RAR DEBATE

Neoteny, female hominin and cognitive evolution

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> 'I have not the least doubt, for functional and behavioural traits as well… [that] the female realizes the promise of the species rather more fully than the male.' – A. Montagu

A while ago, I contributed a commentary on 'Evolutionary aesthetics and sexual selection in the evolution of rock art aesthetics', *Rock Art Research* 28(2): 153–186, by Varella et al., in which the authors relate the origins of rock art and artistic behaviour to sexual selection. It is a view of art going back to Darwin, who attributed the elaborate plumage and songs of some birds to mate-selection behaviour (Darwin 1871), and which has recently been elaborated in the work of G. Miller, a heavily referenced source in the Varella et al. article. Miller believes that artistic behaviour is a biological continuation of sexual display, and that art is an indication of fitness (Miller 2000a: 241). Miller goes even further, asserting that it is sexual selection that caused the human brain to grow and acquire higher cognitive functions (Miller 2000a: 21, 2000b, 2001). I rejected this linkage between art and sexual selection on the grounds that it represents a gendered view of art and cognitive behaviour. Indeed, after connecting to sexual selection and female choice of mate, Varella et al. draw the conclusion that men are 'image-makers' and women 'image-enjoyers' (Varella et al. 2001: 154).

In their rebuttal, Varella et al. responded to all comments except mine, and I simply imputed this silence to some lack of clarity in my argument (Achrati 2011). I am therefore grateful that *RAR*, in a spirit of fostering constructive debate, is allowing me this opportunity to elaborate on my view concerning art and sexual selection.

It should first be noted that I was not the only commentator opposing Varella et al. on their evolutionary view of art and sexual selection. Watson, for example, saw no necessary link between *evaluation* in rock art and fitness indicators. He also criticised the article for its over-reliance on the notion that female choice of mate is based on artistic display (Watson 2011: 164). Dissanayake (2011: 170) also found the sexual selection argument inadequate to account for the evolution of rock art aesthetics. And Helvenston (2011: 166) had doubts that any special adaptation for rock art has evolved either as a signal of fitness or for the purpose of communication. Rather, she said, it is cultural selection that provides a plausible explanation for a broad range of adaptations, including artistic behaviour. Finally, Bednarik pointed out that much of rock art is sacred and gender exclusive, and that 'it cannot be a display to facilitate sexual selection' (Bednarik 2011a: 179).

Instead of relying on borrowed ideas of dubious relevance and merit (economic cost, benefit, game theory etc.), the above arguments against linking art and sexual selection derive from insights that are grounded in scientific thinking, as well as the belief that the study of rock art should be subject to the scientific method and its imperatives of verifiability.

In this respect, these views are in keeping with the tradition of *RAR* under the editorial guidance of Bednarik. In fact the importance of the role of Bednarik is not only editorial; it is also in his seminal contribution to the development of the discipline, including innovative concepts and investigative methods such taphonomic logic, neoteny and self-domestication, to name only few. As indicated in 'Exograms' (Bednarik 2014) and in numerous other publications, his perspectives on rock art are wide, profound, bold, and often capable of generating creative ways of looking at the discipline. With great injustice, Bednarik's evolutionary thinking can be summarised as follows: it revolves around what the evidence allows with due regard to taphonomic considerations. This earliest evidence consists of various known engravings, notches, petroglyphs, pigments, beads, manuports and proto-sculptures, and by logical necessity, seafaring crafts. These material objects testify to an early hominin capacity for symbolling and mental constructs — the product of 'the relentless Pliocene/Pleistocene encephalisation' (Bednarik 2014). These early cognitive and behavioural developments provided the substrate of culture, a process of employing and exploiting exograms to store complex ideas and memories for the purposes of maximising cognitive fitness and niche construction. In time, competence in using exograms became the primary selecting factor, gradually replacing traditional, 'natural' selection criteria. These processes of hominisation are

not unrelated to two other important evolutionary phenomena, neoteny and self-domestication.

In order to show how productive and inspiring Bednarik's thinking is, in the following I will use his ideas on neoteny, evolution and self-domestication to clarify my objection to Varella et al. by advancing a new and testable hypothesis — that when it comes to hominin evolution, be it physiologically or cognitively, the agency of female was the prime factor. If correct, this hypothesis is likely to shift the debate on many evolutionary issues away from the male-centred view that has hobbled some evolutionary research efforts. This idea can be summarised as follows:

Neoteny continues to be subject to extensive multidisciplinary studies, with much of this attention given to encephalisation. Yet the subject of skin, one of the proximate mechanisms in the evolution of the human brain, remains unexplored. Based on established biological research that has never before been connected in such a way, this comment establishes the evolutionary importance of the skin and traces its hypothetical development to a possible neotenous adaptation that transformed the hominin female anogenital display into a thermoregulatory organ, thus allowing for the maintenance of an expanding hominin brain with higher metabolism and energy demand. The gender significance of this neotenous process of hominisation is underscored, and its implication with respect to cognitive development is discussed briefly.

1. Neoteny: a brief description

Ontogeny, the life history of organisms, refers to the rate and/or timing of developmental changes (shape and size) an organism undergoes from its embryonic stage to adulthood. Some organisms experience a greater or lesser rate of growth in a particular trait that persists from ancestor to descendant. These modifications of the temporal characteristics of an ancestral mode of ontogeny (heterochrony) and/or of its spatial characteristics (heterotopy) are thought to be a link between natural selection and genetics (Berge and Penin 2004; Godfrey and Sutherland 1996; Leigh 2004; Rice 1997; Schillaci 2006; Somel et al. 2012; Somel et al. 2013; Somel et al. 2009; Zollikofer and Ponce de León 2011).

One of these ontogenetic processes is neoteny (paedomorphosis), which describes the preservation of juvenile characteristics in adulthood (Bednarik 2011b, 2012; Gould 1977; Montagu 1981). This preservation of juvenile characteristics in adults has been observed in wild animals (e.g. Mexican salamander, flightless female beetle), in domesticated animals (e.g. chickens, dogs), and in humans. In domesticated animals, neoteny is the result of artificial selection for physical and behavioural traits such as docility and cuteness (Bufill et al. 2011; Chandra n.d.; Lorenz 1971; South et al. 2011; Vicedo 2009).

As an evolutionary concept, neoteny has been traced by J. Gould to L. Bolk, and through him to J. Kollmann, E. Haeckel and E. G. Saint-Etienne (Gould 1977: 353). While the term 'neoteny' was coined by Kollmann in 1905, the development of the theory itself was the work of L. Bolk, who described neoteny as a process of foetalisation and identified a number of foetal traits in humans (for Bolk's list of neotenous traits, see Gould 1977: 357; also Montagu 1981: Tables I–IV). He also attributed morphological differences among people (races) to differing intensities of neoteny (Gould 1977: 357; Montagu 1981: App. A).

Neoteny is recognised as a determining factor in the process of hominisation (Bednarik 2011b, 2012; Bufill et al. 2011; Gould 1977; Jones 1995; Montagu 1981; see also Morgan 1997 and Gräslund 2005 who both relate neoteny to the aquatic hypothesis of the origin of humans). L. Bolk, for example, thought that 'Bipedal walk found in the primitive, foetal, central position of the foramen magnum a lucky condition, sympathetic to its trends' (cited in Gould 1977: 397). Similarly, J. Gould indicated that 'The early stages of ontogeny are a reservoir of potential adaptation' (ibid.). Gould, however, was undecided whether 'Juvenile features [are] adaptation[s] in their own right or simple topological consequences of morphogenetic development from simplicity to complexity' (ibid.).

A more elaborate conception of neoteny is provided by Bednarik. A biological variable must first exist to be available for evolutionary selection, Bednarik says, and it is neoteny that makes physiological and neurological structures available for a selection process. Although it can sometimes be deleterious to a species, Bednarik adds, neoteny carries evolutionary benefits, contributing to the production of large structural changes and also facilitating the retention of plasticity or 'morphological evolvability' (Bednarik 2011b: 164). Furthermore, human neotenous adaptations are subject to a selection process operating in feedback systems that include niche construction (ibid.: 128). A hominisation process that integrates genetic, environmental and cultural factors, neotenous adaptation also includes self-domestication (self-breeding through mate selection). Bednarik's argument for self-domestication is that, as a state of prolonged childhood, neoteny dangerously increases hominin vulnerabilities, and that nature 'does not select for such plainly disadvantageous variables'; only culture and breeding patterns would (Bednarik 2011b: 138).

In humans, neoteny is manifested in the resemblance of many physiological features of a human to a late-stage foetal chimpanzee. These foetal characteristics include hair on the head, a globular skull, ear shape, vertical plane face, absence of penal bone (baculum) in foetal male chimpanzees, the vagina pointing forward in foetal ape, the presence of hymen in neonate ape, and the structure of the foot. 'These and many other features', Bednarik says, 'define the anatomical relationship between ape and man as the latter's neoteny' (2011b: 134). In evolutionary terms, these features suggest that upright walking and other

human characteristics are more directly related to adaptive retention of ancestral foetal structures rather than natural selection variables. That is, regardless of how much of a response to selective forces bipedalism has been, it still arose out of a neotenous development/retention of primate foetal structures, including foramen magnum and feet. Bipedalism and the process of becoming human are, therefore, the expression of ancestral neotenous conditions and adaptations (Bednarik 2011b, 2012: 22).

2. Neoteny, human brain and skin

While the evolutionary importance of neoteny is widely acknowledged, ontogenetic and phylogenetic studies overwhelmingly tend to focus on encephalisation, or the growth in human skull and brain size (Godfrey and Sutherland 1996; Goodman and Sterner 2010; Lahr and Foley 2004; Leonard et al. 2007; Mitteroecker et al. 2004; Montagu 1981; Preuss 2012; Raichlen and Polk 2013; Sherwood et al. 2012; Somel et al. 2013; Zollikofer and Ponce de León 2010). This tendency in the research is justified by the fact that the brain is the most distinctly human characteristic and displays a highly paedomorphic development, with postnatal growth continuing the late foetal growth rate well into the third year (Montagu 1981; Preuss 2012).

Yet there is another neotenous feature worth investigating from an evolutionary point of view, not only because of the generally acknowledged physiological dependency and interaction of paedomorphic traits, but also because of its unique contribution to the process of encephalisation itself: the human female skin.

What follows is a hypothesis regarding the neotenous adaptive process that may have led to the emergence of a naked, sweaty skin as a thermoregulatory organ, which allowed for a bigger hominin brain.

3. Brain size and thermoregulation

The emergence of human cognitive skills is due to the rapid expansion of brain size. By enlarging the brain through the prolongation of childhood growth tendencies and by providing a longer period of childhood learning, neoteny produced the intelligence and socialisation that characterised the hominisation process.

In terms of body-size ratio, the human brain is three times larger than would be expected in a primate of similar body size. The spectacular growth in the hominin brain resulted in increased cerebral functions but also led to a higher brain metabolism and energy demand. Today, a human brain, which is only 2% of body mass, consumes about 20% of the body's total energy requirement, compared with 11–13% for apes and 2–8% for other mammals. The evolution of large brain size in the human lineage involved a high metabolic cost (Bufill et al. 2011; Chugani 1998; Deaner et al. 2007; Fu et al. 2011; Goodman and Sterner 2010; Herculano-Houzel 2011; Leonard et al. 2007; Navarrete et al. 2011; Oldham et al. 2006; Preuss 2011). This means that hominin females incur even higher metabolic costs during pregnancy in support of brain ontogeny in their offspring (Leigh 2004).

The high postnatal metabolic rate is due to increased synaptic activity and plasticity in various areas of the cortex, as well as the density of glia relative to neurons, particularly in the prefrontal cortex (Chugani 1998; Harris et al. 2012; Somel et al. 2009; Somel et al. 2013). Differences in brain metabolic rates during postnatal development (synaptogenesis) have been documented in humans and animals. In humans, local metabolism of glucose begins to increase between ages 1 and 2 when synaptic density and dendritic length accelerate. It reaches its maximum in the auditory cortex between 0.4–3.5 years of age, and in the prefrontal cortex between 8 and 10 (Bufill et al. 2011; Herculano-Houzel 2011; Navarrete et al. 2011; Somel et al. 2013).

Clearly, the evolution of large brain size in the human lineage was achieved at a very high metabolic rate. But brain tissues are delicate, requiring the maintenance of a great thermal constancy, or homeothermy (Gisolfi and Mora 2000; Jessen 2001; Wheeler 1984). Encephalisation was, therefore, quite impossible without a cooling mechanism.

Indeed, the importance of thermoregulation with respect to the whole process of hominisation is widely recognised in the literature. P. E. Wheeler, for example, attributed the increase in hominin brain size to a combination of upright posture, water intake, naked skin and sweating (Wheeler 1984). Despite the absence of an intracranial carotid (rete mirable epidurable, found in artiodacyls), M. Cabanac believed that humans are capable of selective brain cooling (SBC) under hyperthermia. SBC, he said, occurs though the mastoid and parietal emissary veins, which allow cooler blood from the face and scalp to flow towards the brain (Cabanac 1993; Cabanac and Brinnel 1985; White et al. 2011; cf. Braga and Boesch 1997; Nybo and Secher 2011).

Building on Cabanac and H. Brinnel's finding of diploic veins (valveless veins in the skull that are open both internally and externally to the brain), D. Falk developed a 'radiator theory' of hominin evolution. Comparing measurements of cranial vascular structures in hominin fossils, great apes and humans, Falk found that increased emissary foramina correlated with increased brain size in the gracile australopithecine lineage leading to *Homo*, but not in the robust australopithecines. Robust australopithecines, Falk said, only evolved a cranial flow of blood built around enlarged occipital/marginal sinuses, which allowed for coping with hydrostatic pressures (gravity stress) but provided no cooling. She concluded that heat stress (thermoregulation) is at the origin of the human high encephalisation quotient (EQ) — brain size as measured by the ratio of actual brain volume of a given mammal to the average volume size of a population

of the same mammals (Falk 2004a: 160; Falk and Gage 1998; Falk 1992; also Kunz 2007: 1372). Jablonski also studied human skin extensively, but her focus was on pigmentation as an adaption to environmental radiation and nutritional conditions (Jablonski 2004, 2006; Quillen and Shriver 2011; for a brief review of the evolution of nakedness of *H. sapiens*, see Rantala 2007).

Although these studies recognise the role of vascular supply and venous drainage in providing the thermal conditions for encephalisation, they overlook the key role of the skin as a thermoregulatory organ and its contribution to the evolutionary development of the human brain. What is needed in order to shed light on the evolutionary role of the skin in the hominisation process is an integral accounting for (1) the origin of nakedness, (2) the development of the eccrine glands, and (3) the sexual dimorphism of humans with respect to hair.

Below is a hypothetical scenario of a neotenous development that gave rise to the skin as a thermoregulation organ, allowing for the cooling and thermal balance of a massively growing hominin brain.

4. Skin, sex and sweat

It is very likely that a female ancestral hominin initially displayed anogenital areas that signalled ovulation through a swelling of the sexual skin, but which subsequently disappeared as a result of a neotenous adaptation process. Swelling of the anogenital area is due mostly to extracellular water retention in the specialised tissue (Clarke 1940). One indication that early female hominins had a sexual signalling similar to chimpanzees is perhaps the size of the human male sex organ, one of the largest among the primates (Disxon 2009: 61–62). This penal condition may have been a response to the increased depth of the vagina caused by the swelling and the need for sperm delivery (Pawlowski 1999: 263). In primates lacking anogenital swelling, such as the gorilla, the orang-utan and the gibbon, the penis is very small.

Display of sexual skin in early hominins could have disappeared for many reasons, including a tendency towards sitting, as in the case of the reduction of the anogenital swelling in the gelada, which often feeds in a sitting position (Dixson 1998; Pawlowski 1999). But it is likely that the disappearance of the sexual skin is part of a neotenous adaptation that transformed the hominin skin into a thermoregulation organ integrating a spread of the eccrine glands and defoliation. This neotenous adaptation may have taken place as follows:

Due most likely to the loss of arboreal locomotion, an ancestral female hominin developed shorter arms, which were ineffective in supporting her obstetric weight when pregnant and full-breasted, or when carrying a nursing child. In response to gravity, the female lumbar gradually assumed an upright position, combining the foetal straight spine and lordosis (a marked posterior concavity), and a taller neck (Berge 1998; Whitcome et al. 2007). The neotenous characteristic of this development is evident in the fact that, in newly born primates, the foramen magnum is at the centre of the skull, where it remains as human infants grow, but in other primates it shifts toward the posterior end of the cranial base (Ahern 2005). Neotenous retention may also be indicated in the early appearance of a lordotic lumbar spine in early hominins. It seems that *Australopithecus afarensis* exhibited a long lumbar spine capable of at least partial lordosis, a post-cranial feature that is missing in *Pan* and *Gorilla*, who possess only three to four lumbar vertebrae and whose mobility is constrained by an 'entrapment' of the most caudal lumbar vertebras between cranially extended ilia (Lovejoy and McCollum 2010). This means that hominin bipedalism may have evolved from a primitive locomotor skeleton that has never been restrictively modified for suspension, vertical climbing or knuckle-walking (ibid.).

As the female's acetabulum (socket of the femur head in the pelvis) and femoral head were rotating so as to align the legs with the spine, the vagina gradually resumed its foetal forward position, with the clitoris positioned at the top of the vagina instead of the bottom as in other primates (Gräslund 2005: 101).

A. Eccrine glands

With this locomotor skeletal alignment, and as the vagina shifted down and forward assuming its foetal formation, the sexual skin began disappearing, being squeezed, as it were, between the female legs. Simultaneously, the function of the sexual skin as a water-retention organ became gradually dedicated to thermoregulation through sweating, a uniquely human trait except in the patas monkey — other primates have sweat glands that function as those of humans only in their armpits (Jablonski 2006: 198, n. 15).

This hominin thermoregulatory transformation was made possible by a gradual spread of the eccrine glands from the volar area (soles and hand pads, where sweating helps with grasping, increased tactile sensitivity and the protection of the skin from damage) to the whole body, making the skin an external execratory organ producing sweat and performing a cooling function (for anatomy of human eccrine glands, see Folk and Semken 1991; Montagna 1985; Shibasaki et al. 2006; for the distribution of eccrine glands over the body see Taylor and Machado-Moreira 2013; Thompson 1954; Wilke et al. 2007). In humans, eccrine sweat varies according to hydration, rest, health and region of the body (Wilke et al. 2007).

B. Embryology

This spread of the eccrine glands and the transformation of the skin into a thermoregulation organ are perhaps captured by the embryonic development of the eccrine glands as migratory cells. Indeed, the

eccrine glands form first when a human foetus is three to three and a half months old only on the volar surfaces of the hands and feet. Then, around five to five and a half months, they appear next to the hairy surfaces, when the hair follicles and their sebaceous glands are already completely differentiated and functional (Montagna 1985; Wilke et al. 2007). It is worth noting that the eccrine glands have the ability to reproduce even when placed in a foreign microenvironment such as shoulder fat or mammary tissue (Lu et al. 2012).

The anatomical distribution of the density of human sweat glands is perhaps also relevant to their embryonic migration and their post-natal function. Studies indicate that the highest density of sweat glands is on the hands and the lowest on the upper lip. In terms of function, the highest rate of sweating under rest conditions is in the forehead and the upper back (Taylor and Machado-Moreira 2013), areas close to the brain.

It is possible that, for heat dissipation, the expanding eccrine glands initially began by discharging the extracellular water that was used in the swelling of the sexual skin (about 1.5 litres) in the form of perspiration. In the process, the skin gradually became integrated into the urinal system, acting as an external execratory organ. Human sweat consists of water (99%), sodium, chloride, potassium, calcium, magnesium, lactate, ammonia, amino acids, urea and bicarbonate. Other elements include several proteins and peptides (Wilke et al. 2007).

The integration of the newly acquired thermoregulation function into the metabolic system was facilitated by the fact that the water retained in sexual swelling is already connected to the renal system. Indeed, primates with sexual skin exhibit thirst and relative low output of urine during the rise of the swelling, and the reverse while the swelling is abating. During the swelling phase, water intake from all sources exceeds the urine output several fold, but promptly at the start of shrinking the urine output is greatly augmented and appetite for fluid water disappears (Clarke 1940).

C. Straight hair, kinky hair

Once thermoregulation through sweating was acquired, its efficiency was further increased as a result of the 'defoliation' of female hominin skin, since straight hair hampers the evaporation of sweat and the process of cooling (Montagu 1981: 57). Again, this loss of hair may have simply been a reversion to a neotenous condition where fur hair became vellus hair, thus exposing more evaporative surface. Perhaps the neotenous loss of hair is also embryologically captured in the lanugo (*infra*), a fine foetal hair that appears on the human foetus around month 5 of gestation and disappears shortly after birth to be replaced by vellus hair.

Unlike vellus hair, hair retained at the pubic area and armpits became kinky to allow for aeration and possible olfactory function of the apocrine glands. It may also be that early African hominins began with straight head-hair that subsequently became kinky to allow for the aeration and cooling of the skull and the brain, the opposite of people in cooler latitudes, where straight hair retains warmth better.

D. Erogenous shifts

Accompanying the acquisition of neotenous skin was the migration of the erogenous areas to the front of the female, where they became concentrated on the face (blushing, colourful lips, erogenous mouth), and a permanently enlarged breast in mature female humans to signal the female's ability for continuous copulation — not simply signalling ovulation as anogenital swellings had. The neotenous position of the female vagina in front also allowed the female visual control of the coital act and copulatory behaviour.

E. The white of her eyes: sclera

Perhaps it is also possible that, in conjunction with these female-centred changes in physiological and sexual behaviour, the whitening of the sclera of the eye, a unique feature of humans among the primates, appeared. Humans have the largest white in their eyes, while other primates have pigmented sclera that tends to be dark. The visibility of the white of the eye is highlighted by a marked contrast between the human skin, sclera and the iris. Because it signals the direction of the gaze regardless of the position of the head, the white of the eye has been interpreted as an indication of cooperative communication (Bickham 2008).

F. Hot sex

Possibly another significant indication of the anogenital origin of the human thermoregulation mechanisms is the tendency of humans to sweat during sexual intercourse.

G. Tears

The relationship between the eccrine glands and lacrimal glands is not known, but it is a point worth investigating given that, like sweating, humans are the only primates who shed salty tears. Interestingly, female tears are larger and more profuse than the male's. Unfortunately there is nothing on the subject in the literature.

H. Menopause

The above-described thermoregulatory transformations and their evolutionary origin in the female anogenital skin may be connected to menopause. Rarely recorded in female chimpanzees in the wild (Thompson et al. 2007; Wood et al. 2001), menopause is a natural phase in every woman's life at age 51 to 60. Female primates can potentially experience menopause, but their 'reproductive senescence usually corresponds with somatic senescence and few species live beyond the depletion of their oocyte' (Robson and

Wood 2008).

Menopause consists of bouts of hot flushes? that are experienced as a rush of body heat, usually in the face and upper body, lasting for several minutes, followed by intense sweating and sometimes shivering night sweats (Pollycove et al. 2011; Shanley and Kirkwood 2001; Spetz et al. 2003). These thermal reactions and other clinical symptoms of the menopausal event seem to be an echo of many of those distant skin-related thermoregulatory changes in ancestral hominins: triggered by a decrease in the levels of oestrogen and progesterone and the end menstrual cycles, menopause involves vaginal dryness, lack of skin elasticity and brief experiences of excessive warmth and perspiration.

It is interesting that hot flushes are experienced by men who undergo surgical castration for treatment of prostate cancer. These vasomotor symptoms are thought to be due to a drop in in sex hormone levels (Frisk 2010), which underscore the deep connection between the physiology of sex and skin.

I. Lanugo and anorexia

As mentioned above, lanugo is a fine foetal hair that appears on the human foetus around month 5 of gestation and disappears shortly after birth to be replaced by vellus hair. What is interesting is that lanugo is also linked to anorexia, an eating disorder that is prevalent in women. In the Unites States of America, for example, about 20 million women and 10 million men suffer from a clinically significant eating disorder at some time in their life, including anorexia nervosa and bulimia nervosa (*http://www.nationaleatingdisorders.org/get-facts-eating-disorders*).

In addition to the physical problems it causes, anorexia disturbs the normal functioning of hormones in women, as the body is deprived of sufficient oestrogen due to lack of fat. This causes amenorrhea (absence of menstrual cycle). Some anorectic individuals tend to grow lanugo, a fine or vellus hair, which covers the whole body (hypertrichosis lanuginosa acquisita, HTLA), which is perhaps a reverse of the evolutionary development of human skin.

5. Neoteny, play and art

Behaviourally, neoteny is most manifested in play, an essential fitness which is part of the adaptive repertoire of many species, including humans (Flannery 1986; Guthrie 2005; Harshbarger 2010; Trezza 2010). Some animals are more playful than others, but humans, especially children, are the most playful of all species. In humans, children's playfulness has been evolutionarily linked to the function of triggering nurturing responses in adults toward babies (Lorenz 1971). Spontaneous and self-rewarding, play helps children develop their cognitive and motor skills. Emotionally rewarding, it also promotes creativity and motivates learning, especially in the form of imitation of adult actions (e.g. doodling, singing and gesturing). The repetition of play actions and the permutation of their sequences also give children the flexibility to apply their cognitive abilities to different settings (Trezza et al. 2010: 463). Through joyful playing, children acquire social and cognitive competence and learn communication, cooperation and group hierarchy. The social dimension of play is indicated by the fact that, although mothers are the constant focus of their children's attention, play is the first behaviour that a child directs at people other than his/her mother (Trezza et al. 2010: 463).

Playfulness, or ludic behaviour, also connects neoteny to art. Indeed, not only do children approach art as a form of play (Kellogg 1970; Sully 1977; Turner 2006), but there is also a ludic aspect to art itself (Achrati 2013; Calder 1973; Dissanayake 2010; Hodgson 2000; Huizinga 1956; for ludology as an emerging a scientific discipline see Nacke 2009). In fact, as R. Guthrie said, art is simply 'play around'. Guthrie even thought that 'art making is a uniquely evolved offshoot of play' (Guthrie 2005: 374). This is perhaps why children are known for their spontaneous display of iconographic drawing ability, even when living in a culture whose graphic art is otherwise entirely non-iconic (Bednarik 1986, 2008; Bednarik and Sreenathan 2012). This is also why it is believed that much of the Pleistocene art is the product of children (Bednarik 1986, 2008; Guthrie 2005).

6. Neoteny, cognitive evolution and self-domestication

From what has been said, it seems that neotenous adaptation may have conferred on the female hominin a primary role in the hominisation process; specifically, an expansion of the brain made possible by, among other developments, the transformation of the anogenital sexual skin into a thermoregulatory organ. Through playfulness, neoteny also contributed to hominin cognitive evolution, while parental investment and childhood dependency extended the female's influence over the development of offspring (see e.g. Falk 2004b). Neotenous adaptation also made possible female continuous mating, visual control of the coital act and copulatory behaviour.

A question arises as to how sexual selection may have modified this privileged evolutionary role of the hominin female. This is a pertinent question because, in Darwinian terms, sexual selection, which accounts for the evolution of secondary sexual characters, usually involves competition between males for access to females who chose a mate from the opposite sex. But as Darwin also noted, sexual selection can produce odd structures, usually male ornamental traits, to aid in the competition for females (Darwin 1871). Indeed, as Fellmann and Walsh (2013: 64) have indicated, 'Sexual selection knows no boundaries in its formation of gender-specific traits, and would only lead to eccentric developments if the permanent effects of natural selection did not regulate its functions'.

This means that, unchecked by natural selection, sexual selection is apt to produce gender-specific traits that are not only anomalous but, perhaps, also maladaptive.

Natural selection promotes various modalities of biological improvement, including adaptation to environment, specialisation, functional efficiency and self-regulation (Huxley 1974). Under the influence of natural selection, and operating through modification of female physiological and anatomical structures, neotenous adaptations gave rise to a hominin species with increasing cognitive capacities, enabling it to develop a culture and create its own niche. In time, culture 'markedly reduced the impact of natural selection', while reproductive differentials began increasingly operating under selective pressures deriving from social and psychological influences (Huxley 1974: 586). These socially derived mechanisms of selection gained momentum as they took the form of self-domestication. Driven by sexual preference, these selection mechanisms may have begun as unconscious tendencies similar to what Darwin noted in connection with animal breeding (Darwin 1875, Vol. 2: 177; Heiser 1988; Fellmann and Walsh 2013). Rooted in 'the rudiment of an aesthetic faculty' that produces its effect through the 'emotional reaction of the other members of the species' (Fisher 1958; 145), self-domestication became increasingly male-oriented, attaching much importance to cuteness and passivity in the female mate.

By selecting for female traits that have no direct bearing on fitness, self-domestication may have promoted the 'infantilisation' of the hominin female and her dependence on the male. If this is so, then self-domestication in fact constituted a *detournement* of the neotenous process for the purpose of securing female domesticity. The submission of the female recorded in all cultures, therefore, was not so much the product of evolutionary pressure as it was the result of a prevalence of the male's desire and physical dominance.

Unfortunately, this evolutionary development continues to be rationalised and perpetuated in the literature as 'female choice', a notion which A. R. Wallace, the discoverer of natural evolution, found highly questionable (Wallace 1900: 390–392, n.1; 521–523; also Puts 2010). For example, some believe that male's sexual displays and 'ornaments are due to cumulative action of sexual preference of the female', which is fine until we learn that the ultimate preference of the female is actually to have her 'sons … most decidedly have any advantage over [other] sons' (Fisher 1958: 136; Parker 2006). In other words, the female is a willing accomplice in this evolutionary privileging of the male. In relation to art, the sexual selection theory holds that men are 'image makers' and women 'image-enjoyers' (Varella et al. 2011a: 154); that there are 'display-producers and display-judgers. To produce a really effective display, it helps to anticipate how the display will be judged … For females to judge which male tells the best jokes, they may benefit by evolving joke-telling ability' (Miller 2000a: 93).

Fortunately, the infantilisation that the female has suffered through evolution did not affect her brain or intellectual abilities, as her accessibility to modern education and employment opportunities have shown. Advances in the area of human freedom, our understanding of gender, sexuality and sexual orientation also indicate that the evolution of human consciousness is a far larger story than the often-repeated peacock tail tale.

7. Conclusion

Through neotenous retention and adaptation, the hominin female was probably singularly responsible for evolving a thermoregulatory system, an evolutionary process involving the disappearance of the sexual skin, the spread of eccrine glands and the appearance of a naked skin. This thermoregulatory adaptation of the skin may have contributed to the expansion of the hominin brain. It also resulted in a redesign of the sensory and erogenous areas of the human body; removed hominin mating function from the hormonal cycle; and gave the female control of the coital act and copulation behaviour. Hominisation is, to a great extent, female-driven neotenous developments. The role of the female in human development is great still, considering the span of childhood dependency.

The above-listed biological facts, which are the basis of the hypothesised female-induced hominisation, all have their genetic expressions, the timing of which is apt to shed new lights on chronology of hominin evolution. One of the primary tasks of genomics is to study the evolution of the molecular bases of those traits that are uniquely human: brain size and language. If the discovery of a language gene (FOXP2) is any indication, it is possible to identify some of the genetic expressions involved in the evolution of human skin-related structures identified in this essay (e.g. eccrine, sclera, menopause, lanugo, tears etc.) and trace their evolution via their possible presence in the Neanderthal and Denisovan.

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The role of male and female in reproduction, and understanding of sexual selection when applied to human artistic propensities

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We authors are pleased that the cross-disciplinary debate regarding 'Evolutionary aesthetics, sexual selection and palaeoart' started by Varella et al. (2011a) and Varella et al. (2011b), continued in Varella et al. (2012), is still happening. We are grateful to *Rock Art Research* for creating such recurrent fruitful discussion opportunities. The new comment from Achrati offers a welcome opportunity for us to further explain our evolutionary approach.

In this reply, we will touch upon both comments made by Achrati, in 2011 and 2014. Along the same line of our previous replies Varella et al. (2011b) and Varella et al. (2012), we will attempt to solve some misunderstandings, without closing doors of different possibilities of explanations nor limiting the options of possible approaches to investigate the evolutionary roots of human palaeoart.

In Varella et al. (2011b: 179) we have already reacted on Achrati's comment, by reminding that explaining art in terms of pleasure does not oppose evolutionary explanations and that not mentioning pleasure is not a flaw of evolutionary explanations. The pleasure we get when producing and/or appreciating artistic products is part of the proximate reasons why we manifest our artistic potential. The reasons why we have our artistic potential and why we get pleasure out of it belong to distal evolutionary explanations. The confusion, or attributed incompatibility, between proximate and distal kinds of explanation is a prevalent obstacle to interdisciplinary integration (Varella et al. 2013), which was also the main point of our second reply (Varella et al. 2012).

The main conclusion of criticisms by Achrati (2011) was that 'connecting evolution, art and male sexual behaviour, as this article seems to do, ignores the fact that evolutionary reproduction is primarily a maternal function (Dissanayake 2007, 2000b; Coe 2007), and risks giving patriarchy the endorsement of science, a job already taken by religion' (Achrati 2011: 176). Indeed, in his new comment he states that he has 'rejected this linkage between art and sexual selection on the grounds that it represents a gendered view of art and cognitive behaviour'.

First of all, the lack of clarity attributed by him is perceivable in the use of the not-so-clear term 'evolutionary reproduction'. Secondly, in the rare parthenogenetic vertebrate species, such as the New Mexico whiptail lizard (*Cnemidophorus neomexicanus*), reproduction is indeed primarily a maternal function. That is, because in this species there are no males, and sometime after receiving copulatory movements from another female, females lay their clonal eggs. In the majority of vertebrates though, for reproduction to occur, it is required that both sexes perform their function, which can vary according to the relative level of parental investment (Trivers 1972). As Trivers (1972) predicted, species in which females invest more than males per offspring, as for most mammals, females are the limiting and choosy sex, while males tend to have more weapons or ornaments to compete for or to attract females. However, species in which males invest more per offspring than females (seahorses, for instance), males are the limiting and choosy sex, while females tend to have more weapons or ornaments to compete for and attract males. Therefore, we find more males developing weapons or ornaments precisely because mammalian females have a crucial role in reproduction. Thus, emphasising one sex in the studied trait, even if we had done so, does not ignore the role of the other sex.

Thirdly, as we said in our first reply, 'some [authors, including Achrati] also indicated that our argument implied that only the ancestral males doing art would have reproductive success' (Varella et al. 2011b: 181). We have never said that men are 'image-makers' and women 'image-enjoyers', as Achrati now claims. As we have said in Varella et al. (2011b), since human males invest considerably in the offspring, both sexes compete for, exhibit to and choose the other sex. These 'set the scenario for a more monogamous mating system with fewer sex differences, but there would still be some' (Varella et al. 2011b: 182). Thus, both sexes are at the same time image-makers and image-enjoyers, although not to the same extent, given that women still invest slightly more than men per offspring. 'Of course this does not mean that *only* males would have produced rock art, but simply that they would have had the higher motivation to do so' (Varella et al. 2011b: 181). Also, this does not mean that only sexually mature individuals would produce and appreciate palaeoartistic products. As we stressed in Varella et al. (2011b), sex differences in children's play mirror adult forms of intra-sexual competition consistent with relative levels of parental investment, so children's propensity to art is not contrary to sexual selection. 'One can see that both male and female can display and appreciate displays of others, no matter which sex is displaying and on which domain' (Varella et al. 2011b: 181). Varella et al. (2010) showed that although women are found to be a music-enjoyer more than men, both sexes tend to produce music: males by playing instruments and women by singing, indicating that there is no simple clear-cut separation between men and women regarding artistic displays.

Fourthly, the author of the comment runs the risk of the moralistic fallacy (see Varella et al. 2013), also related to confirmatory bias (Wason 1960), by rejecting

an evolutionary explanation based on sexual selection *on the grounds of* an attributed gendered view or possible endorsement of patriarchy, machoism or sexism. Moralistic fallacy occurs when people deny or distort facts or hypotheses in order to better fit, or not disturb, certain moral beliefs held. For instance, the (mis)use of quantum physics terms by self-claimed gurus and mystical healers is not a good reason to reject the field of quantum physics. Instead, it is a reason for us to increase the vigilance over misuse of science to endorse any ideology or dubious practices. As Pinker said, 'a denial of human nature, no less than an emphasis on it, can be warped to serve harmful ends. We should expose whatever ends are harmful and whatever ideas are false, and not confuse the two' (Pinker 1997: 48). Ironically, Cronin (1993) showed that, historically, sexual selection has been rejected by sexist Victorian scientists for almost a century because since the theory gives too much power to guide evolutionary change to women and most other female animals, it was not seen as a good endorsement of patriarchy. It is curious how easily people reject sexual selection based on moral justifications in both directions. To promote the understanding of the topic, Miller (2003) has clarified six misunderstandings about the theory of fitness indicators, in order to decrease part of the ideological anxieties and fears that hinder the understanding of the modern theory of sexual selection.

Cronin (1993) also shown that thanks to many theoretical achievements from the sociobiological synthesis since the 1970s, research on sexual selection could flourish. Most of criticism in Achrati (2011), as for some in the new comment, is due to a lack of appreciation of the importance and relevance of the sociobiological synthesis to behavioural sciences, despite its controversies (Alcock 2001). A better understanding of the scientific advances that occurred in sociobiology (Alcock 2001) will not only help authors to better grasp our proposition, but also improve their own theorisations.

Lastly, Achrati's theorisation connecting neoteny and cognitive evolution in female hominins through self-domestication is interesting and not exclusive to our approach, since we also focus on co-evolutionary processes occurring within human species. In fact Dutton (2009) explained sexual selection as a form of self-domestication which every species does to itself, influencing its further evolution. The process of neotenisation is included in the evolution of human life history resulting from selection processes influenced by both natural and sexual selection pressures. The possible survival advantages of the female-driven neotenous developments responsible for evolving a thermoregulatory system interacts also with the possible reproductive advantages given that men cross-culturally prefer neotenous women as partners (Jones et al. 1995). Moreover, neoteny is not exclusive only to females in our species. With a slow life history strategy, resulting in a slower ontogenetic development and consequently a longer period of childhood, human babies need high levels of parental investment (Geary 2002), because they are helpless, requiring protection, food, thermoregulation, social and physical stimuli, particularly in high-stress environments (Ellis et al. 2009). Then, females were selected to choose mates with the capacity to invest in their offspring and invest more in long-term relationships (Geary 2002). Ancestral women started also choosing males with attributes that tend to signal qualities of a 'good parent', with more gracile and neotenous traits, and consequently, higher willingness to long-term romantic relationship (Buss and Shackelford 2008). Furthermore, Elia (2013) shows another link between domestication processes and attractiveness of neoteny by comparing the fox domestication with attractive facial features in humans. Thus, there is no need to reject our proposal based on sexual selection to build on a possible explanation for human artistic capacities using neotenous adaptation processes.

Furthermore, we are mostly concerned that Achrati's proposal, which has not much resemblance to what he wrote in 2011, might be too ambitious in trying to explain many traits at once, too broad to be experimentally tested and too general to be able to generate particular predictions regarding palaeoart production and appreciation.

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BRIEF REPORTS

Historical vandalism and 'graffiti' at Ngaut Ngaut (Devon Downs), South Australia

By AMY ROBERTS, NATALIE FRANKLIN, ISOBELLE CAMPBELL and the Mannum Aboriginal Community Association Inc. (MACAI)

This brief report provides some additional points of interest in relation to the rock art of Ngaut Ngaut (Devon Downs), South Australia (see Roberts et al. in the previous edition of *Rock Art Research* for a more detailed background on this heritage complex). In this paper we outline issues relating to the historical vandalism and 'graffiti' that have occurred at this significant site and related ongoing issues of management and curation.

As we outline in Roberts et al. (2014) the Ngaut Ngaut heritage complex is significant for many reasons, however, in relation to rock art studies this site is important as it was arguably the first in Australia to reveal rock art in an excavation (conducted in 1929 by Hale and Tindale) (see Bednarik 2001; Hale and Tindale 1930; Layton 1992: 213; Mulvaney and Kamminga 1999: 367; Roberts and MACAI 2012). The site also provides one of the few instances where the approximate 'dating of rock art by excavation' has been possible worldwide (Bednarik 2001).

Unfortunately there have been numerous occurrences of vandalism and 'graffiti' at Ngaut Ngaut. Whilst such damage has largely been halted by the Mannum Aboriginal Community Association Inc.'s (MACAI) co-management agreement with the government (which has resulted in the fencing and locking of the park so that legitimate access to the park can now only take place with the consent of MACAI), some instances of graffiti/vandalism still occur from time to time.

Due to the fact that Ngaut Ngaut has been of interest to researchers for such a long time we have been able to track a number of instances of historical vandalism and 'graffiti'. In particular, one of the more obvious issues that has affected the preservation of the petroglyphs over time includes their removal ('souveniring'). In this regard a number of interesting points have come to light during recent research. The first issue relates to a large missing piece in the main area of the Ngaut Ngaut rockshelter (Fig. 1).

This piece was already missing by 1929 and was recorded in Tindale's (1922–1930: 381) journal (Fig. 2). As may be noted in his sketch below he writes 'mutilated (piece w Mus coll.)'. Presumably this refers to the fact that the removed section was placed with the South Australian Museum (SAM) collection — although the details relating to this event are not recorded in association with the sketch. However, despite searching this piece cannot be located by SAM staff (Keryn Walshe pers. comm.).

Sheard (1927) also records an

***Figure 1**. Missing piece from the main area of the Ngaut Ngaut rockshelter. Photograph by Robin Coles, 26/9/2012.*

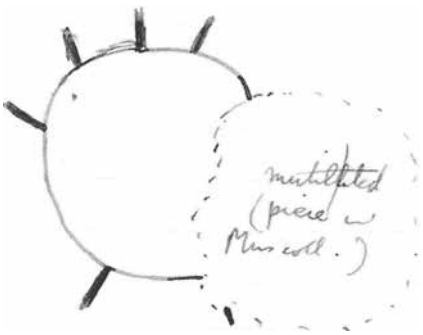

***Figure 2**. Sketch of the 'mutilated piece' by Tindale from 1929. Image courtesy of the South Australian Museum Archives, AA338/1/2/p. 381, Tindale Collection.*

***Figure 3**. Hewn-away portion according to Sheard (1927). Photograph by Natalie Franklin, 21/9/2011.*

early vandalism attempt in reference to a hewn-away portion of rock adjacent to the prominent 'sun' motif in the main gallery at Ngaut Ngaut (Fig. 3). Although difficult to discern it would appear that the chiselled section is larger in the recent photograph above (Fig. 3) in comparison to Sheard's photograph (see Sheard 1927: Plate IV, Fig. 2) — possibly as a result of subsequent attempts to remove the petroglyphs. In addition, it should also be noted that a 'rock art engraving' was accessioned into the SAM collection (Registry No. A 32885-32886 Sublot 2055x) with the collector listed as Sheard. Unfortunately, like the previous example, this item/s cannot currently be located by SAM staff (Keryn Walshe pers. comm.). These cases reveal the difficulties relating to the long-term curation of artefacts in museum collections.

There are, of course, numerous other examples of vandalism/'graffiti' at the site (e.g. see reference to later removals in Tindale 1961–1965: 1062). On the issue of 'graffiti', based on observations to date, it can be stated that many consist of the typical name/initials/date variety and predominantly span the 20th century (e.g. see Fig. 4).

However, arguably the most interesting 'graffiti' at Ngaut Ngaut is the 'G. Karpany BORN 1871' inscription at the western end of the Ngaut Ngaut rockshelter

***Figure 4**. Example of 20th century 'graffiti'. Photograph by Vanessa Orange, 21/9/2011.*

(although not in the rockshelter proper but on a lower face of the cliff). The surname, Karpany, is a distinctly Aboriginal name in the region and given the date this is most likely George Karpany, son of 'Queen' Louisa Karpany and husband of Sarah Perry (see Kartinyeri 2006: 74). Tindale (1922–1930: 403) sketched this engraving in one of his field notebooks and noted in 1929 that the inscription was 'very clean cut probably done in the last 20 years'. His sketch is reproduced below (Fig. 5a) along with a current image of the engraving (Fig. 5b).

As can be observed, since 1929 this engraving has significantly weathered with the date nearly worn away altogether. On a recent field trip to the site (11/7/2013) it was observed (by Alan Watchman) that the background surface to the engraving appeared to have been smoothed or lightly scraped by its maker — it was postulated that this preparation may be related to the reasonably rapid weathering of the motif.

It should also be noted that the MACAI chairperson, Isobelle Campbell, together with her son, also discovered a second, and previously unrecorded, 'G. Karpany' inscription at Ngaut Ngaut in 2012, further east of the above image (see Fig. 6).

These engravings raise important issues regarding continuity of access to the rockshelter by different Aboriginal people from the region over time (cf. Smith and Jennings 2011). Indeed, numerous ethno-historical records, oral histories and recent examples show that Ngaut Ngaut has been accessed, lived at and cared for by Aboriginal people over a considerable period of time (e.g. see Roberts and MACAI 2012). This finding is in stark contrast to Sheard's (1927: 18) conclusions

***Figure 5a**. Sketch of the 'G. Karpany' inscription by Tindale from 1929. Image courtesy of the South Australian Museum Archives, AA338/1/2/p. 403, Tindale Collection.*

***Figure 5b**. 'G. Karpany' inscription condition in 2012. Photograph by Robin Coles.*

***Figure 6**. The newly discovered 'G. Karpany' inscription. Photograph by Robin Coles, 26/9/2012.*

on this issue in relation to Ngaut Ngaut about which he wrote, 'the natives present at Swan Reach on being questioned had no knowledge of the place'. This statement should clearly be read and understood in light of what is known about Aboriginal knowledge of Ngaut Ngaut — indeed it seems more probable that those he spoke to either did not want to talk to him about the area or were not the appropriate people to speak for country.

These inscriptions have also provided interesting and ongoing discussions amongst contemporary community members as to how such recent engravings should be understood (e.g. as 'graffiti', evidence of continuity etc.). In this regard we note that some researchers (e.g. Field 2009) prefer the term 'historical motifs' as 'graffiti' has negative connotations. Field (2009) found that historical motifs can have social, historical and research significance, as is the case, for example, at the Carr's Gap Rock Art Site near Mudgee in NSW. The historical motifs at this site show the marking of place by two communities of people over a long period of time, as the motifs have been left by direct descendants of the Wiradjuri people of the area, as well as non-Indigenous settlers. Field (2009: 42) comments that '[t]his re-visiting of a site over generations to mark place arguably can be seen as indicative of the place having had importance in their lives'. Similar observations by Smith and Jennings (2011) pertain.

Given these issues we would argue that a more detailed analysis of vandalism and 'graffiti' at Ngaut Ngaut is warranted. Such a study could reveal more insights into the continuity of use of the site by Aboriginal people, and in addition European occupation and visitation of the area (cf. Field 2009; Winchester et al. 1996).

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RAR 31-1142

Joseph Bradshaw's 'lost' watercolours found

By MICHAEL P. RAINSBURY

Until late 2013 watercolour paintings of rock art discoveries by explorer and pastoralist Joseph Bradshaw, from his 1891 expedition into the Kimberley of Western Australia, were thought to have been lost or destroyed (Rainsbury 2013). Their original existence was only known from second-hand accounts such as the Rev. John Mathew's (1894). This changed when Melbourne-based auction house Sotheby's Australia announced their inclusion in a sale of Fine Asian, Australian and European Arts and Design for the 29th October 2013. *Lot 255: Joseph Bradshaw 1854–1916. An important collection of 19th century archaeological watercolours* (Sotheby's Australia 2013), fetched A$18 000, comfortably within the guide price range. The watercolours were appropriately bought by the Berndt Museum and the University of Western Australia and returned to Western Australia.

Lot 255 comprised seven watercolours from the estate of the late Margaret Cameron Dykes of Sydney (Sotheby's Australia 2013). Two of the paintings are copies of illustrations of Lieutenant George Grey's discoveries on the Glenelg River in 1838. One is a version of Grey's 26th March cave showing a rockshelter with Wandjina figures, but omitting the men, horses and camp paraphernalia Grey included (1841). The other is a kangaroo or wallaby from the same cave. A third painting is of black hand prints within a rockshelter. The remaining four watercolours are colour renditions of art encountered on Bradshaw's visit to the Roe River in April 1891 (Mathew 1894; Parker et al. 2007; Rainsbury 2013). Bradshaw selected four panels to draw at a weathered site complex (R0042, R0043) amidst other examples of art. The main panel (Fig. 1), previously only published in black and white, is titled in the catalogue as 'Five Bradshaw figures with snake, kangaroo and abstract markings'.

It is as Mathew described it (1894: 47), with a red-coloured snake and kangaroo, and five human figures painted brown, three of which are portrayed with anomalous yellow collars. The dominant catalogue illustration is the curious figure with pear-shaped body, described as a 'Bradshaw figure with tasselled snake and mask' (Fig. 2). The watercolour shows the rounded figure with superimposed tassel figure, rearing snake and mask on a stalk, the latter now known to be the remains of a headdress after the body has faded (Rainsbury 2013: 252).

The sixth painting is of two people superimposed over a crocodile, 'Two Bradshaw figures with crocodile'. The final watercolour of four tassel figures over a parallel line figure is captioned 'Four Bradshaw figures with abstract designs'.

The watercolours are large, slightly differing in size from each other, but averaging around 54 × 80 cm. Joseph Bradshaw was an accomplished water colourist and it seems he painted them in conjunction with an unnamed artist or assistant. He initialled the paintings JB along with initials PPF from the other artist. The art seems to have been painted as a visual aid for use in public presentations, most probably Bradshaw's talk in Melbourne on 10th September 1891 to the Royal Geographical Society of Australasia, Victorian Branch. Bradshaw was certainly familiar with the writings of both Philip Parker King and Lieutenant George Grey and he may have reproduced two of Grey's paintings to draw a parallel with his own discoveries.

Figure 1. *Five Bradshaw figures with snake, kangaroo and abstract markings (image courtesy of Sotheby's Australia).*

The original sketches have not been found and perhaps were destroyed after the watercolours and lithograph copies (for publication) were made (John Bradshaw pers. comm.). As for how the works came to be owned by Margaret Cameron Dykes, descent through her family is the most likely. Her great grandfather, J. R. Tuckett was a Fellow of the Royal Geographical Society of Australasia, though he died before the 1891 talk. Her grandfather Reginald Tuckett was a partner in the Melbourne

Figure 2. *Bradshaw figure with tasselled snake and mask (image courtesy of Sotheby's Australia).*

auction house Gemmell, Tuckett and Co. and may have obtained the watercolours after Joseph Bradshaw's 10th September presentation (John Bradshaw pers. comm.). Bradshaw departed for Darwin and returned to the Kimberley with his wife Mary after the lecture on the 12th of that month.

The reappearance of Joseph Bradshaw's watercolours after 122 years, and in such excellent condition, is nothing short of miraculous. They are of great historical importance for Western Australia and rock art studies, and their purchase by the Berndt Museum in conjunction with the University of Western Australia is to be applauded.

Acknowledgments

I am indebted to John Bradshaw for information on both Joseph Bradshaw and the late Margaret Cameron Dykes. Thank you to Sotheby's Australia for their help and kind permission to use the illustrations, in particular to Dr David Hansen, Gary Singer and John Keats. Thank you to Kim Akerman and to Prof. Sandy Toussaint of the Berndt Museum, and Prof. M. Diaz-Andreu and Prof. R. Layton.

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RAR 31-1143

RAR REVIEW

Wadi Sura – The Cave of Beasts. A rock art site in the Gilf Kebir (SW-Egypt), by RUDOLPH KUPER. In collaboration with Franziska Bartz, Erik Büttner, Frank Darius, Frank Förster, Lutz Hermsdorf-Knauth, Sabine Krause, Hans Leisen, Heiko Riemer, Jürgen Seidel and András Zboray. 2013. Africa Praehistorica 26. Heinrich-Barth-Institut, Köln, 545 full colour pages, numerous figures, tables and maps, 2 folded plates, 24 × 34 cm, 4.3 kg, hardcover and half linen-bound, €85.00 plus postage, ISBN 978-3-927688-40-7.

It has always been my deep regret, being far too occupied with rock art research and other archaeological work in and near the Egyptian Nile Valley, that I have never been able to visit some of the rock art sites in the Sahara proper. Indeed, my good friend Salima Ikram has kindly given me the occasion to see some wonderful rock art, including rare historical cave paintings, at Ain Amur near Kharga Oasis in 2007, but I have never been beyond that point in the field — barely 250 km west of the Nile Valley. And certainly, the Tassili n'Ajjer, the Tadrart Acacus Mountains and Jebel Uweinat are musts on the itinerary of anyone who is a rock art aficionado. I will probably keep postponing these visits until it is too late ... . But, now, there is this book on Wadi Sura ('Valley of the Pictures' in Arabic) in Gilf Kebir in the Egyptian part of the Libyan Desert. Without anticipating my review below, let me announce it loudly and clearly: browsing through it is the next best thing to being on the spot, and, in some ways, maybe even better. I am not sure if I will ever see the 'Cave of Beasts' with my own eyes, but I have the feeling that I can rest my head in peace: I have been 'there'! Few other rock art books would be able to give that impression.

The name of the 'Cave of Beasts' should ring a bell for anyone who is even vaguely interested in north African rock art. The cave, rather an open rockshelter, or an *abri sous roche* as French-speaking colleagues would term it, was discovered in May 2002 by the Italian desert travellers Massimo and Jacopo Foggini. Its official site designation is Wadi Sura II (Wadi Sura I being the 'Cave of Swimmers' discovered by the Hungarian explorer László Almásy in 1933 and world-famous because of its appearance in the 1996 Hollywood blockbuster *The English patient*). The cave, one of the world's most densely decorated rock art sites, contains an incredible amount of rock art, roughly eight thousand individual figures, most of which are paintings. Petroglyphs, often situated at a higher level than the pictograms, are much fewer in number. Among the most striking images are dozens of mysterious, headless beasts, sometimes shown to swallow (or disgorge?) humans; the so-called 'swimmers', human figures arranged in a long row that are represented as if floating in the air or on water; and hundreds of sprayed hand stencils. Together, these motifs define the 'Wadi Sura rock art style'.

Producing this superb, heavyweight volume on the 'Cave of Beasts' must surely have been a titanic undertaking. However, as we have become used to expect, from so many other realisations of the Africa Research Unit of the Institute of Prehistoric Archaeology at the University of Cologne, this has again been performed with utmost *deutsche Gründlichkeit*. The book offers a complete photographic record of the paintings scaled to half their actual size. In order to realise this, in cooperation with the Cologne Institute of Conservation Sciences at Cologne University of Applied Sciences, a combination of 3D laser scanning and extremely high-resolution digital photography was employed. A wide variety of digital apparatus, cameras and lighting setups were used in order to record all the aspects of the images in their entirety. The aim of the book is primarily to reproduce the rock art in the 'Cave of Beasts' as closely as possible to what is viewed by the naked eye. As such, it is only the initial step in the scientific study of the Wadi Sura rock art: processing of the photos by applying colour-enhancing software (DStretch in particular), that will make scenes and details better visible, will be part of a following volume. This second volume will also include a comprehensive catalogue and description of all the pictures, their statistical analysis and chronological classification, as well as attempts at clarifying the meaning and underlying motivation of this art. It is to be hoped that this coming volume, or a subsequent one, will also contain detailed drawings of (some of) the panels, such as presented in the comprehensive catalogue publications, by the same research unit, on the Brandberg in Namibia. This would, of course, greatly facilitate the use of the Wadi Sura rock art imagery in comparative and interpretative studies.

As Rudolph Kuper writes in his foreword to the book, one of its principal aims is 'to provide a safe

foundation for possible informed interpretations, instead of constructing hypotheses on the basis of arbitrarily selected motifs or scenes'. This 'safe foundation' is the photographic catalogue (Part II of the book, pp. 80–537), but it is preceded by a number of short thematic essays (Part I, pp. 10–79) that are equally crucial for understanding what this rock art is about and what the well thought-out research and conservation strategies of the Cologne team are. There is far too much, and varied, information in this part of the book to discuss it in great detail and I simply list here in brief the treated themes: history of Libyan Desert exploration (by R. Kuper), regional rock art context (by A. Zboray), myths and messages in the rock art (by F. Förster and R. Kuper), Cologne Wadi Sura project (by R. Kuper), archaeological survey (by H. Riemer and F. Bartz), dating of the rock art (by H. Riemer), approaches to rock art recording (by H. Leisen et al.), computer-aided rock art recording and analysis (by F. Förster), rock art locations (by H. Riemer), paints and pigments (by S. Krause et al.), conservation (by H. Leisen and S. Krause), impact of desert tourism (by R. Kuper), and environmental setting (by F. Darius).

Already in this first volume on Wadi Sura, I am especially pleased to read that Frank Förster and Rudolph Kuper, in their chapter on myths and messages in the rock art, and in just four pages, adequately deal with those colleagues who, apparently unhampered by a profound knowledge of early Egyptian iconography, have claimed (also recently in this journal, incidentally; Caldwell 2013) that the eastern Sahara in general and the Gilf Kebir region in particular would be the birthplace of ancient Egyptian mythology, symbolism and even civilisation throughout. Such a notion bluntly ignores, as Förster and Kuper write, 'the general conviction among Egyptologists that a complex structure like the Pharaonic civilization can hardly be deduced from one region only'. Which regions contributed to the establishment of the ancient Egyptian (Predynastic and Pharaonic) mythological, cosmological and religious concepts remains to be determined, but it is often forgotten or ignored that there may also have been an ancient and indigenous Nilotic component, in particular the local Epipalaeolithic cultures of the early and middle Holocene, which may have been much more substantial and complex than the severely biased archaeological record from that period seems to indicate. If only for climatic reasons (the desiccation of the Egyptian Sahara from c. 5300 cal BCE onwards causing human migration to the east), it is beyond doubt that 'desert cultures' must have contributed directly or indirectly to the rise of civilisation in the Nile Valley, but these contributions may have been more material than spiritual in nature. Could it be that the true trigger of civilisation in the Nile Valley was the creation, from the late 5th or the early part of the 4th millennium BCE onwards, of a new mythology connected to a formalised religion, in which, for logical and opportunistic reasons, the Nilotic environment came to play a primordial role, and in which the ancient and obsolete 'desert religious beliefs' quickly faded into the background? As Förster and Kuper correctly note, 'there is little among the visual representations and concepts of Predynastic and Early Dynastic times (c. 4000–2600 BCE) that can be compared with the Wadi Sura imagery'. As a matter of fact, to the best of my knowledge, there is nothing whatsoever in the overwhelmingly rich Predynastic rock art and other iconography of the 4th millennium BCE, known from many hundreds of sites and thousands of decorated objects, that is even vaguely reminiscent of the Wadi Sura imagery. 'Mythologically' speaking, the rock art of Gilf Kebir and that of the Nile Valley and its neighbouring desert areas (including the intervening oases of the Libyan Desert) are clearly worlds apart.

Now that this matter has been dealt with, we can focus on what Wadi Sura really is: a grandiose testimony to a unique and obviously extremely complex pre-Historic civilisation. But what kind of civilisation was this? Could it possibly be defined by its rock art? Among the total of individual figures that have been entered into the relational database thus far, about one quarter of the estimated total number of drawings, human figures abound (almost 60 %). Representations of animals are much less frequent (8 %) and consist almost exclusively of wild animals, such as 'ostriches', 'giraffes' and 'gazelles' or 'antelopes'. Not a single representation of a 'cow' could be securely identified and there are only very few representations of 'dogs' (not more than four), which are currently the one possible indication of the presence of domesticated species. In the light of this, and as the human figures are often provided with bows and arrows, the authors propose that the artwork was created by a society of hunter-gatherers rather than by pastoralists. This proposal, taken on its own, is an unwarranted deduction as examples are known of civilisations (we will mention one below, in fact) displaying a complete contrast between their symbolic focus and their ways of subsistence. However, in the particular case of Wadi Sura, the abundant circumstantial archaeological evidence seems to corroborate the attribution of the rock art to a pre-pastoralist occupation phase of the Gilf Kebir. Heiko Riemer, in his chapter on dating, convincingly lists the arguments for correlating the Wadi Sura rock art with the time period of the so-called 'Gilf B' archaeological phase (c. 6500–4400 cal BCE). Indeed, the overwhelming majority of the diagnostic archaeological material (mainly Khartoum-style pottery in this case) found in the immediate vicinity of the rock art sites can be ascribed to this time frame. Sites in the area belonging to the subsequent Gilf C phase (c. 4400–3500 cal BCE) are only very few (and apparently short-term occupations). Also, the preceding (aceramic) Gilf A phase (c. 8500–6500 cal BCE) is in evidence at only a few sites. Thus, according to Riemer, there is ample evidence to conclude that the Gilf B phase represents not only the climax of the pre-Historic occupation at Wadi Sura, but also the apogee of the rock art, i.e. the

'Wadi Sura style' with its thousands of images. Whereas it should be properly emphasised that this attribution necessarily remains a hypothesis, it is clear that it best fits the data currently at hand.

The Wadi Sura rock art with its headless beasts and 'swimmers' is absolutely unique in the entire Sahara. The intricate scenes showing large numbers of small human figures surrounding, and occasionally touching, the mysterious monstrous creatures finds no parallels elsewhere in north Africa. Nevertheless, similar pre-Historic art is not completely unknown and, browsing through the volume, I have been impressed with the likeness of this imagery to the artwork of another famous pre-Historic civilisation, the early Neolithic culture of Çatalhöyük in central Anatolia. Roughly comparable in age to Wadi Sura, the intricate wall paintings from Çatalhöyük (c. 7400–6000 cal BCE) show equally complex scenes featuring humans and beasts. In this case, however, the beasts are not the imaginary headless monsters of Wadi Sura, but real wild animals like 'bulls', 'wild boar' and 'deer'. Like the headless beasts in Wadi Sura, they are represented at a much larger scale in relation to the smaller human figures surrounding them. The latter figures, sometimes also provided with bows, are touching the animals and seem to be arousing, teasing or annoying them in the course of what may be festive or ritual activities, quite possibly initiation ceremonies. The visual resemblance of the Çatalhöyük wall paintings, an exception in their own right as their narrative character remains unparalleled in Anatolia and the Middle East (Hodder 2006: 16), to the Wadi Sura compositions is striking. How can it be explained that two fundamentally different civilisations, mobile hunter-gatherers in Wadi Sura and city-dwelling farmers and cattle-breeders at Çatalhöyük, geographically spaced too widely apart to make any direct connection thinkable, produce sophisticated artwork (far too complex to be declared simply an archetype, I would think) that is so amazingly similar? Honestly, it is beyond my comprehension, but at the very least it can be said is that these works of art seem to relate to a closely comparable mythology and/or a very similar spiritual ethos.

It would be quite unfair, from this point forward, to assess future rock art publications in the light of *Wadi Sura – The Cave of Beasts*. The incredible financial and logistical means — quite justified — put at the disposal of the Cologne team by the Deutsche Forschungsgemeinschaft (as well as some private foundations and sponsors) will not be available everywhere and to everyone. Any publication on a rock art site will always be better than no publication at all, but the current volume is definitely one of the best ever. Any rock art library that does not have *Wadi Sura – The Cave of Beasts* on the shelves is simply not worthy of the name. Together with the volumes that still have to appear, it can be anticipated, the current publication sets new standards for north African rock art research and beyond.

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RECENT ROCK ART JOURNALS

International Newsletter of Rock Art. Newsletter of the Association pour Rayonnement de l'Art Pariétal Européen (ARAPE). Edited by JEAN CLOTTES. Bilingual newsletter (French and English). Recent issues include these research articles:

Number 67 (2013):
BEDNARIK, R. G.: Proboscidean petroglyphs in the USA.
CLOTTES, J.: Two petroglyphs of proboscideans at Upper Sand Island, Bluff, Utah (USA).
EISENBERG-DEGEN, D.: Concluding the Har Michia rock art survey.
BEDNARIK, R. G.: History's largest confrontation over rock art protection.
CLOTTES, J. and M. DUBEY-PATHAK: Two ritually destroyed art shelters in central India.

Volume 68 (2014):
ROMÁN RAMOS, I.: Rock art on the south-east coast of Guerrero, Mexico.
RAINSBURY, M. P. and J. SCHMIECHEN: A dotted macropod painting on the Drysdale River, Kimberley, Western Australia.
FIGUEIREDO, S. S., L. NOBRE, R. GASPAR et al.: Foz do Medal terrace — an open-air settlement with Palaeolithic portable art.
MATHPAL, Y.: Megaliths in the higher Himalayas.
OTTE, M.: Plastic art codes at Qurta (Upper Egypt) and trans-Mediterranean analogies.

SIARB Boletín. Journal of the Sociadad de Investigación del Arte Rupestre de Bolivia (SIARB). Edited by MATTHIAS STRECKER. The most recent issues include the following papers:

Volume 27 (2013):
FRANKLIN, N.: Novedades, de arte rupestre de Australia: perspectivas de las investigaciones recientes, administración y conservación.

TABOADA, F., C. RIVERA, P. LIMA, M. STRECKER and M. L. SOUX: El proyecto del arte rupestre de Peñas, Prov. Los Andes, Depto. de La Paz.
CORDERO, R., M. STRECKER, M. DE LOS ÁNGELES M. and M. L. CHOQUE: El arte rupestre de Chaupisuyo (Municipio Morochata, Depto. de Cochabamba).
FAUCONNIER, F.: Los grabados de La Pintada (depot. De Chuquisaca, Proyecto Río San Juan del Oro).
ARENAS, M. A.: Significantes repestres colonials del sitio Toro Muerto (Chile).

Sahara. International journal of pre-History and History of the Sahara, with a strong emphasis on the region's rock art. Edited by D. CALATI, G. NEGRO, A. RAVENNA and R. SIMONIS. The most recent issue includes these articles:

Volume 24 (2013):
REIMER, H., F. BARTZ and S. KRAUSE: New rock art sites in the Gif Kebir, SW Egypt. A review of recent results from the Wadi Sura survey 2009–2011.
BUHAGAR, S. and T. ARGANT: L'art rupestre du sud-est libyen) region de Kufra).
IKRAM, S.: A possible panel of arachnids in Kharga Oasis (Egypt's Western Desert).
POLKOWSKI, P., W. KUCIEWICZ, E. JARONI and M. KOBUSIEWICZ: Rock art research in the Dakleh Oasis, Western Desert (Egypt).
BRAVIN, A.: Nuove figure antropomorfe del Jebel Rat, Alto Atlante (Marocco),
BERNEZAT, J.-L.: L'art rupestre de la Téfedest, une des richesses de Parc National de l'Ahaggar (Algérie).
CAMBIERI, F. and L. DE COLA: WW71, the 'gallant shelter' of Jebel Uweinat.
ROSSI, P. P.: Un sito di pitture rupestri sul versante sud-occidentale del gruppo montuoso di Terkei (Ennedi, Ciad).
D'HUY, J.: Proposition d'identification des 'singes affrontes' dans l'oued Mathendus.
JACQUET, G.: Contes d'arts rupestres en Ennedi. Nouveaux sites de Kadarala (plateau Erdébé).
HONORÉ, N.: Tissoukaï, campement néolithique du Tassili-n-Ajjer (Algérie).
EWAGUE, A., A. MOUMANE and A. LACHHEB: Un nouveau site rupestre du Draa-Bani: Tizi n'Mgarbiya.
ZBORAY, A. and M. BORDA: New finds and observations made during a recent visit to Jebel Uweinat (northwest Sudan).
MENARDI NOGUERA, A.: Ibex, camels and mounted warriors from Jebel Galala el Qibliya (Egypt).
HALLIER, U. W. and B. C. HALLIER: L'habitat aqualithique de l'homme épipaléolithique-néolithique du Sahara.
HONORÉ, N., S. SEARIGHT-MARTINET, F. SOLEILHAVOUP and F. SOLEILHAVOUP: Wa-n-Kalia: and exceptional engraved site in the Aramat massif (north-west Fezzan, Libya).
WOLFF, R. and L. DE COLA: Les gravures rupestres de djebel Ben Ghnema (Sud libyen): une relecture.
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SUKOVA, L.: The 'Venus' of Jebel Uweinat (SE Libya).
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ACHRATI, A.: The relationship between the Iheren-Tahilahi/Wa-n-Amil art and the Algerian Saharan Atlas. The significance of Garet al-Khalwa.
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RECENT BOOKS OF INTEREST

Rock art sites of the Minusinsk basin, edited by SAPAR. 2012. Occasional SAPAR Publications 10, Siberian Association of Prehistoric Art Researchers. In Russian with English summaries, contains four papers, numerous monochrome and colour plates, 112 pages, softcover, ISBN 978-5-202-01141-2.

Изобразительные и технологические традиции в искусстве северной и центральной азии, edited by O. S. SOVETOVA and G. G. KOROL. 2012. Occasional SAPAR Publications 9, Siberian Association of Prehistoric Art Researchers, Moscow and Kemerovo. In Russian, containing ten papers, monochrome illustrations, 288 pages, hardcover, ISBN 978-5-202-01-038-5.

The psychology of human behaviour, edited by ROBERT G. BEDNARIK. 2013. Nova Science Publishers, Inc., New York, contains contributions by R. G. Bednarik, P. A. Helvenston, R. A. Dielenberg, D. Hodgson, B. Watson, A. Craig, E. Blumgart and Y. Tran; 276 pages, hardcover, ISBN 978-1-62257-901-3.

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Art mobilier inédit du gisement de Bourrouilla à Arancou (Pyrénées-Atlantiques, France): données technostylistiques et chrono-culturelles, by L. AURIÈRE, F.-x. CHAUVIÈRE, F. PLASSARD, C. FRITZ and M. DACHARY. 2013. *Paleo*, Volume 24, pp. 195–218.

Brain disorder and rock art, by ROBERT G. BEDNARIK. 2013. *Cambridge Archaeological Journal*, Volume 23, Number 1, pp. 69–81.

Of particular interest to rock art researchers is the substantial Special Issue entitled 'World rock art' in the open access journal *Arts*, at *http://www.mdpi.com/journal/arts/special_issues/world_rock_art*, edited by R. G. BEDNARIK. The following articles have so far been published:

Pleistocene palaeoart of Africa, by ROBERT G. BEDNARIK, at *http://www.mdpi.com/2076-0752/2/1/6*

Morocco's rock art: age and meaning, by SUSAN SEARIGHT, at *http://www.mdpi.com/2076-0752/2/1/35*

Pleistocene palaeoart of Asia, by ROBERT G. BEDNARIK, at *http://www.mdpi.com/2076-0752/2/2/46*

Rock art of the Howz-Māhy region in central Iran, by EBRAHIM KARIMI MOBARAKABADI, at *http://www.mdpi.com/2076-0752/2/3/124*

Architectural history and painting art at Ajanta: some salient features, by MANAGER SINGH and BABASAHEB RAMRAO ARBAD, at *http://www.mdpi.com/2076-0752/2/3/134*

Late Pleistocene and Early Holocene rock art from the Mongolian Altai: the material and its cultural implications, by ESTHER JACOBSON-TEPFER, at *http://www.mdpi.com/2076-0752/2/3/151*

No reprieve for Tasmanian rock art, by PETER C. SIMS, at *http://www.mdpi.com/2076-0752/2/4/182*

Chronological trends in Negev rock art: the Har Michia petroglyphs as a test case, by DAVIDA EISENBERG-DEGEN and STEVEN A. ROSEN, at *http://www.mdpi.com/2076-0752/2/4/225*

The cave of Isturitz (west Pyrenees, France): one century of research in Paleolithic parietal art, by DIEGOGARATE,AUDELABARGE,OLIVIA RIVERO, CHRISTIAN NORMAND and JOËLLE DARRICAU, at *http://www.mdpi.com/2076-0752/2/4/253*

The case for hand stencils and prints as proprio-performative, by PATRICIA DOBREZ, at *http://www.mdpi.com/2076-0752/2/4/273*

Rock art in Kurdistan Iran, by JAMAL LAHAFIAN, at *http://www.mdpi.com/2076-0752/2/4/328*

Saharan rock art: local dynamics and wider perspectives, by MARINA GALLINARO, at *http://www.mdpi.com/2076-0752/2/4/350*

The perception of depicted motion, by LIVIO DOBREZ, at *http://www.mdpi.com/2076-0752/2/4/383*

Rock art of Saudi Arabia, by MAJEED KHAN, at *http://www.mdpi.com/2076-0752/2/4/447*

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Amerindian cosmologies and European prehistoric cave art: reasons for and usefulness of a comparison, by ENRICO COMBA, at *http://www.mdpi.com/2076-0752/3/1/1*

Archaeological investigations at a Wisconsin petroglyph site, by JACK STEINBRING, at *http://www.mdpi.com/2076-0752/3/1/27*

Dating petroglyphs from Fugoppe Cave, Japan, by MASARU OGAWA, at *http://www.mdpi.com/2076-0752/3/1/46*

Rock art research in Southeast Asia: a synthesis, by NOEL HIDALGO TAN, at *http://www.mdpi.com/2076-0752/3/1/73*

... and many more!

ORIENTATION

US$2.3 million: the largest fine in Chilean history for damage to the archaeological heritage

By PATRICIO BUSTAMANTE DÍAZ

Environmental Qualification Resolution No. 038 (RCA 2004) imposed on Minera Los Pelambres precise requirements to approve the construction of a 3600 million tonnes toxic tailings dam in El Mauro, IV Region, Chile. The El Mauro dam is one of the biggest of its kind in the world. Over 500 rock art panels with 2000 petroglyphs and 148 archaeological sites were found in the area, to be buried under the min-ing waste tailings (Bustamante 2007, 2012a).

The company was required to build in nearby Monte Aranda a rock art park, showrooms and warehouses to keep the archaeological material and petroglyphs found at El Mauro. The company agreed to build the required infrastructure prior to the intervention at the archaeological sites, to ensure the proper handling and safekeeping of the material. Chilean law also requires archaeological research to be done to retrieve all possible data from an area, to increase scientific understanding of ancient indigenous cultures who inhabited the area.

On 7 February 2014, the Superintendence of the Environment (SMA 2014) established that ten years after the removal of the archaeological material, the mining company had not complied with any of the regulatory requirements it had agreed upon to attain the governmental permits to build the dam, infringing Chilean law.

SMA investigators found that archaeologists had stored the excavated archaeological material at their own homes due to lack of warehouses and that petroglyphs removed from the area remained stored at inadequate facilities until 2013, as the agreed upon infrastructure at Monte Aranda was non-existent. They also determined that the mining company never delivered the final report on the El Mauro archaeological sites, as required by law. Investigators established that there are no photographs or plans with archaeological finds and petroglyph locations. Of 148 archaeological sites, Minera Los Pelambres was only able to present incomplete information on 40 sites. The faulty procedures employed at El Mauro may imply significant data loss (Bustamante 2012b).

The Comptroller General of the Republic has initiated proceedings at the Council of Monuments, which is

Figure 1. *Map of El Monte Mauro and Aranda.*

the governmental agency that oversees regulations on archaeological sites, to determine administrative responsibilities by its officials. The Comptroller has established that, contrary to declarations by Council of Monuments' personnel to Congress, the Ministry of Education and the SMA, the final report required by law was never delivered by Minera Los Pelambres.

Local prosecutors at the Los Vilos Court have dismissed complaints by the SMA and the community about heritage damage by the Mining Company or possible antiquities trafficking. Chilean law requires a court order for police to begin investigations on these matters, so they remain unresolved. In the ensuing legal battle between the mining company and complainants, the La Serena Appeals Court has overturned rulings by the Los Vilos court against complainants.

Furthermore, the Chilean Society of Archaeology has consistently refused to investigate complaints.

The SMA findings prove the allegations by the community are real. The company infringed Chilean law and damaged El Mauro's archaeological heritage. Government agencies and archaeologists failed in their duty to protect it. The US$2.3 million fine is the largest of its kind in Chilean history, but the damage is done and is irreparable. It is expected the company will appeal to lower the fine's amount.

The 'rock art park' that the Minera Los Pelambres is currently building with a 10-year delay in Monte Aranda will be forever a monument to the folly of destroying ancient, 7000-years-old sites, to build a gigantic toxic dump that has been deemed unsafe by the Supreme Court ruling on 6 April 2013 that its currently being appealed by Los Pelambres.

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RAR 31-1145

Saudi Arabian sites proposed for World Heritage listing

By R. G. BEDNARIK

Like most countries in the world, Saudi Arabia does not have a rock art property on the UNESCO World Heritage List, yet it is one of the rock art-richest countries. But in early 2014, the Saudi Commission for Tourism and Antiquities submitted two of the most outstanding rock art complexes for inclusion on the List, those of Jabal Umm Sinman at Jubbah and of Jabal al-Manjor / Jabal al-Raat near Shuwaymis. Both monuments are in the Hail region. The nomination was prepared by Majeed Khan and Robert G. Bednarik, building on their work in the region for over one decade (Bednarik and Khan 2002, 2005).

Both properties comprise large numbers of petroglyphs representing numerous periods of almost the entire Holocene. The most outstanding component is the Neolithic tradition, epitomised especially well at the Shuwaymis sites, which were re-discovered only in 2001. These site complexes exemplify the most extensive and the most finely made corpus of Neolithic petroglyphs anywhere in the world, numbering many thousands of motifs. Prior to 6000 years ago the sites were near palaeo-lakes whose favourable environment supported flourishing cultural traditions. The subsequent rock art phases, many of which are now dated, document the region's gradual desertification.

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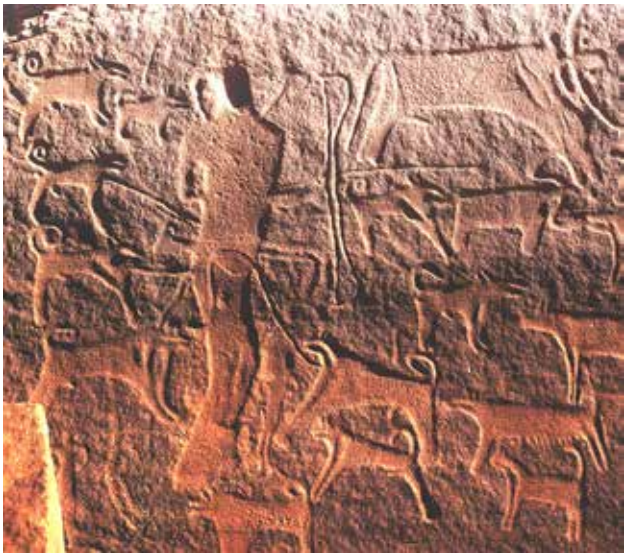

Neolithic petroglyphs at Jabal al-Raat, Saudi Arabia.