



BRIEF REPORTS

A possible origin for some ancient palaeoart

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The rocks and dunes on which we innocently played as youngsters contain secrets that a knowledgeable observer can decipher. This is because of what we call the 'Great Serendipity': an area in which 'cognitive modernity' appears to have evolved happens to be precisely where the beaches and dunes those ancestral hominins traversed have become cemented, with the capacity to preserve evidence in stone (aeolianite). This applies not only to their tracks but also to the activities they partook in, which may include creating what is known as 'palaeoart'.

Examples of palaeoart become harder to find with increasing time intervals between their creation and the present. This may be due to taphonomic effects (Bednarik 1994): wood and leather decay faster than bone, which decays faster than stone, or perhaps it may be more challenging to detect the human 'signature' in really ancient examples. Thankfully, sand-cemented-into-rock, the medium we investigate, can preserve such evidence for long periods. However, once palaeosurfaces are exposed through coastal erosion, the forces of water and wind act rapidly on the tracks and traces that might occur on them. The term 'ammoglyph' was coined to refer to probable anthropogenic patterns encountered on these surfaces, representing a previously undocumented form of palaeoart (Helm et al. 2019, 2020, 2021, 2024).

Perceptive observers have speculated that sand was probably the original medium for the inscription of palaeoart. Hodgson and Helvenston (2007: 5) presciently suggested that early art would have been 'likely in sand originally' but noted that 'scratches in the sand ... are seldom preserved from those distant times ...'. Likewise, Morriss-Kay (2009) commented on how much palaeoart must have been 'created in perishable materials and has therefore been lost to the archaeological record'. At the time, such statements reflected the state of knowledge, and sand was possibly thought to fall into the category of 'perishable materials'.

While the concept of sand being a vast

Middle Stone Age (MSA) canvas is evocative, sand art would not have been created with the intention of durability, something that may have distinguished it from images on other substrates. Nevertheless, Morphy (2007) observed how, in the case of the Yolngu in Australia, the temporary nature of patterns and sculptures in sand was actually tied to their meaning. It also seems that the work of creating a pattern or sculpture in sand must have been substantially less than what was required to produce other forms of palaeoart, such as engravings in ochre. Optically stimulated luminescence results from the Cape south coast indicate that purported ammoglyphs are as old as 139 ± 10 ka (Helm et al. 2023).

The notion that they might be 'bio-mimetic' in origin became apparent to us via a publication by Tributsch (2016), in which it was suggested that ochre use by hominins may have originated in mimicking its use by the Bearded Vulture (*Gypaetus barbatus*). Ancient hominins and vultures presumably shared space at carcasses, providing ample opportunities for astute observation. The use of ochre may initially have had health benefits (Tributsch 2016), and then morphed over time into human adornment and was used as a medium for painting or a substrate for engraving.

Some of the purported ammoglyphs on South Africa's Cape south coast have circular motifs with a central depression (Fig. 1). If a bio-mimetic origin is extended from the use of ochre and is applied to



Figure 1. A circular purported ammoglyph from the Cape south coast of South Africa; scale bar = 10 cm.



Figure 2. A scratch arc in sand on the Cape coast; the camera case is 14 cm long (photo by Jack Carrigan).



Figure 3. Scratch arcs in sand on the Cape coast (photo by Jack Carrigan).

such forms, there is a ready template on Cape coastal dunes: scratch circles. These are defined as ‘structures formed by the rotation of a tethered organism into the surrounding sediment’ and can be found in dune environments on the Cape coast today (Figs 2 and 3) and in the regional fossil record (Helm et al. publ. online). Essentially, they typically form when a frond or flimsy blade of vegetation is blown in the wind, thus inscribing an arc or circle in the sand. Moreover, the mechanism of creation is readily apparent.

It can, therefore, be hypothesised that ancestral hominins in places like the Cape south coast noted scratch circles in sand, inferred their origin, were perhaps impressed by their aesthetic qualities, and sought to replicate them. The easiest way to achieve this would have been to place one end of a forked stick in the sand and inscribe a circle with the other end of



Figure 4. Replicating a scratch circle using a forked stick (photo by Linda Helm).

the stick in a rotating or twirling motion (Fig. 4). We can speculate on the profound feelings that might have occurred in the mind of the first ‘replicator’, using a forked stick in the same way that a compass is used today. While ammoglyphs appear to be a rare phenomenon and have only been reported from the Cape south coast, it would have been straightforward to inscribe large numbers of perfect circular features on Pleistocene dunes and beaches.

The circle is the most perfect two-dimensional form, with an axis of symmetry around any straight line drawn through its centre. It has no beginning or end point, and its perimeter has a constant curvature. Humans across many cultures appear attracted to the circular form. For example, the petroglyphs of the Tasmanians, who had a Mode 3 tool industry right up to British colonisation, consist almost entirely of circles and cupules (Sims 1977; Bednarik et al. 2007), as does the surviving presumed Mode 3 rock art in the southern Kalahari (Beaumont and Bednarik 2015). Circles also feature prominently in Mode 3 times on the Australian mainland, which applies to all Pleistocene and early Holocene occupations of that continent, e.g. the Karake genre of cave petroglyphs (Aslin and Bednarik 1984).

Similar considerations may have applied to our MSA ancestors, and scratch circles in sand, with their conspicuous mechanism of origin, might have applied the impetus. Feliks (2008) and Hodgson (2011) have discussed the role of symmetry in hominin creations since the Early Pleistocene and Bednarik (2003) has discussed hominin appreciation of symmetry in fossils and crystals. It appears that circles, straight lines and ‘geometric patterns’ (Helm et al. 2021) may have been important to inhabitants of the Cape south coast during the MSA and are today evident as ammoglyphs.

It is evident, then, that fossilised scratch circles of botanical origin and purported circular ammoglyphs can both be found on aeolianite surfaces on the Cape south coast. Helm et al. (publ. online) have presented

guidelines for distinguishing between them, and a hominin origin needs to be considered when assessing scratch circles in Pleistocene deposits. Our research team has also recently advanced the notion that tracing animal outlines in sand may have formed an early (also bio-mimetic) form of representational art (Helm et al. 2024).

It seems that perhaps in archaeology, more than any other discipline, absence of evidence is not evidence of absence and that we truly do not know how much we do not know. In such circumstances, humility is a virtue, absolute certainty is elusive, and acknowledgements of uncertainty are generally commendable. Occasionally, we may be blessed with a fleeting glimpse of something rare that may provide us with novel insights. We regard every purported ammoglyph as a potential minor miracle of preservation, possibly providing a privileged window into a hitherto unimagined aspect of our collective heritage. Scratch circles registered by plants form a plausible bio-mimetic inspiration for the creation of circular forms in sand by MSA hominins on the Cape south coast.

It is acknowledged that this concept is not falsifiable and cannot be proven. However, if such informed speculation is correct, it forms an explanation (not the only explanation) for the origin of some ancient palaeoart. It appears that this is a novel concept, which suggests that, at least sometimes, our distant ancestors were astute observers of the world around them and good mimics rather than true inventors *ab initio*.

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REFERENCES

ASLIN, G. D. and R. G. BEDNARIK 1984. Karlie-ngooinpool Cave: a preliminary report. *Rock Art Research* 1(1): 36–45.
BEAUMONT, P. B. and R. G. BEDNARIK 2015. Concerning a cupule sequence on the edge of the Kalahari Desert in

South Africa. *Rock Art Research* 32(2): 163–177.
BEDNARIK, R. G. 1994. A taphonomy of palaeoart. *Antiquity* 68(258): 68–74.
BEDNARIK, R. G. 2003. The earliest evidence of palaeoart. *Rock Art Research* 20(2): 89–135.
BEDNARIK, R. G., G. ANDREWS, S. CAMERON and E. BEDNARIK 2007. Petroglyphs of Meenamatta, the Blue Tier mountains, Tasmania. *Rock Art Research* 24(2): 161–170.
FELIKS, J. 2008. Phi in the Acheulian: Lower Palaeolithic intuition and the natural origins of analogy. In R. G. Bednarik and D. Hodgson (eds.), *Pleistocene palaeoart of the world*, pp. 11–31. Proceedings of the XV UISPP World Congress (Lisbon, 4–9 September 2006), British Archaeological Reports International Series 1804, Oxford.
HELM, C. W., H. C. CAWTHRA, J. C. DE VYNCK, C. J. HELM, R. RUST and W. STEAR 2019. Patterns in the sand: a Pleistocene hominin signature along the South African coastline? *Proceedings of the Geologists' Association* 130(6): 719–740; <https://doi.org/10.1016/j.pgeola.2019.08.004>.
HELM, C. W., H. C. CAWTHRA, J. C. DE VYNCK, C. J. HELM, R. RUST and W. STEAR 2020. Drawing a line in the sand. *Rock Art Research* 37(1): 95–99.
HELM, C. W., H. C. CAWTHRA, J. C. DE VYNCK, C. J. HELM, R. RUST and W. STEAR 2021. Large geometric patterns from the Middle Stone Age in aeolianites on the Cape south coast, South Africa. *Rock Art Research* 38(1): 10–22.
HELM, C. W., A. S. CARR, M. G. LOCKLEY, H. C. CAWTHRA, J. C. DE VYNCK, M. G. DIXON, and W. STEAR 2023. Dating the Pleistocene hominin ichnosites on South Africa's Cape south coast. *Ichnos* 30(1): 49–68; <https://doi.org/10.1080/10420940.2023.2204231>.
HELM, C. W., A. S. CARR, H. C. CAWTHRA, P. D. COWLEY, J. C. DE VYNCK, P.-J. GRÄBE, R. RUST, W. STEAR and A. K. WHITFIELD 2024. A purported Pleistocene sand-sculpture from South Africa: representational art of another species? *Rock Art Research* 41(1): 58–73.
HELM, C. W., R. M. CATCHPOLE, H. C. CAWTHRA, R. M., COWLING, J. C. DE VYNCK, M. G. DIXON, R. RUST, W. STEAR and G. H. THESEN publ. online. Scratch circles and circular purported ammoglyphs: novel observations from the Cape south coast of South Africa. *Proceedings of the Geologists' Association*.
HODGSON, D. 2011. The first appearance of symmetry in the human lineage: where perception meets art. *Symmetry* 3(1): 37–53; <https://doi.org/10.3390/sym3010037>
HODGSON, D. and P. A. HELVENSTON 2007. The evolution of animal representation: response to Dobrez. *Rock Art Research* 24(1): 116–123.
MORPHY, H. 2007. *Becoming art: exploring cross-cultural categories*. Berg, Oxford.
MORRIS-KAY, G. M. 2009. The evolution of human artistic creativity. *Journal of Anatomy* 216(2): 158–176; <https://doi.org/10.1111/j.1469-7580.2009.01160.x>.
SIMS, P. C. 1977. Variations in Tasmanian petroglyphs. In P. J. Ucko (ed.), *Form in indigenous art: schematisation in the art of Aboriginal Australia and prehistoric Europe*, pp. 429–438. Australian Institute of Aboriginal Studies, Canberra.
TRIBUTSCH, H. 2016. Ochre bathing of the Bearded Vulture: a bio-mimetic model for early humans towards smell prevention and health. *Animals* 6(1): 7; <https://doi.org/10.3390/ani6010007>.

A linguistic approach to the depictions of humans touching animals in Saharan rock art

By JULIEN d'HUY

In Saharan rock art, many animals are depicted in contact with other animals, and the interpretation of these images is often linked to the sense of touch. Various interpretations have been proposed, ranging from the expression of a desire to 'control' the animal to the widespread African belief that the spirit of an ancestor can manifest itself to humans in the form of an animal (Le Quellec 1993: 426–427). More generally, according to Le Quellec, 'we can assume that the Saharan figurations are motivated by magical practices of conciliation or neutralisation, domination or appropriation, whether real or psychological, of the coveted game' (Le Quellec 1993: 427). Alternatively, a recent interpretation suggests a hunting hypothesis based on an image depicting a man touching an elephant (Le Quellec 2023: 140). Leclant, Huard and Allard-Huard consider this type of image characteristic of a possible 'hunter culture', attributing to it a 'psychic value' (Leclant et al. 1980: 365–395). In another context, I have argued that the representation of humans touching animals in Saharan rock art may symbolise establishing a relationship between two entities, with contact symbolising the comparison (d'Huy 2011).

The linguistic path I explored at that time still seems correct to me since language can serve as a repository for certain forms of thought that have now disappeared. However, I probably have taken the wrong path. Alongside others, in this paper, I aim to demonstrate how linguistics can be a valuable tool for retracing the past, allowing us to rediscover the meanings of ancient images whose creators have long since disappeared.

1. Colexification between 'touch' and 'taste'

The world is not perceived similarly across different cultures or regions. These differences can be explored through a linguistic phenomenon called colexification, wherein two or more different meanings are expressed with a single word (François 2008). I will demonstrate how an areological study of such colexification can shed new light on specific images in Saharan rock art.

The areological approach involves creating large-scale distribution maps of social traits and phenomena. This method has been used to infer the origin and distribution routes of linguistic features (e.g. Nichols 1992, 1994), myths and mythological motifs (e.g. Hatt 1949; Berezkin 2013; Le Quellec 2021), and rituals (e.g. Stépanoff 2019). About colexification, Urban (2009) has shown that words combining the

meanings 'sun' and 'moon' are found preferentially in the languages of America but also northeast Eurasia (so-called 'Palaeosiberian' languages) and New Guinea. The geographical distribution of this colexification appears to be strongly correlated with the vast and ancient circum-Pacific linguistic area dating back to the first settlements of the Americas (Nichols 1994). The colexification between 'firewood' and 'fire' is widespread among Sahul, Australia and the southern Americas and is very rare elsewhere, including among Austronesian languages (Schapper et al. 2016). The fact that New Guinean and Australian languages share rare typological patterns in common highlights a possible inherited pattern that persisted since the first settlement of this area. Under these conditions and considering their permanence and areal nature, it would be interesting to examine the distribution of certain colexifications that are particularly widespread in Africa. This examination could help us understand the meaning of Saharan images in which a human touches a (wild) animal.

Looking at the Ethiopian *sprachbund*, an area of linguistic convergence where languages from three different families of the Afroasiatic phylum (Semitic, Cushitic and Omotic) and several Nilo-Saharan languages are spoken, Treis finds that the same verbal lexemes are used for visual experiences and activities as for auditory experiences and activities. There is no separate verbal lexeme for 'taste' or 'touch'. The passive form of the verb 'to hear' is used to designate tactile and gustatory experiences and sometimes olfactory experiences but not to designate activities related to the same senses. The verb 'to see' can be used to account for perceptive activities not related to sight, etc. (Treis 2010: 31). Güldemann and Fehn (2017: 508) have looked at the linguistic features that unite the languages of the Kalahari Basin (including, among others, Bantu, Khoe and Kx'a languages) and have noted that they all have polysemy covering at least three sensory modalities among sight, hearing, touch, taste and smell. Almost all these languages specifically colexify touch and taste; touch never has its own verbal lexeme and is combined with one or more of the other senses.

More generally, Georgakopoulos et al. (2021: 467, 469) note that the colexifications of hearing and taste on the one hand and touch and smell on the other, are particularly well-represented in African languages compared to the rest of the world. They also show that in Africa, touch is indifferently colexified with the other four senses. The variability of the data warrants caution but demonstrates a frequent link between touch and the other senses, particularly taste. A consultation of the Clics3 website (<https://clics.clld.org/edges/21-1892>, consulted on 29/12/2023) increases the granularity of the analysis and confirms the strong presence of touch/taste colexification in North Africa. It shows a predominance of this colexification among Afroasiatic languages (Tangale, Ngwaxi,

Miya, Mandara, Gələvda, Gábin, Geji, Gawwada, Fali Bwagira, Bade, Angas, i.e. 79% of the cases identified), with two occurrences among Atlantic-Congo languages (Jari, Jaku; 14% of the occurrences) and one among a Caribbean language (Panare; 7%). Following Le Quellec, it is, therefore, possible to propose that images of humans touching animals can be compared to figurations of hands that are superimposed on or surmount representations of animals, with a desire for domination or appropriation (Le Quellec 1993: 426), consumption being considered the ultimate act of domination.

Is it possible to support this interpretation with other African linguistic facts, ancient enough to have been known to the Saharan artists?

2. Colexification between 'meat' and '(wild) animal'

Greenberg notes that the use of a single noun to mean both 'meat' and '(wild) animal', or alternatively the existence of different but etymologically related nouns, is not only pan-African but also very rare outside Africa (Greenberg 1983: 3–4; see also Greenberg 1959). Whenever the two meanings are distinguished using a derivational mechanism, compositional or otherwise, the term 'meat' is far more likely to be unmarked than the term 'animal', indicating that when one of the two meanings is derived from the other, it passes from 'meat' to 'animal' rather than the reverse. Greenberg supports a Niger-Congo origin for this polysemy (1983: 18), which then spread outside its original linguistic area. However, this colexification is also found in hunter-gatherer cultures of Southeast Asia, for example, among the Lahu (*šrā* 'animal'; 'meat, flesh') and the Jinghpaw (*shàn* 'flesh'; 'deer'; 'large consumable game') (Matisoff 1978: 138), or in Australia, e.g. among the Warlpiri (Wierzbicka 1992: 8). Clics3 adds various languages: Sino-Tibetan (Khoirao, Konyak, Meluri, Ntenyi, Rengma, Tangkhul, Wancho), Indo-European (Saramaccan), Austronesian (Dobel, Adonora Lamaholot, Dulhi), West Bomberai (Kalamang), Pama-Nyungan (Gurindji) languages in the Old World; Caribbean (Kali'na), Tucanoan (Siona) and Yanomamic (Yanomámi) languages in South America.

In agreement with Boyeldieu (2008), it may be reasonable to think that the importance of hunting and game as a source of food could explain the use of a single term to designate both animal and meat. However, the exclusively southern distribution area of this colexification suggests that it may have spread simultaneously with the first waves of *Homo sapiens* settlement outside Africa (excluding archaic genera such as Neanderthals and Denisovans), similar to what has been observed for the areal distribution of certain myths (see, for example, Witzel 2012; Berezkin 2013, 2017; d'Huy 2020a, 2023; Le Quellec 2021, 2022). Accordingly, it has been shown that a myth explaining how the sun animal was resurrected from a bone or a bit of flesh had origins before *Homo sapi-*

ens first left Africa and followed its spread outside that continent (d'Huy 2021, 2023: 265–300). The antiquity of the colexification between 'meat' and 'animal' could be linked to the age of these types of tales, which would imply the derivation, identified by Greenberg, of the word 'animal' from the word 'meat.' Colexification would, therefore, predate the first expansion of the Niger-Congo peoples and be ancient and widespread enough in Africa to have been known during the Saharan Neolithic period.

3. Colexification between 'eat', 'conquer', 'capture a piece in a game' and 'have sexual intercourse'

Greenberg (1959, 1983) has identified other colexifications specific to Africa or rare outside the continent. These include the use of the same term for 'eat', 'conquer', 'capture a piece in a game' and 'have sexual intercourse'.

This colexification seems to complicate 'the very deep analogy that human thought seems to conceive of all over the world between the act of copulating and the act of eating, to such an extent that a very large number of languages designate them by the same word' (Lévi-Strauss 1962: 129). In agreement with its worldwide distribution, and perhaps some linguistic arguments (Cabrera 2012), colexification associating consumption of food and sexual intercourse is undoubtedly very ancient.

After the initial *H. sapiens* dissemination, the primitive analogy between 'eat' and 'have sexual intercourse' developed differently in various regions of the world. In Eurasia, during the Upper Palaeolithic, it appears to have taken the form of a belief in a 'toothed vagina', which later spread to North America (Hatt 1949: 87; d'Huy 2020b). The African colexification, for its part, shows complexification of the food/sexuality connection through the idea of 'conquest' and 'capture', undoubtedly at an early date given its widespread continental diffusion. In line with the different meanings embodying a possible danger, brought together by this colexification, the mythological motif 'For various reasons, sexual contact with a woman is fatal for a man' can be statistically reconstructed shortly after *Homo sapiens* first left Africa (d'Huy 2020b).

4. Conclusion

I have attempted to demonstrate that at least three African colexifications may be ancient enough to have been familiar to those who created engravings and paintings during the Saharan Neolithic. Colexifications appear to share a similar structure, as illustrated in Table 1. This ancient and African structure itself echoes the Saharan images depicting humans touching wild animals.

While the connection is primarily probable, the alignment of colexifications suggests a prediction: the existence, alongside the figuration of animals be-

Touch	Taste
Animal	Meat
Conquer Capture a piece in a game Have sexual intercourse	Eat

Table 1. Correspondence between linguistic terms.

ing touched, of humans depicted having sexual relations with animals, with a similar meaning. This is indeed the case, and numerous scenes of zoophilia can be found in the Neolithic Sahara, which Le Quellec links either to hunting-related rites or to mythological narratives manifesting imaginary relationships of domination (Le Quellec 1993: 431–440).

In conclusion, Saharan images portraying humans touching animals or engaging in sexual activities with animals could be explained by an ancient pan-African complex. Traces of this complex can still be found in current linguistic practices that brought the act of touching an animal and capturing/consuming it closer together.

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REFERENCES

- BEREZKIN, Y. 2013. *Afrika, migracii, mifologija. Arealyrasprostranjenija fol'klornyx motivov v istoričeskoj perspektive*. Nauka, Saint Petersburg.
- BEREZKIN, Y. 2017. *Roždenie zvezdnogo neba: predstavlenija o nočnyh svetilah v istoričeskojdinamike*. MAË RAN, Saint Petersburg.
- BOYELDIEU, P. 2008. From semantic change to polysemy. The cases of 'meat/animal' and 'drink'. In M. Vanhove (ed.), *From polysemy to semantic change: towards a typology of lexical semantic associations*, pp. 303–315. J. Benjamins, Amsterdam.
- CABRERA, J. C. M. 2012. The role of sound symbolism in protolanguage: some linguistic and archaeological speculations. *Theoria et Historia Scientiarum* 9: 115–130.
- FRANÇOIS, A. 2008. Semantic maps and the typology of colexification: intertwining polysemous networks across languages. In M. Vanhove (ed.), *From polysemy to semantic change: towards a typology of lexical semantic associations*, pp. 163–215. J. Benjamins, Amsterdam.
- GEORGAPOULOS, T., E. GROSSMAN, D. NIKOLAEV and S. POLIS 2021. Universal and macro-areal patterns in the lexicon: a case-study in the perception-cognition domain. *Journal of Historical Linguistics* 11(3): 367–420.
- GREENBERG, J. H. 1959. Africa as a linguistic area. In W. R. Bascom and M. J. Herskovits (eds), *Continuity and change in African cultures*, pp. 15–27. University of Chicago Press, Chicago.
- GREENBERG, J. H. 1983. Some areal characteristics of African languages. In I. R. Dihoff (ed.), *Current approaches to African linguistics*, pp. 3–21. Foris, Dordrecht.
- GÜLDEMANN, T. and A.-M. FEHN 2017. The Kalahari Basin area as a 'Sprachbund' before the Bantu Expansion. In R. Hickey (ed.), *The Cambridge handbook of areal linguistics*, pp. 500–526. Cambridge University Press, Cambridge.
- HATT, G. 1949. *Asiatic influences in American folklore*. I kommission hos ejnar Munksgaard, København.
- D'HUY, J. 2011. An explanation to the depictions of humans touching animals. *Sahara* 22: 176.
- D'HUY, J. 2020a. *Cosmogonies: la préhistoire des mythes*. La Découverte, Paris.
- D'HUY, J. 2020b. Mythologie matrimoniale: ce que la mythologie peut nous apprendre du comportement de nos ancêtres. *Nouvelle mythologie comparée / New comparative mythology 2019–2020*, 5: 65–86.
- D'HUY, J. 2021. Le Soleil est un mammifère: origine africaine d'un motif mythologique. *Cahiers d'études africaines*, 244: 799–829.
- D'HUY, J. 2023. *L'Aube des mythes*. La Découverte, Paris.
- LE QUELLEC, J.-L. 1993. *Symbolisme et art rupestre au Sahara*. L'Harmattan, Paris.
- LE QUELLEC, J.-L. 2021. *Avant nous le Déluge! L'humanité et ses mythes*. Éditions du Détour, Bordeaux.
- LE QUELLEC, J.-L. 2022. *La caverne originelle: art, mythes et premières humanités*. La Découverte, Paris.
- LE QUELLEC, J.-L. 2023. I-n-Alobbu, style d'Ihāren et chasse à l'éléphant. *Les Cahiers de l'AARS* 24: 103–146.
- LECLANT, J., P. HUARD and L. ALLARD-HUARD 1980. *La culture des chasseurs du Nil et du Sahara*. Centre de recherches anthropologiques, préhistoriques et ethnographiques, Alger.
- LÉVI-STRAUSS, C. 1962. *Le totémisme aujourd'hui*. Presses universitaires de France, Paris.
- MATISOFF, J. A. 1978. *Variational semantics in Tibeto-Burman: the 'organic' approach to linguistic comparison*. Institute for the Study of Human Issues, Philadelphia.
- NICHOLS, J. 1992. *Linguistic diversity in space and time*. University of Chicago Press, Chicago.
- NICHOLS, J. 1994. The spread of language around the Pacific rim. *Evolutionary Anthropology: Issues, News, and Reviews* 3(6): 206–215.
- SCHAPPER, A., L. SAN ROQUE and R. HENDERY 2016. Tree, firewood and fire in the languages of Sahul. In P. Juvonen and M. Koptjevskaja-Tamm (eds), *The lexical typology of semantic shifts*, pp. 355–422. De Gruyter Mouton, Berlin.
- STÉPANOFF, C. 2019. *Voyager dans l'invisible: techniques chamaniques de l'imagination*. La Découverte, Paris.
- TREIS, Y. 2010. Perception verbs and taste adjectives in Kambaata and beyond. *Sprache und Geschichte in Afrika* 21: 313–346.
- URBAN, M. 2009. 'Sun' and 'Moon' in the Circum-Pacific language area. *Anthropological Linguistics* 51(3/4): 328–346.
- WIERZBICKA, A. 1992. *Semantics, culture, and cognition: universal human concepts in culture-specific configurations*. Oxford University Press, Oxford.
- WITZEL, E. J. M. 2012. *The origins of the world's mythologies*. Oxford University Press, Oxford.

Otugsar petroglyph site complex, northwest China

By CHAO GE and JIN ANNI

The Borohoro Range, also known as the northern branch of the central Tianshan or Zhetysu-Alatau Range, covers an area of approximately 800 × 300 km. It is situated in the centre of the Eurasian continent, along the borders of China, Kazakhstan, Kyrgyzstan and Uzbekistan (Fig. 1). This vast mountain system was established during the late Palaeozoic and Mesozoic periods (Zhang and Wu 1985: 13). However, its present geomorphological characteristics are a result of crustal movements since the late Cenozoic era (Li et al. 2006: 905). The Tarbaghatay Mountains lie north of the range, along the western edge of the Junggar Basin. Acting as a barrier to warm and humid air currents from the North Atlantic, these mountains render the northern side of the range more arid than the southern Ili Valley. The Borohoro Range receives an average annual precipitation of approximately 300–500 mm, significantly more than the 200–300 mm typically seen in the eastern part of the Tianshan Mountains (Guo 2010; Cao 2015).

Over millennia, this area has been contested by various ancient ethnic groups, including the Sakas, Yuechis, Xiongnu, Usuns, Ranrans, Tölös, Türks, Hans, Khitans, Mongols and Jurchens. The consistent human activity, conflicts and integration have resulted in numerous remains, including settlements,

fortresses, beacon towers, mounded tombs, rock art and standing stones. Many of these were uncovered during the 3rd National Cultural Heritage Survey of China, conducted from 2007 to 2011 (Xinjiang Uygur Autonomous Region Bureau of Cultural Heritage 2011a: 2).

The studied petroglyph site complex is located in a canyon that cuts through the Borohoro Mountains, approximately 30 km southeast of Wenquan (Arxan) County, in the Bortala Prefecture, Xinjiang Region, China. This U-shaped valley originates from ice peaks over 3800 m high, about 60 km southwest, characterised by moraine hills on both sides, reflecting a typical glacial landscape. In 2009, dozens of rock art panels were found at three moraines on the south bank of the Otugsar River, which translates to ‘the mountains of homeland’ in Mongolian, near the valley’s end. However, they have received little scholarly attention. In July 2022, the authors surveyed this site and examined twenty-nine rock art panels. This paper briefly reports the authors’ fieldwork and introduces the site to international colleagues for the first time.

The survey identified three sandstone-conglomerate-shale moraines: Otugsar-1, Otugsar-2 and Otugsar-3 (Fig. 1). Otugsar-1 features the fewest petroglyphs, with only 4 panels and 15 motifs. Otugsar-2 is the primary part of the rock art complex, housing 15 panels. Otugsar-3 is mainly characterised by contemporary graffiti across its ten panels. In total, the study examined 143 motifs, mainly zoomorphic, averaging 12.4 × 12.6 cm in size. These motifs included 87 ‘sheep’ (possibly *Capra sibirica* and *Ovis ammon*), 5 ‘deer’ (all variant figures with unnaturally large, tree-

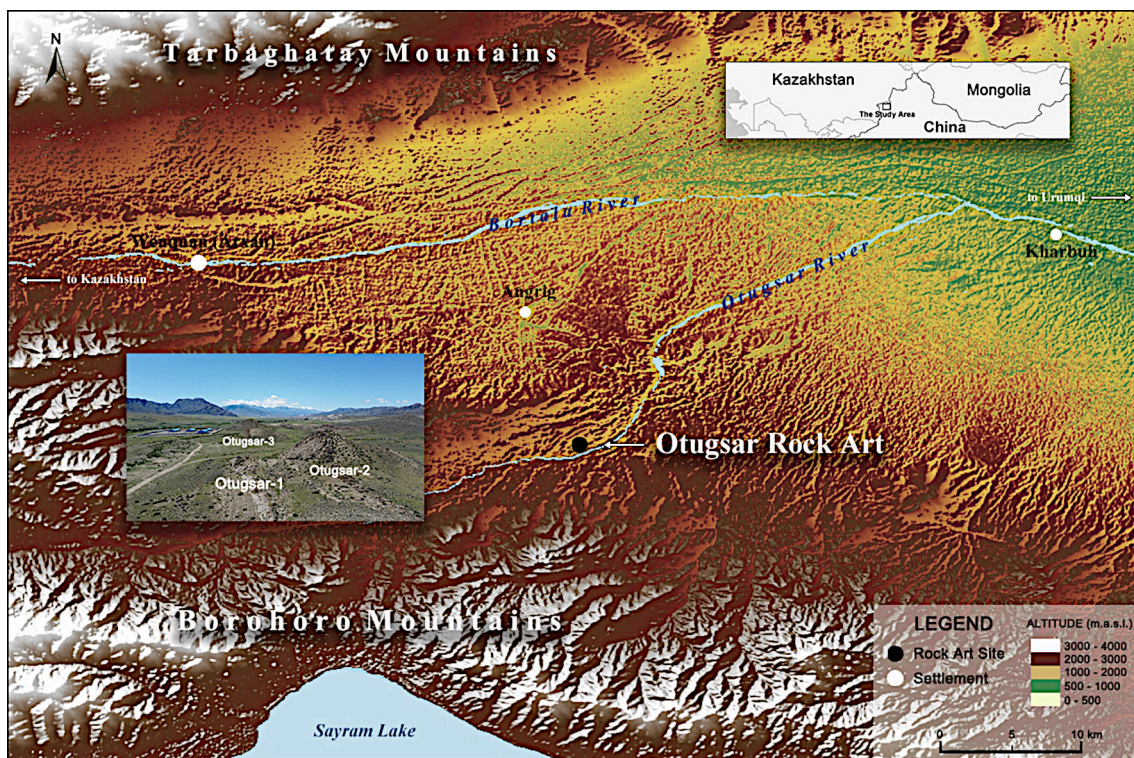


Figure 1. The study area, with a view from a UAV showing the landscape of the site complex.

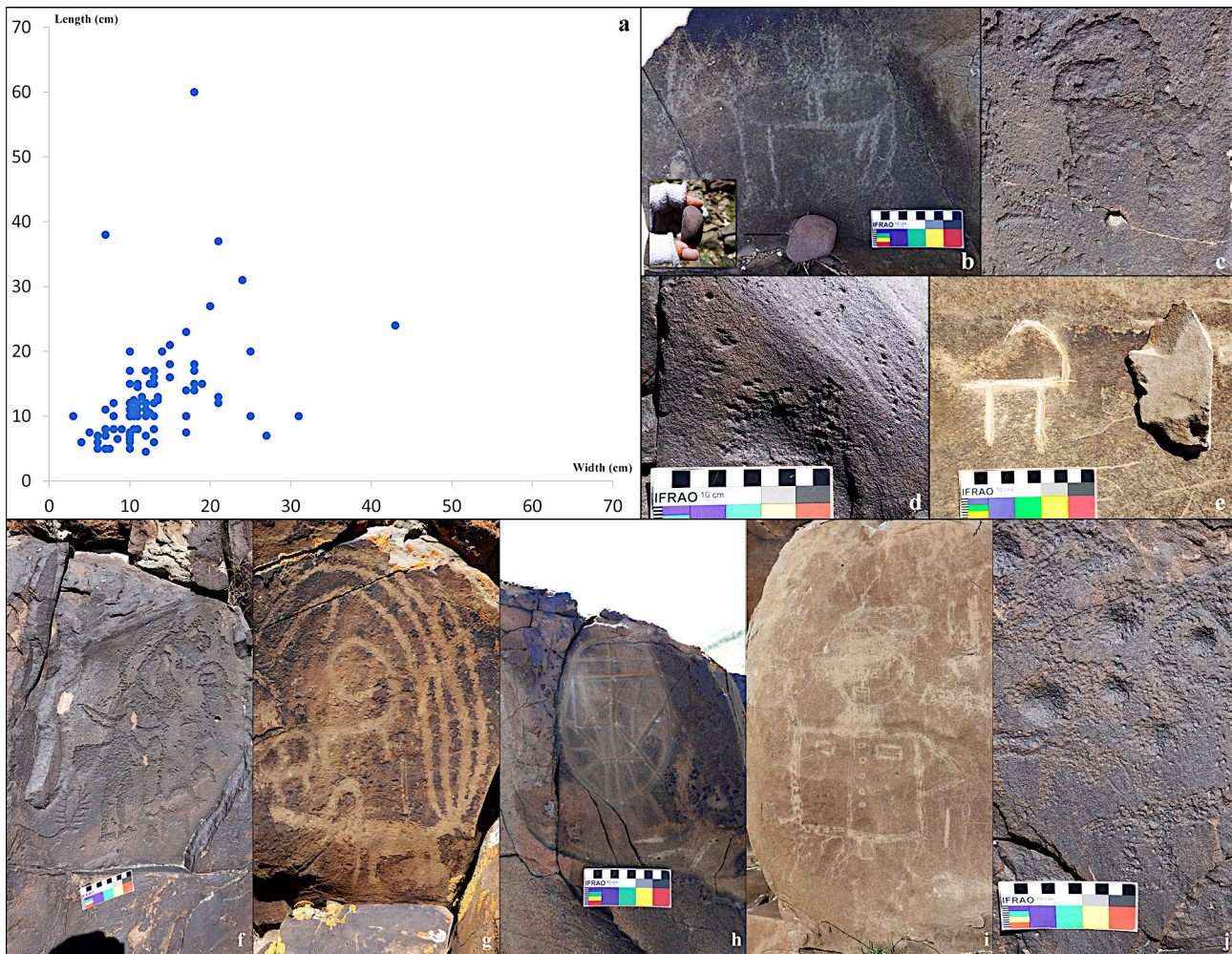


Figure 2. Phases and techniques (a - scatter diagram of the size values of the petroglyphs; b - a recently made graffiti and a mur-e left on site; c - a sheep-like linear motif of the 1st phase, made by percussion, note the marks caused by sharp metal tools around; d - a cupule, made by percussion with metal tools, of the post-3rd phase; e - linear sheep-like motif made by scratching/carving, during a replication experiment, on the right is the tool used by the author, a piece of flaked sandstone; f - typical motifs of the 1st phase, made by percussion; g - typical motifs of the 2nd phase, linear or linear-silhouetted style, made by abrasion; h - typical motifs of the 3rd phase, resembling a dream-catcher or shamanic drum, linear style, made by scratching/carving; i - a recent graffiti depicting a person in a modern uniform; j - the cupules made above some 2nd phase motifs).

like antlers, which likely symbolise the Tree of Life or the shamanic tree), 6 'wolves/dogs', 4 'serpents', 2 'tigers' and 1 'lizard'. The remaining motifs consisted of anthropomorphs (9), cupules (20), dates (5), geometric shapes (2), and unidentified designs (2). Ovicaprine-like motifs were the most common, accounting for 60.8% of the total. Four styles were observed: linear, silhouetted, linear-silhouetted and outlined (Fig. 2). They consist of 91, 33, 10 and 8 motifs, respectively, with the linear style being the most prevalent (63.6%). The petroglyphs were created using four techniques: percussion (66), abrasion (65), percussion-abrasion (6) and scratching/carving (8).

Based on the authors' observations, rock art production did not occur consistently. Instead, it likely evolved in three chronological phases. The earliest phase is represented by linear or linear-silhouetted motifs created by percussion, covered with black rock varnish. In a later, more complex phase, the silhouetted

style was predominant. However, other styles such as linear, linear-silhouetted and outlined were also occasionally produced. The main technique during this phase was abrasion, supplemented by percussion-abrasion, percussion and scratching. The most recent phase is characterised by roughly abraded or scratched, grey or light-grey linear graffiti without varnish. Clear and consistent superimposition and disruptions among the motifs from the three phases can be seen on some large panels (Fig. 3).

From a technical viewpoint, percussion possibly involved two types of tools: hammerstones, creating shallow grooves, and iron or steel chisels, leaving deep triangular tip marks (Fig. 2c). The abrasion technique, resulting in broad grooves with flat bottoms, likely relied on pebbles exfoliated from the conglomerate stratum. For instance, the authors discovered a 6.2 × 4.8 cm pebble with a slightly worn tip at Otugsar 3-9 (Fig. 2b). Scratched petroglyphs may have been creat-

ed using two potential tools: sandstone flakes or sharp iron/steel tools. In an in-situ replication experiment, the authors rapidly created a typical linear sheep-like motif on a sandstone panel using a randomly found, exfoliated flake of the same material (Fig. 2e). This technique might be associated with some deep-grooved petroglyphs (Fig. 2h and Fig. 3).

Dating the rock art is complicated. Some researchers suggest it was made between 4000–2000 BP, basing their theory on the age estimates of a recently excavated Bronze Age settlement about 50 km to the northwest (Wei 2014: 183; Grili 2016: 140). Even though commonly used methods like microerosion, radiocarbon and uranium series are not applicable in this case, it is still possible to obtain approximate date ranges by analysing available clues. The third phase rock art is the easiest to date, believed to be graffiti from the last century or even the past fifty years. This estimation is based on several factors: (1) The earliest engraved date found at the site is from November 1978, which is over forty years old. (2) The presence of anthropomorphs of modern appearances (e.g. wearing Sun Yat-Sen suits, which were popular in China from the 1950s to early 1990s, and space suits). (3) The shallow, light-grey scratches suggest casual production. They indicate that these are spontaneous graffiti, likely made by juveniles, and do not represent a surviving tradition.

Given the rock types and the rate of natural surface retreat (Rimstidt and Barnes 1980; Chou et al. 1989; Bednarik 2001: 60), the rock art could not have survived more than two millennia. This theory is supported by the presence of metal tool marks in the grooves of the first phase (Fig. 2c)¹. Conversely, the superimposition of cupules, the most common rock art type in central China but very rare in Xinjiang, marks the end of the second phase (see Jin and Chao 2019, 2020, 2021 for details). Cupules likely represent a tradition from the middle and lower reaches of the Yellow River, miles away to the east where the Han Chinese lived. According to local history, the Han Chinese conquered this land around the 7th century CE and maintained effective governance for about a century². A similar

1 A recent replication experiment of petroglyph production conducted in the adjacent area has rejected the possibility of using bronze tools on the varnish layer. Other materials like bloomery iron and steel are also considered less effective and uneconomic (Jin et al. 2023). Therefore, the only potential option left is cast iron, an industry established in Xinjiang during the Han dynasties (Qian et al. 2000).

2 This area was once under the jurisdiction of the Western Region Protectorate (Xi Yu Du Hu Fu) during the Han Dynasties (2nd century BCE – 2nd century CE), as documented in the *Han Shu: Xi Yu Zhuan (Book of Han: The western regions)*. However, the Protectorate's territory was



Figure 3. A panel demonstrating the superimposition of the three phases of rock art.

phenomenon, showing the discontinuation of rock art

extremely vast, extending from the Fergana Basin in the west to the Hexi Corridor in the east. With its main military force stationed in Luntai (today's Kuqa) about 400 km to the south, the control over the northern side of the Tianshan Mountains was intermittent. Moreover, there is no archaeological evidence to suggest that the Han people settled or stationed troops here before the 7th century CE. As recorded in the *Xin Tang Shu: Tu Jue Zhuan (New book of Tang: the Türks)*, in 658 CE, the Beiting Protectorate's (Bei Ting Du Hu Fu) army of the Tang Dynasty eliminated the power of the Western Turkic Ishbara Qaghan through a decisive battle in the land of today's Bortala Prefecture and established the Shuanghe Commandary (Shuang He Du Du Fu) instead. This rule lasted until the first half of the 8th century CE. In recent decades, archaeologists have discovered three city ruins from the 9th to 12th century CE within the area, though their actual construction may date back to the 7th or 8th century CE (Xinjiang Uygur Autonomous Region Bureau of Cultural Heritage 2011b: 13). One of them (Kharbuh) lies on the alluvial fan outside the entrance of Otugsar Valley, approximately 20 km northeast from the studied site.

tradition after the 7th century CE, has been observed and reported in the eastern Tianshan area (Jin et al. 2023: 11). This is unlikely to be a coincidence.

The authors suggest that nomadic groups created most of the Otugsar petroglyphs between the 1st and 7th centuries CE, including the Usuns, Ranrans, Tölös and Türks. Following this period, the Han Chinese briefly controlled the area, leaving their own markings (cupules). However, the previous art tradition did not continue until recent decades when locals started creating graffiti on the same moraines. Additionally, the first and second phases of the Otugsar rock art coincide with the third phase of the eastern Tianshan tradition (refer to Jin et al. 2023 for more details). A similar case was found by the authors approximately 200 km north in the Tarbaghatay Mountains. Here, the petroglyphs were engraved into more delicate rocks and have experienced significant deterioration due to exfoliation and weathering.

Given these findings, the authors propose that the petroglyphs on the western edge of the Junggar Basin might have been created significantly later than those on the eastern edge. This implies a potential east-to-west cultural diffusion. Nonetheless, further studies are needed to confirm this theory and explore the connection between rock art traditions and many other issues, such as lifestyle, social behaviour, migration, economic patterns and belief systems.

Acknowledgments

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REFERENCES

- BEDNARIK, R. G. 2001. *Rock art science: the scientific study of palaeoart*. Aryan Books International, New Delhi.
- CAO X., LI X. and WU S. 2015. Analysing the dynamic changes of watershed area and meteorological factors of Barkol Lake in the recent thirty years (in Chinese). *Hubei Agricultural Sciences (Hu Bei Nong Ye Ke Xue)* 4: 848–851.
- CHOU L., R. M. GARRELS and R. WOLLAST 1989. Comparative study of the kinetics and mechanisms of dissolution of carbonate minerals. *Chemistry and Geology* 78: 269–282.
- GRILLI, N. 2016. Rock art of the Bortala Basin, Wenquan County (in Chinese). *Journal of Liaoning Normal University (Liao Ning Shi Fan Da Xue Xue Bao)* 4: 135–144.
- GUO W. 2010. The temporal and spatial distribution of precipitation in the Yiwu Basin (in Chinese). *Modern Agricultural Science and Technology (Xian Dai Nong Ye Ke Ji)* 5: 281–282.
- JIN A. and CHAO G. 2019. The 2018 expedition to Fangcheng cupule sites in central China. *Rock Art Research* 36(2): 157–163.
- JIN A. and CHAO G. 2020. The 2018 and 2019 rock art expeditions to Lianyungang, east China. *Rock Art Research* 37(1): 74–81.
- JIN A. and CHAO G. 2021. The 2018 expedition to Anshan cupule sites, northeast China. *Rock Art Research* 38(1): 3–9.
- JIN A., BEDNARIK, R. G., REN M., WANG J. and CHAO G. 2023. Scientific research at the Hongshankou petroglyph site complex in the eastern Tianshan Range, northwest China. *Rock Art Research* 40(1): 3–12.
- LI J., WANG K., LI Y., SUN G., CHU C., LI L. and ZHU Z. 2006. Geomorphological features, crustal composition and geological evolution of the Tianshan Mountains (in Chinese). *Geological Bulletin of China (Zhong Guo Di Zhi Tong Bao)* 25(8): 895–909.
- QIAN W., SUN S. and YIDILISI 2000. Metallurgical research on the metal products unearthed from the Keriya River Basin, Xinjiang (in Chinese). *The Western Regions Studies (Xi Yu Yan Jiu)* 4: 1–11.
- RIMSTIJD, J. D. and H. L. BARNES 1980. The kinetics of silica-water reactions. *Geochimica et Cosmochimica Acta* 44: 1683–1699.
- WEI J. 2011. *Research on the rock art sites in the areas of Tianshan and Altay mountains* (PhD thesis, in Chinese). Northwest University.
- Xinjiang Uygur Autonomous Region Bureau of Cultural Heritage 2011a. *Report of the 3rd National Cultural Heritage Survey in Xinjiang Uygur Autonomous Region: volume of standing stones* (in Chinese). Science Press, Beijing.
- Xinjiang Uygur Autonomous Region Bureau of Cultural Heritage 2011b. *Report of the 3rd National Cultural Heritage Survey in Xinjiang Uygur Autonomous Region: volume of Bortala Prefecture* (in Chinese). Science Press, Beijing.
- ZHANG L. and WU N. 1985. The geotectonic and its evolution of Tianshan (in Chinese). *Xinjiang Geology (Xin Jiang Di Zhi)* 3(3): 1–14.



RAR REVIEW

RECENT ROCK ART JOURNALS

Journal of Rock Art (岩画学报), Volume 2, Number 2, has been published in November 2023:

The following articles can be downloaded at
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New discovery of a large number of chariot petroglyphs in the Olon Owoo area and their preliminary identification and interpretation

ALTAD S. TERGUUNBAYAR, Inner Mongolia Museum

Olon Owoo petroglyphs are located in the Gobi Desert area with an altitude of about 1100 metres, more than 20 kilometres northeast of Mandal Town, Darhan Muumyangan Banner, Bao Tou city, Inner Mongolia Autonomous Region. From 2011 to 2022, the rock art research team of the Inner Mongolia Museum completed more than 10 surveys in the Olon Owoo area and recorded more than 1270 groups of petroglyphs. So far, a total of 36 groups of chariot petroglyphs have been found in the Olon Owoo petroglyphs, including 62 images with a single chariot. The article makes a detailed observation and interpretation of the chariot structure, the form of draught animals, and the image of the charioteer seen in the above-mentioned petroglyphs. Meanwhile, the article also makes a preliminary analysis of the relationship between the combined images of roads, people leading horses, archers, wrestlers, dome-style buildings and various animals that appear around the chariots.

Archaeological investigation of the Zuojiang Huashan rock art study

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People's understanding of the Zuojiang Huashan rock art has grown as new archaeological materials are continually discovered. In the region of archaeological culture where the Zuojiang River Basin is located, the relationship between archaeological remains and rock art is very close. The distinctiveness and continuity of archaeological culture provide crucial academic evidence for explaining the historical context, image content, chronology, painters and cultural connotation produced by the Zuojiang Huashan rock art, as well as play a vital role in enhancing the authenticity and distinctiveness of the rock art.

A study on the generation and extraction of rock art line drawings

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Rock art, as a precious cultural heritage, carries the memory of ancient civilisation and the essence of art. However, its preservation and research are facing great challenges, among which the extraction of rock art line drawings has become one of the important links. This paper discusses the technical method of edge detection for rock art line drawing extraction and its importance in rock art research. Through the introduction of rock art line drawing extraction examples, the complexity of rock art line drawing production and possible problems in image processing are discussed. It is hoped that the use of the computer as a tool to extract line drawings will ease the work of researchers.

Conservation and inheritance path of rock art under the shift of cultural protection

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By looking back at the history of the conservation and inheritance of rock art in China, the article sorts out the limitations and deficiencies at the present stage and believes that the two different ideas between conservation and inheritance can be integrated. From the perspective of 'holism', we can actively explore the new dynamic integration mode and path integrating conservation and inheritance rather than pure static protection, so as to enhance the survivability of the existing rock art conservation and inheritance system in China and realise the turn under cultural protection.

Survey on Jiangjunya rock art in Lianyungang City, Jiangsu Province, China

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As one of the most famous historic sites for rock art, Jiangjunya rock art is in the ecotone of China's eastern coastal areas, including five groups which are mask, rice pattern, cupules, waffle pattern and sun image. Among them, the mask is an important link in the mask rock art of Pacific Rim. The systematic investigation on Jiangjunya rock art is the foundation of the study as well as the key to rock art protection. The meticulous records about various images at the historic site of Jiangjunya rock art will provide precious materials for the image analysis on China's petroglyph and mask of Pacific Rim.

Investigation of cupules in Haicheng, Liaoning Province

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To master the distribution and status of the cupules in Anshan, Anshan Museum has appointed an investigation panel and coordinated administrative departments for cultural relics at and above the county level, to investigate the cupules in five areas of Anshan. The quantity of cupules in Haicheng ranks first in the five areas of Anshan, with various types of patterns and representative shapes. This article mainly describes the investigation of cupules in Haicheng, and introduces the cupules' geographical location, pattern, and inspiration from the investigation etc.

Change of mindset: the need for developing scientific approaches to rock art studies

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Questions in rock art studies need to be answered scientifically, including how can we use it for understanding the cognitive, cultural and epistemological development of humans, place rock art in proper chronological order, or effect its conservation and protection. After so many decades of applying the traditional archaeological approach, it has helped us little to answer significant research questions. For answering these questions correctly, we have to change our mindset and adopt a scientific approach. That means our studies should be based on testable propositions. We need to understand the lithology, taphonomy, topography, sedimentology, palaeoclimate of the sites and the epistemology of our ideas about rock art. We also need to be able to effectively discriminate between natural and anthropogenic rock markings and use modern recording methodology, apply scientific dating methods and learn how to conduct rock art replication.

New evidence for a Bronze Age date of chariot depictions in the Eurasian steppes

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Two-wheeled horse-drawn chariot depictions in the Eurasian steppe have long been stylistically dated to the Bronze Age. Here we present an example of a petroglyph embedded in the architecture of an early Scythian royal tomb in the Tuva Republic, Siberia. The construction of the tomb is dated through wiggle-matching to between 833 and 800 BCE (95.4%) thus providing a rare terminus ante quem for chariot depictions in southern Siberia. The new evidence supports the current chronological range for this type of petroglyph in the Eurasian steppe belt.

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The following articles can be downloaded at
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On the development of Chinese rock art discipline—Also on the current tasks of the *Journal of Rock Art* BO XIAO^{1*}, JING CHE¹

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With a scholarly lineage spanning over a century, Chinese rock art research has witnessed significant progress yet lacks comprehensive retrospectives. This paper systematically examines the developmental trajectory of Chinese rock art studies, delineating distinct phases, achievements and persistent challenges. Additionally, it elucidates the objectives of the *Journal of Rock Art*, underscoring its pivotal role in shaping the Chinese rock art discipline. By illuminating the evolution of this discipline, the paper aims to foster both domestic scholarly coherence and international engagement, facilitating deeper exploration of interconnected rock art traditions across China and neighbouring regions.

Weathering disease characteristics and impact assessment of Helankou rock art

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This study investigated the distribution and types of surface weathering diseases on rock art in the Helankou area, using field surveys and statistical analyses. In addition, a damage index analysis method was proposed to quantify the effect of weathering diseases on the integrity and preservation status of the artefacts. The study findings revealed that the weathering diseases affecting the rock art in Helankou primarily encompass surface delamination, splitting and blistering. Significant variations were observed in the extent of damage to the rock art depending on the rock surface type. Spheroidal surfaces and vertical planes typically exhibit more pronounced damage, whereas parallel planes experience a relatively lower impact. A comparative analysis of the damage indices revealed that the most significant disease affecting the integrity and preservation status of the rock art is delamination, which is predominantly observed on the surfaces of spheroidal weathering planes. This study will facilitate the development of protective measures for paintings. This will lead to improved management strategies and the implementation of measures tailored to different levels of weathering severity.

Analysis of similarity and image recognition of human face rock art in Helan Mountain

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The Helan Mountain region boasts a diverse array of human face rock art, serving as a vital cultural heritage resource in China with significant research value. However, large-scale comparative and identification studies of numerous human-faced rock art forms typically require the involvement of specialised researchers and substantial time and effort. This study aims to take advantage of image processing techniques from the field of computer science to analyse human face rock art in the Helan Mountain region, facilitating a more rapid and accurate comparison and identification of these precious rock arts. The research findings indicate that image similarity calculation methods can effectively capture the degree of similarity among human face rock arts. Additionally, image recognition methods based on deep learning exhibit the capability to swiftly identify human face rock arts. Both approaches demonstrate practical utility in the study of human face rock art.

Overview of the Pacific Rim human face petroglyphs

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The human face petroglyph is a unique type of rock art around the Pacific Rim, the study of this type of rock art has gone through hundreds of years. The international research of the mainstream content and frontier method involves the naming, discovery, cultural interpretation, archaeological dating, protection and development, etc. Especially since the 21st century, the research of human face petroglyphs has received unprecedented attention, and has achieved fruitful research results. By combing the centuries of the research literature and its research content, systematically and comprehensively introduced the research results of the human face petroglyphs around the Pacific Rim, a brief overview of the concept and research scope, the international human face petroglyphs discovery history, research history, and focus on the discovery, cultural interpretation, generational research and protection development angle of human face petroglyphs, in order to inspire other areas of rock art research.

Mandalay Mountain rock art investigation in Badain Jaran Desert of Inner Mongolia of China

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Situated at the Menggensumu village of Alxa Right Banner, which is deep in the Alxa Gobi of Inner Mongolia, Mandalay Mountain is 14 km from southwest Sumu, with the area of 3 km from east to west, and 5 km from north to south. High and steep in terrain, Gobi and desert grassland surround the mountain. The massif is composed of granite and basalt and is highlighted on the top of the wasteland. According to the historical data, early in the Neolithic age, people lived and multiplied on Mandalay Mountain. Mongolia, Xianbei, Xiongnu, Tangut and other northern minorities lived and nomadised here one after another. At present, in total 4234

rock art motifs are found on this mountain, and they are mostly located at the elevation of about 1500 m – 1750 m. Mainly based on animal images, Mandalay Mountain rock art involves horse, cow, goat, donkey, mule, camel, hound dog, leopard, wolf, fox, megaloceros, argali, ibex, turtle, birds and so on, meanwhile, it covers hunting, large-scale hunting, riding, battle, fighting, going out, grazing, sexual intercourse, Western Xia letters, religious activities and other scenes. The producing of Mandalay Mountain rock art almost started from the late Old Stone Age, experienced the Neolithic Age, the Bronze Age, and then the early-stage Iron Age (which is equivalent to Shang and Zhou Dynasties in our central China Qin and Han Dynasties), until all historical periods in ancient China.

The function and significance of the colour red in petroglyphs: a case study of the Badain Jaran Desert petroglyphs

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Red is the colour most often used in rock art production. The basic colour tone of the natural physical and image field of the famous cave red handprint rock art, represented by the Badain Jaran Desert paintings, belongs to the red series. The main colour tone of its raw materials, cliffs or stones, includes six colours: yellow-brown, earthy yellow, pink-brown, coral, dark-purple and reddish-brown. The vivid and dazzling image field, full of various natural phenomena, such as the sun, moon, rainbow, fire and clouds, is mixed with these six colours. This objectively demonstrates that early humans passively adapted to nature and actively created a humanised material and spiritual world. The rock painting producers carefully selected the raw materials needed to produce the rock art their natural physical environments. They preferred the material carriers and contexts with special colours. They used the colours of the red series and made artificial red pigments. The widespread existence of red series petroglyphs vividly demonstrates the rich emotions and spiritual world of early humans, including healing, worship and sacrifice.

Archaeological typology analysis of Yinshan petroglyphs

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The accurate classification of petroglyphs plays a pivotal role in determining their age, organising them into chronological stages, and investigating the evolving patterns of ancient social structures. Establishing a scientific, standardised, and locally relevant method for classifying petroglyphs is essential for contemporary research in this field. Within the rich cultural tapestry of Yinshan and its environs, Yinshan petroglyphs, alongside other cultural heritage sites, contribute significantly to the historical and cultural narrative of the region. This study proposes an exploration of a classification method that aligns with the cultural nuances of Yinshan petroglyphs, utilising a well-established archaeological chronology scale. By considering the de-

developmental sequence of archaeological cultures from the middle to late Neolithic Age through the Iron Age in the Yinshan Mountains and its northern and southern regions, we aim to develop a preliminary archaeological typology scale for Yinshan petroglyphs, integrating it with established archaeological typology methodologies.

Modern era Galisteo Basin petroglyph looting and government controls, 1977–2023

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New Mexico, U.S.A., indigenous people's petroglyphs have endured more than 400 years of post-contact exposure. Only in the 2nd half of the 20th century did preservation and conservation efforts commence. Beginning then, public laws, regulations and enforcement have sought to protect petroglyphs in the Galisteo Basin. Cattle and sheep herders, farmers and tourists all infringed upon these panels, often composites of multiple images, situated on both private and public lands. Unpublished government surveys reported on destruction and vandalism with photos and risk analyses upon which future strategies were mapped. Photos illustrate both incising in situ and looting of rock pieces, which provided impetus for preservation across multiple political spheres of influence. Archaeologists contributed literature reviews and style analysis, in the process of recording the petroglyphs. Federal and state laws and regulations and administrative efforts in preservation between 1977 and 2023 are tracked, together with whether they were successful.

Pasargadae petroglyphs

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Since a long time ago, Pasargadae palaces are known as the first capital of the Achaemenian Empire and the first sample of an Iranian garden have been considered in Iranian history and archaeology. After the collapse of the Achaemenid Empire and the abandoned Pasargadae and before the

registration and protection of these unique palaces, much damage has been done in this site. In passing time everyone has traced his memorial to the Pasargadae. One of the pieces of evidence that do not always equal the greatness of Pasargadae are many petroglyphs anywhere on this site after being abandoned and until recently visible on the stone Monuments of Pasargadae. This paper only focused on description, typology and classification of human and animal petroglyphs existing in Pasargadae.

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The Editor



ORIENTATION

Dr Tilman Lenssen-Erz (1955–2023)

On 10 November 2023, after a brave and prolonged fight, our colleague and friend, Dr Tilman Lenssen-Erz—in formal retirement for only two years—succumbed to an invincible illness. From 1986 to 2021, he was a research fellow at the African Archaeology Unit within the Institute of Prehistoric Archaeology, University of Cologne, where he played a key role in shaping rock art research and the valorisation of indigenous knowledge for pre-Historic archaeology, both nationally and internationally.

Tilman Lenssen-Erz studied African studies, pre-Historic archaeology and the history of religion at the University of Marburg from 1977 to 1982. His master's thesis was devoted to 'Studies on the verb in Kwang (Chad)'. This was followed by years as a staff member and local director on various archaeological excavations in Germany, Tunisia and Egypt. With his broad interdisciplinary expertise, he took on the project 'Rock paintings in the Upper Brandberg' in Cologne in 1986. This led to his doctoral thesis at the Goethe University Frankfurt in 1997, entitled 'Gemeinschaft – Gleichheit – Mobilität. Rock paintings in the Brandberg, Namibia, and their meaning. Foundations of a textual rock art archaeology'.

Between 1986 and 2006, Tilman Lenssen-Erz shaped and directed the world's most comprehensive publication project for pre-Historic rock art, accompanied by a data recording system whose innovative methodology benefited from his linguistic knowledge. Based on field documentation compiled by Harald Pager between 1977 and 1985, six volumes were published in the *Africa Praehistorica* series (Heinrich-Barth-Institut, Cologne).

As a member and Principal Investigator in the Cologne DFG Collaborative Research Centre 389 ACACIA (1995–2007), Tilman Lenssen-Erz enriched rock art archaeology in the Ennedi Mountains (Chad) with his research focus. Since 2012, he has been co-founder of the African Archaeology Archive Cologne (AAArC) and co-PI over several projects of development and maintenance, most recently in FAIR.rdm, the central research data

management in the DFG Priority Program SPP 2143 *Entangled Africa*.

Since 2008, Tilman Lenssen-Erz has dedicated his research to making traditional knowledge and skills of recent San hunters in southern Africa accessible to archaeological science. This initially resulted in *Tracking in Caves* (with Dr Andreas Pastoors), an internationally acclaimed project analysing pre-Historic footprints in European caves featuring Palaeolithic parietal art, in collaboration with San trackers. In two further projects since 2019, entitled *Indigenous Knowledge and Archaeoinformatics* and *Modelling of Prehistoric Hunting Behaviour* (with Prof. Eleftheria Paliou), traditional hunters in Namibia have been accompanied while hunting in order to incorporate empirical data and traditional explanatory patterns into existing archaeological models.

Archaeology has lost an innovative, widely networked and enormously productive researcher, while our Institute has lost a colleague who saw science first and foremost as social practice. Deeply well-read, politically and socially committed, and blessed with an abundance of humour (including black humour), he had expertise, encouragement, advice and action for everyone right to the end. He will be remembered worldwide as a constructive, exemplarily generous, self-critical and always inspiring colleague, critic, expert and mentor. We mourn his loss.

Oliver Vogels, Eymard Fäder, Andreas Pastoors, Hans-Peter Wotzka and Rudolph Kuper

RAR 41-1451



The academic debate on the Qiusang hand and footprints near Lhasa, Tibet

By FEIXU TANG and MU HU

In 2002, Professor Zhang Dian from the University of Hong Kong published an article entitled 'Optically stimulated luminescence dating of Tibetan footprints: implications for the Last Glacial Maximum paleo-environment on the Qinghai-Tibet Plateau' (Zhang and Li 2002). The article reported the discovery of 19 hominin footprints and one hearth formed on the hot spring deposits in Qiusang Hot Spring, Duilong Deqing County, central Tibet. The optically stimulated luminescence (OSL) dating results indicated an age of 20,000 years. This report aroused great interest among scholars and strong reactions within the academic community. Initially, some scholars believed that unweathered quartz debris could potentially cause the optically stimulated luminescence dating to yield ages older than the actual time (Madsen et al. 2006). Subsequently, numerous scholars conducted dating at this site. Austrian geochronologist Michael Meyer and archaeologist Mark Aldenderfer collected 11 samples from the Qiusang Hot Spring hand and footprints site and used uranium-series dating, optically stimulated luminescence dating, and radiocarbon dating methods to obtain data sets ranging from 7400 to 8400 years ago and 12,000 to 13,000 years ago (Meyer et al. 2017).

In 2021, Zhang Dian and his team discovered another set of hand and footprints outside the original location. Uranium-series dating placed the age of these prints between 169 and 226 thousand years Before Present (BP). This age not only became the earliest evidence of human activity on the plateau but was also considered the earliest 'parietal art' in the world (Zhang D. et al. 2021), earning it a spot on the list of the top ten archaeological discoveries of 2021 by *Archaeology* magazine.

However, this report sparked much controversy within the academic community. Australian rock art scholar R. G. Bednarik largely agreed with Zhang Dian's claims. For example, he agreed that the traces on the Qiusang travertine were formed by pressing hands and feet into a soft medium rather than being created with tools. He also agreed that these footprints and handprints were deliberately made, making them a form of ancient 'art'. Additionally, he accepted the identification of the prints as those of adolescents. He also agreed that these hand and footprints were formed before the travertine was petrified and during precipitation, indicating that their age should match the medium.

However, Bednarik disputed Zhang Dian's dating results, particularly the claim that the travertine with the footprints and handprints dates to the Middle Pleistocene, approximately between 169,000

and 226,000 years ago. First, Bednarik argued that the Qiusang hand and footprints were at an open-air site, and precipitation would significantly affect the uranium ratio in the travertine, considerably reducing the uranium content. Such an open system inevitably leads to age estimates that are significantly older than the actual age of the deposit. Furthermore, Bednarik argued that the uranium-thorium method used by Zhang Dian had been proven unreliable in determining the age of certain Pleistocene carbonate deposits. In any case, radiocarbon ages of carbonate cave deposits, such as thin speleothem deposits, formed through similar processes are far lower than those detected by uranium-thorium dating. While radiocarbon ages and uranium-thorium ages often align in the Holocene, they show significant discrepancies in the Pleistocene, with uranium-thorium ages for Late Pleistocene samples exponentially increasing with age and potentially being many times 'older' than the actual age. Bednarik further stated that the stochastic nature of uranium-thorium ages suggests that they may be due to the random function of taphonomic processes affecting the uranium-thorium ratio. It should be noted that uranium is soluble in water and is easily removed from precipitates after they form. This often occurs in cave deposits and is even more pronounced in travertine that is fully exposed to precipitation (in the open). Travertine has a less dense crystal structure than stalagmites, and it has varying degrees of porosity, which facilitates its reaction with carbonic acid, making it more susceptible to returning to its soluble (bicarbonate) state. To reduce the data bias caused by contaminating detrital thorium, Bednarik suggests using isochron methods or taking core samples of the Qiusang travertine to compare the age variations of weathering zones. Only by doing so can the extent of uranium loss be determined (Bednarik et al. 2022).

Former Chairman of the Centro Camuno di Studi Preistorici, Emanuel Anati, agreed with Professor Zhang Dian's dating and identification of the human child's hand and footprints but expressed doubts about their designation as the world's earliest rock art. According to the published article, Anati stated that the hand and footprints on the travertine were a result of forceful pressing, as evident from the published photographs. At least two of the four handprints show indications of forceful propulsion, giving the impression that the hands and feet were used to push blocks of mud. These hand and footprints appear to result from a mechanical action to move objects. Zhang Dian and his team explained this as a deliberate artistic creation, which contradicts the apparent signs of forcefully pushing mud blocks and the overlapping of hands and feet, indicating an act of pushing mud blocks. However, they do not represent a recurring cultural pattern. The presence of handprints is preserved as a record of past behaviours, initiation rituals, or agreements between tribes that have been recorded over the past 70,000 years, at least 100,000 years later

than this case. In intentional cultural contexts, whether hands and feet were combined is unknown, and this unusual circumstance requires assumptions about their function and purpose. Ultimately, Anati believed that this discovery could only prove the existence of humans in that region at that time and does not seem to indicate that Tibetan art predates any other place on Earth by over 100,000 years (Anati 2021).

Chinese archaeologists Tang Huisheng, Xiagewangdui, Lü Hongliang and others also wrote an article titled 'The Qiusang hand and footprints in Tibet and related issues', expressing doubts about Professor Zhang Dian's dating and qualitative analysis. Based on the current set of chronological research data, the age of the Qiusang hand and footprints ranges from 7000 to 220,000 years ago (汤惠生 et al. 2022). In such a vast range of ages, it is unclear which ages are more reliable. Tang Huisheng and his team believed that the biggest problem in chronology does not stem from the inconsistencies of various scientific dating methods but from the travertine imprints themselves. Besides the hand and footprints, Tibetan alphabet letters were also found on the travertine of Qiusang Hot Spring. Although the Tibetan script has become blurred and poorly distinguishable, it is undoubtedly recognised as Tibetan inscriptions. Moreover, based on on-site observations, just like the footprints and handprints, the Tibetan inscriptions were made on the soft travertine before it was petrified. The travertine remains soft and pliable only for a year or two; therefore, the two marking types must be about the same age. Considering that the earliest appearance of the Tibetan script is only recorded after the 7th century CE, these Tibetan scripts on the travertine have a history of at most a little over a thousand years. If based on Zhang Dian's uranium-series dating, the travertine petrification occurred during the Middle Pleistocene, approximately 160,000 to 220,000 years ago, or 20,000 years ago by OSL analysis, then these Tibetan script characters would also date back to that time. On the contrary, if we consider the appearance time of Tibetan script after the 7th century CE, these human footprints and handprints would also be from after the 7th century. Therefore, determining the age of the Qiusang hand and footprints requires more refined dating methods and richer archaeological materials to confirm. Relying solely on uranium-thorium dating may not be sufficient to resolve the conflicts and contradictions regarding the age. In addition, other places in the Qinghai-Tibet Plateau, such as Yushu and Jilong, have recently seen finds of hand and footprints rock art. The academic community should embark on investigations and scientific dating work on these types of remains to establish comparative data with the Qiusang site.

Tang et al. believed that it was inappropriate for Zhang et al. to categorise the rock art at Qiusang as 'parietal art' (cave art), as the hand and footprints at Qiusang were all found in open-air environments, unrelated to caves. Furthermore, there is also an ongoing

debate about whether the footprints at Qiusang can be considered rock art created by humans. It is argued that footprints that simply reflect human natural attributes (such as when pre-Historic people occasionally walked on soft travertine and left footprints) cannot be considered art, whereas only footprints that reflect human symbolic thinking (engraved) can be called rock art.

In January 2023, Zhang et al. responded to the criticisms about the 'age' and 'how to define rock art' aspects of the Qiusang prints studies raised by Tang Huisheng and Bednarik. They addressed the following four issues: (1) the reliability of applying U-Th dating to dating Quaternary travertine deposits; (2) the suggestion that the location of the footprints is an 'open system' on the surface of exposed ground, which would introduce a decrease in uranium presence; (3) the use of the age of Tibetan script symbols on the calcium carbonate deposition surfaces at other locations around Qiusang Springs (approximately 1 ka) as evidence to argue against the age of the prints from the Middle Pleistocene; and (4) whether the term 'parietal art' is applicable to the Qiusang prints. They particularly emphasised that they conducted extensive geological surveys and sampling of the ancient travertine deposits around the Qiusang Springs and, through analysis and testing, confirmed that the deposit ages ranged from several thousand years to over 500,000 years. They also mentioned that modern hot springs can also deposit travertine along gullies. Additionally, through outdoor experiments, they confirmed that the imprints on the soft, mud-like travertine can become rock within several years, suggesting that the travertine deposition at the Qiusang Springs should range from 500 to 0 ka. This also explains the discovery of Tibetan script symbols on the calcium carbonate deposition surfaces at other locations around the Qiusang Springs. Zhang et al. proposed that the term 'parietal art' can be used in accordance with international conventions for the open-air rock art at Qiusang and introduced the Chinese term 'rock art' to correspond with the English 'parietal art'. They concluded in the abstract of their response article, stating, 'We believe that U-Th dating is currently the most appropriate method to date the Qiusang Springs travertine, and the dates obtained are reliable, and the term 'rock art' is the most suitable name for this combination of hand and footprints' (章典 et al. 2023).

As a response to Zhang et al.'s 2023 article on the Qiusang footprints, Tang Huisheng and his colleagues did not attempt to solely refute Zhang et al.'s arguments, as both parties have exchanged views and engaged in debates on many common issues (Tang et al. 2024). Instead, they focused on suggesting several solutions to resolve the disputes arising from differing perspectives.

1) The parietal art issue. Both Bednarik et al. (2022) and Tang et al. (2022) noted in passing that this was a misapplication of the word 'parietal'. Rather

than conceding their minor terminological deviation, Zhang et al. (2023) have doubled down on that issue, maintaining that their application of the term to the Qiusang rock markings complies with general convention. This is a genuine misunderstanding on their part. The objection to their terminological transgression was not to the term 'art' but to 'parietal'. Bednarik et al. (2022) noted in their concluding sentence that the word 'denotes cave art ("parietal" refers to a cavity wall, as in anatomy and other disciplines), whereas Qiusang is an open-air site'. In the response to Zhang et al.'s 2023 article on the Qiusang footprints, Tang and his colleagues consider this is an issue of language. If Zhang and his colleagues still need clarification, they must consult a dictionary.

- 2) The recrystallisation issue. Zhang et al. (2023) said the sediment samples 'were determined to be dense calcite crystals without recrystallisation phenomena'. However, Tang et al. believe the crystallisation process applies anywhere in the universe, even high on the central Tibetan Plateau. The travertine of the site derives from a saturated solution of calcite that has been dissolved by carbonic acid, a weak acid temporarily formed by water and carbon dioxide, according to the reversible reaction. Importantly, some of the carbon dioxide's carbon derives from the atmosphere. About one-half of the calcium bicarbonate's carbon would then comprise a given component of ^{14}C , which remains upon re-precipitation (crystallisation) back to CaCO_3 . That is why reprecipitated carbonate is usually amenable to radiocarbon analysis (Bednarik 1999). A valid counterargument would be that the CO_2 that dissolved and mobilised the limestone was of volcanic origin, but the authors did not attempt to determine its isotopic origin. What is certain is that the precipitation of the carbonate solute occurred because of the changed conditions as it emerged at the surface. Both temperature and pressure had to adjust to atmospheric conditions: the carbonate reverted to its solid state, and it did so by crystallisation.
 - 3) The stratigraphical issue. In Zhang et al.'s article, they mentioned that their dates concurred with the stratigraphy of the four layers of travertine. While this claim is based on Figure S11 of their 2021 paper (Supplementary), the apparent regularity in that table is illusory. The results need to be arranged according to their relative stratigraphical depth to be meaningful. Moreover, the samples were taken from between 1 and 3 mm depth from the present surface 'to minimise the effects of weathering'. Travertine that is millennia old weathers much deeper than 1 mm, and it stands to reason that if one sampled four strata of rock subjected to similar amounts of precipitation for enormous time spans, their subsurface $^{230}\text{Th}/^{234}\text{U}$ ratios would all be similarly distorted. That would result in a sequence relatively resembling the sequence of the strata but with illusory ages attached to them. Zhang Dian said, 'if the surface uranium element is lost, the age results should be older on top and younger at the bottom'. Tang and Bednarik said that it is true, but the surface layer affected by uranium loss is not under 1 mm thick; its loss of the parent isotope would extend as deeply as prolonged exposure to precipitation can mobilise it. Indeed, the authors should have tested their hypothesis by securing core samples from inside the massive travertine deposits. Tang and Bednarik predicted that if they had done that (of course, away from the hand and footprints), they would have found that the deep interior of a given stratum delivered 'younger' 'ages' than the surface-nearest sample. That would have served as a proper test to check that there was no loss of ^{234}U or deposition of detrital ^{230}Th , but unfortunately, it was not attempted.
 - 4) The inscribed symbols. Tang et al. (2022) have now reported the presence of two Tibetan writing characters on the hardened surface of the Qiusang Hot Spring site. Suggesting that they should be less than 1300 years old, they have presented clear evidence that the symbols were made before the travertine had fully crystallised. Zhang and colleagues are quite right that this hardening process occurs relatively quickly. Therefore, Tang et al. assumed that the historical inscriptions and the hand and footprints are about the same age, although more detailed morphological analysis and dating on the rock surface with the Tibetan inscriptions need to be conducted. Zhang and Li (2002) have either disregarded the significance of the historical symbols or failed to notice them.
 - 5) Tang and his colleagues suggested that to sustain this sensationalist proposition, Zhang Dian needs to conduct radiocarbon and uranium-series analyses at both sites, using core samples rather than subsurface samples. He also needs to determine how deeply precipitation moisture penetrates the travertine, thereby creating an open C, U and Th system. Tang et al. (2024) predict that it is significantly more than 1 mm, which may render the current U-Th results from Qiusang irrelevant. They also mention that one of the two laboratories providing the conflicting results Tang et al. (2020) and Tang and Bednarik (2021) reported was the same Zhang et al. (2021) used in their work. Tang et al. (2024) suggest that what Zhang et al. call their 'mature method' is still experimental, as are all methods currently used for rock art age estimation, including those Tang and Bednarik use. The issue is not about the method as such but its manner of application.
- As Johnson (1986) stated, 'Cultural processes do not correspond to the contours of academic knowledges as they stand. Cultural studies must be interdisciplinary or a-disciplinary in its tendency. Each

approach tells us about one small aspect of a larger process. Each approach is theoretically partisan, but also very partial in its objects.' The debate is, therefore, far from over, and research will continue. The Qiusang hand and footprints are not only important for the study of Palaeolithic cultures and 'art' in the Qinghai-Tibet Plateau or within China but also have significant implications for the study of rock art globally, especially in understanding the early occupation of plateau regions by humans, as well as the origins of human symbolic thinking and spiritual civilisation. At the same time, we should also note that, no matter what the outcome of the debate is, it is of great significance to the in-depth development of Chinese rock art research, which has strongly promoted the development of Chinese rock art research towards the combination of modern science and multidisciplinary subjects.

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REFERENCES

ANATI, E. 2021. Discussion forum. *Expression* 37: 8–9.

BEDNARIK, R. G. 1999. The speleothem medium of finger flutings and its isotopic geochemistry. *The Artefact: Pacific Rim Archaeology* 22: 49–64.

BEDNARIK, R. G., JIN A. and CHAO G. 2022. The travertine hand and footprints at Qiusang, Tibet. *Rock Art Research*

39(2): 215–217.

JOHNSON, R. 1986. The story so far: and further transformation. In David Punter (ed.), *Introduction to contemporary cultural studies*, pp. 277–314. Longman, London.

MADSEN, D. B., MA H., P. J. BRANTINGHAM, GAO X., D. RHODE, ZHANG H. and J. W. OLSEN 2006. The Late Upper Palaeolithic occupation of the northern Tibetan Plateau margin. *Journal of Archaeological Science* 33: 1433–1444.

MEYER, M. C., M. S. ALDENDERFER, Z. WANG et al. 2017. Permanent human occupation of the central Tibetan Plateau in the early Holocene. *Science* 355: 64–67.

TANG H. and R. G. BEDNARIK 2021. Rock art dating by ²³⁰Th/²³⁴U analysis: an appraisal of Chinese case studies. *Archaeological and Anthropological Sciences* 13(1): 1–10.

TANG H., G. KUMAR, JIN A. and R. G. BEDNARIK 2020. Rock art of Heilongjiang Province, China. *Journal of Archaeological Science: Reports* 31(2): 102348.

TANG H., XIAGE W., YIN J., JIN A., CHAO G., SHI L. and R. G. BEDNARIK 2024. The hand and footprints at Qiusang in Tibet: recommendations for dating rock art by U–Th. *Journal of Archaeological Science* 161: 105899.

汤惠生、夏格旺堆、吕红亮：《西藏邱桑手脚印遗迹及相关问题》，《河北师范大学学报》（哲社版）2022（5）：77–85。

ZHANG D., M. R. BENNETT, CHENG H., WANG L., ZHANG H., S. C. REYNOLDS, ZHANG S., WANG X., LI T., T. URBAN, PEI Q., WU Z., ZHANG P., LIU C., WANG Y., WANG C., ZHANG D. and R. L. EDWARDS 2021. Earliest parietal art: hominin hand and foot traces from the Middle Pleistocene of Tibet. *Science Bulletin* 66(24): 2506–2515.

ZHANG D. D. and LI S. H. 2002. Optical dating of Tibetan human hand- and footprints: an implication for the palaeoenvironment of the last glaciation of the Tibetan Plateau. *Geophysical Research Letters* 29(5): 16–21.

章典、王蕾彬、程海等：《西藏邱桑温泉古人类手脚印的年代测定及其岩面艺术价值》，《地球环境学报》2023年14(1)：1–8。