting from the tomb of Djehutihotep shows a worker pouring water on the sand in front of a sled that's carrying a colossal statue. Egyptologists had been interpreting the water as part of a purification ritual. *Physical Review Letters, 05/05/2014*

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