

# ALMOGAREN

44-45/2013-2014



 **IC**  
INSTITUTUM CANARIUM

 **ICDIGITAL**

Separata 44-45/2



Eine PDF-Serie des Institutum Canarium  
herausgegeben von  
Hans-Joachim Ulbrich

Technische Hinweise für den Leser:

Die vorliegende Datei ist die digitale Version eines im Jahrbuch "Almogaren" gedruckten Aufsatzes. Aus technischen Gründen konnte – nur bei Aufsätzen vor 1990 – der originale Zeilenfall nicht beibehalten werden. Das bedeutet, dass Zeilennummern hier nicht unbedingt jenen im Original entsprechen. Nach wie vor unverändert ist jedoch der Text pro Seite, so dass Zitate von Textstellen in der gedruckten wie in der digitalen Version identisch sind, d.h. gleiche Seitenzahlen (Paginierung) aufweisen. Der im Aufsatzkopf erwähnte Erscheinungsort kann vom Sitz der Gesellschaft abweichen, wenn die Publikation nicht im Selbstverlag erschienen ist (z.B. Vereinssitz = Hallein, Verlagsort = Graz wie bei Almogaren III). Die deutsche Rechtschreibung wurde – mit Ausnahme von Literaturzitaten – den aktuellen Regeln angepasst. Englischsprachige Keywords wurden zum Teil nachträglich ergänzt. PDF-Dokumente des IC lassen sich mit dem kostenlosen Adobe Acrobat Reader (Version 7.0 oder höher) lesen.

Für den Inhalt der Aufsätze sind allein die Autoren verantwortlich.  
Dunkelrot gefärbter Text kennzeichnet spätere Einfügungen der Redaktion.

Alle Vervielfältigungs- und Medien-Rechte dieses Beitrags liegen beim  
Institutum Canarium  
Hauslabgasse 31/6  
A-1050 Wien

IC-Separatas werden für den privaten bzw. wissenschaftlichen Bereich kostenlos zur Verfügung gestellt. Digitale oder gedruckte Kopien von diesen PDFs herzustellen und gegen Gebühr zu verbreiten, ist jedoch strengstens untersagt und bedeutet eine schwerwiegende Verletzung der Urheberrechte.

Weitere Informationen und Kontaktmöglichkeiten:  
[institutum-canarium.org](http://institutum-canarium.org)  
[almogaren.org](http://almogaren.org)

Abbildung Titelseite: Original-Umschlag des gedruckten Jahrbuches.

# Inhaltsverzeichnis

(der kompletten Print-Version)

Carmen Díaz Alayón & Francisco Javier Castillo: Estudio de la lista de voces prehispánicas de Juan Bautista Lorenzo Rodríguez .....	7
● <b>Robert G. Bednarik:</b> <b>Archaeology and rock art science</b> .....	57
Hans-Joachim Ulbrich: Bibliographie der Ilhas Selvagens (Portugal) – Addenda II .....	73
Rudolf Franz Ertl: Neue Donaureiter-Bleivotivtafeln entdeckt .....	99
Arnaud F. Lambert: Megaliths and the Early Mezcala Urban Tradition of Mexico .....	135
Xavier Li Tah Lee Lee: Canarias: destino didáctico de la expedición de Martin Rikli y Carl Schröter .....	147
Alain Rodrigue: The rock engravings of Tighremt n'Ouazdidene (High Atlas, Morocco) .....	167
Andoni Sáenz de Buruaga: Grabados rupestres de hachas de "tipo Metgourine" en el entorno artístico de Lejuad (Tiris, Sahara Occidental) .....	173
Marcos Sarmiento Pérez: La estancia de Nikolay Nikolajevitsch Mikloucho-Maclay en Lanzarote en 1866-67 .....	203
Franz Trost: Der Nil als Grenze zweier Landmassen .....	223
Hans-Joachim Ulbrich: Die kanarischen Ureinwohner in der Cosmographia (1544) des Sebastian Münster .....	249
Hartwig-E. Steiner: Zeichen des Vogelmann-Kultes der Osterinsel in den Höhlen auf Motu Nui / Polynesien .....	269

**Zitieren Sie bitte diesen Aufsatz folgendermaßen / Please cite this article as follows:**

Bednarik, Robert G. (2014): Archaeology and rock art science.- Almogaren 44-45 / 2013-2014 (Institutum Canarium), Wien, 57-72

Robert G. Bednarik

## **Archaeology and rock art science**

Keywords: Rock art research, archaeology, epistemology, interpretation, motif identification, dating, vandalism, neuroscience

### Abstract:

This critical review of the relationship between the scientific study of rock art and mainstream archaeology considers the epistemological and procedural limitations of the latter discipline and defines its limited relevance to the former field. It particularly focuses on the archaeological practice of interpreting the meaning of rock art and then applying such opinions to other aspects, such as the age estimation of rock art. The basis of rock art interpretation is examined and found to be neuroscientifically unsound and logically faulty.

### Zusammenfassung:

Diese kritische Überprüfung der Beziehung zwischen der wissenschaftlichen Studie von Felsbildern und Mainstream-Archäologie erwägt die erkenntnistheoretischen und verfahrensrechtlichen Einschränkungen der letzteren Disziplin und definiert ihre begrenzte Relevanz für den ersteren Bereich. Sie konzentriert sich insbesondere auf die archäologische Praxis der Interpretation der Bedeutung von Felsbildern und die Anwendung solcher Stellungnahmen für andere Aspekte, wie die Alters-Schätzung der Felsmalereien. Die Basis von Felskunst-Interpretation wird untersucht und es wird festgestellt, dass sie neurowissenschaftlich unsolide und logisch fehlerhaft ist.

### Résumé:

Cette revue critique de la relation entre l'étude scientifique de l'art rupestre et l'archéologie traditionnelle considère les limites épistémologiques et de procédure de cette dernière discipline et définit sa pertinence limitée pour l'ancien champ. Il se concentre en particulier sur la pratique de l'archéologie de l'interprétation du sens de l'art rupestre, puis à appliquer ces opinions pour d'autres aspects, tels que l'estimation de l'âge de l'art rupestre. L'interprétation de l'art rupestre est examinée et jugée malsaine neuroscientifique et logiquement défectueux.

### Resumen:

Esta revisión crítica de la relación entre el estudio científico del arte rupestre y la arqueología convencional considera las limitaciones epistemológicas y de procedimiento de esta última disciplina y define su relevancia limitada al campo anterior. En particular, se centra en la práctica arqueológica de interpretar el significado del arte rupestre y luego aplicar esas opiniones a otros aspectos, tales como la estimación de la edad de arte rupestre. La base de la interpretación del arte rupestre es examinado y se encontró que neurocientífica erróneo y defectuoso lógicamente.

## Introduction

The scientific study of rock art straddles many disciplines, among them forensic science, semiotics, neurosciences, cognitive sciences, ethnography, art history, various sub-disciplines of geology, conservation science, anthropology and archaeology. They address a great variety of aspects of rock art by a multitude of methods, resulting in many propositions, some of which are testable and thus scientific, and some of which are not. In its involvement with rock art, archaeology has traditionally focused on interpretation and recording, often recording by interpreting, and on endeavours to integrate rock art into archaeological narratives and chronologies. Here, the usefulness of these archaeological approaches or methods in contributing to the scientific study of rock art is considered.

A principal method of archaeology is excavation, and over the course of more than a century, many thousands of rock art sites have been excavated. In such cases it was hoped to either find rock art beneath the sediment, or to find exfoliated fragments of rock art in the strata below the art. In the first case this would provide a minimum antiquity for the rock art, in the second an approximate date for the exfoliation event, if the age of the corresponding sediment layer could be ascertained. However, this approach has only ever been successful in very few cases globally (Daleau 1896; Lalanne & Breuil 1911; Capitan et al. 1912; Lemozi 1920; Hale & Tindale 1930; David 1934; Passemard 1944; Ampoulange & Pintaud 1955; Mensan et al. 2012; Mulvaney 1969: 176; de Saint Mathurin 1975; Anati 1976a: 34, 41; Thackeray et al. 1981; Rosenfeld et al. 1981; Cannon & Ricks 1986; Steinbring et al. 1987; Bednarik 1989; Crivelli et al. 1996; Roberts et al. 1998; Pessis 1999; Bednarik et al. 2005). In all except one of these instances, petroglyphs rather than rock paintings were involved. But in the process of this mostly futile pursuit involving thousands of other sites, the chance of securing *actual* ages of petroglyphs rather than *minimum* ages was often literally destroyed. Many percussion petroglyph sites contain in their sediments the hammerstones that were used in the creation of the rock art, and their stratified location indicates the time petroglyphs were made at the site.

An example of these missed opportunities are the over one hundred excavations in the Côa valley of northern Portugal, where not a single submerged pre-Historic petroglyph was found, yet the stone tools used in the production of the rock art were discarded because the archaeologists had not been trained in recognising them (Swartz 1997; Bednarik 2004). The most important archaeological component of any sediment near a petroglyph panel are the stone hammers used in the production of the petroglyphs (Figure 1),

because their stratigraphical position is likely to tell us roughly at what time petroglyphs were made at the site (Bednarik 1998a). And yet, worldwide there are only very few reports of archaeologists finding and recognising these tools (Edwards 1964: 650; Wilman 1968; Anati 1976a: 41, 1976b: 28, 1981: 14–15, 1994: Fig. 40; Kearns et al. 1975: 325; Ives 1986; Wallace & Holmlund 1986: 26; Moore 1992; Arcà 1995: Fig. 112; Bednarik 1998a, 2001: 39–41; Bednarik et al. 2005). The thousands of other such deposits excavated, usually in the hope of exposing rock art below ground in order to determine mere *minimum* dates for the art, were essentially misguided and counterproductive: in the vain quest to date the rock art the evidence that would have provided *secure* dating was destroyed or discarded.



Figure 1. Hammerstones used in the production of petroglyphs at Toro Muer-to, Bolivia.

This is one indication of the damage archaeological research has done to the scientific study of rock art, of which many other examples can be cited. For instance in the recording of rock art, the research potential of countless sites around the planet has been compromised by inappropriate recording methods (see e.g. critiques in Bock 1981; Leen 1981; Bednarik 1987, 1990; Genge 1990; Chaffee et al. 1993: 71; Bednarik & Devlet 1993; Francis et al. 1993; Bahn et al. 1995; Löfvendahl & Magnusson 2000; Loendorf 2001). Similarly, innumerable rock art sites were excavated without protecting the rock art panels above the sediment, which in the process suffered from dust and human contact (Morwood 1994). An academically more pernicious problem is that so many archaeologically inspired but untestable claims about the meaning of rock art have become so deeply entrenched in the archaeo-lore disseminated by the discipline that it seems impossible to correct them. It is therefore essential to consider the usefulness of archaeology's involvement in exploring rock art.

## Epistemological issues in archaeology

Essentially, there are only two viable connections between rock art and archaeology. One is that both relate to the distant human past – although much archaeology no longer does, it relates to recent history or present. Secondly, rock art can only be integrated into archaeological narratives if its age is known. Without that common denominator *time*, the two entities lack a legitimate connection. This is because without it, rock art cannot be slotted into the chronology and narrative of archaeology. Unfortunately, there is very limited scientific information available about the age of any rock art, while there is a profusion of false claims in the literature. For instance numerous archaeologists claim that rock art of recent centuries is of the Pleistocene (for examples of corrections see Bednarik 1994a, 1995a, 1995b, 1998b, 2002, 2005, 2006a, 2009a, 2009b; Bednarik & Devlet 1993; Watchman 1995, 1996), just as there have been claims, in the past, that Pleistocene rock art is either modern or fake (consider Altamira). With the exception of the minimum age claims derived from the few instances of excavated rock art (as noted above), all others offered by archaeology derive from stylistic contentions and catenulate reasoning that lacks a sound epistemology. To complicate matters further, in inventing a taxonomy of pre-Historic cultures archaeology has not used cultural data, such as palaeoart, but has chosen purported technological variables. This applies particularly to the Pleistocene, where combinations of tools, especially stone tools, have been used to define 'cultures'. Yet tools obviously do not differentiate cultures; cultural variables do. Moreover, even these tool types are not real entities, they are etic, 'institutional facts' (Searle 1995); they are invented mental templates of specialists. In other words, archaeology applies made-up classes to collectively designate technocomplexes, then uses these to invent cultures, which in turn are attributed to equally invented groups of people, be they nations, tribes, ethnic groups or language groups. This is an indication of the depth of the problem: by relegating rock art to subsidiary roles in establishing a cultural history of hominins, conventional archaeology has invented a human past that should be expected to be in many ways false.

When it is considered that minimum dating of rock art by archaeological excavation has only been possible in about twenty cases globally since the late 19th century, and that it is in any case of limited utility in establishing true antiquity, it becomes necessary to examine the value of archaeology to rock art research. In particular the damage archaeology has inflicted on world rock art needs to be considered. There are countless cases of the involvement of archaeological consultants in the deliberate destruction of rock art and other cultural sites, such as stone arrangements. This has occurred in all continents



except Antarctica. Outstanding examples can be cited from Portugal, where whole valleys containing hundreds of sites were destroyed with the collaboration, acquiescence and even advancement of archaeological agencies (Bednarik 1995a, 2004; Gonçalves 1998; Arcà et al. 2001). In Chile (Bustamente 2006), Australia (Bednarik 2006b) and many other regions, archaeological consultants are generously rewarded by developers to destroy rock art and other cultural sites, sometimes on an industrial scale (Figure 2). In countries where much of the human past refers to indigenous or traditional societies, their descendents object vigorously to this cultural vandalism, but usually with little effect. Indigenous also object to the archaeological interpretation of their past, and to its usurpation by the occupying states and their archaeologists (Bednarik 2013).



Figure 2. Rock art destruction on an industrial scale: Dampier Archipelago, north-western Australia, February 2007.

The frequent clashes between the 'octopus of archaeology' (Lorblanchet 1992) and rock art science need to be viewed in this light, but the causes of these discords also need to be considered. They inevitably derive from the incommensurability between the epistemology of a non-scientific, humanistic pursuit and that of a science (Bednarik 2012a). All archaeological propositions lack internal falsifiability, which accounts for the countless false datings and interpretations of rock art. Archaeology, especially Pleistocene archaeology, has a distinctive history of rejecting heresies of its dogma, extending back to the mid-19th century, and this tendency continues today. Any scientific corrections of dominant models are vigorously resisted, even though modern archaeology could not possibly operate without the data provided by a range of sciences.

Therefore the nexus between archaeology and rock art science is characterised by unease. Archaeology needs the support of various sciences pro-

foundly (e.g. nuclear science, chemistry, palynology, sedimentology), but objects to its own interpretations of scientific evidence being critically assessed by any outsiders. It presents the profile of one of Kuhn's (1962) disciplines of 'pre-paradigmatic state'. Rock art science, which is dominated by forensic methodology, is therefore suspicious of archaeological interpretations, such as those of the meanings of rock art, its perceived styles and its claimed chronologies. In fact it perceives only one utility of archaeology: in the excavation of sediment-covered petroglyphs. Archaeology's de-facto universal theory, marked by uniformitarianism and ethnographic analogy; its arbitrary imposition of etic taxonomies; its treatment of rock art as art; its restrictive practices and its destructive methods and ethical impairments are all anathema to scientific rock art research.

### **Interpretation of rock art: an ethnography of archaeologists**

The most pervasive human reaction to rock art, irrespective of the age, ethnicity or mental conditioning of the beholder (such as academic training), is to try to figure out what it depicts and what it means. If adequate clues are spotted in a motif to invite an 'identification', it is considered to be figurative or iconographic, and it is then interpreted on the basis of such perceived diagnostics. Clearly, then, this process reflects the values, mental constructs and visual responses of the beholder rather than the producer of the rock art motif. Moreover, it is a form of circular reasoning: because one believes to detect interpretable details in an image, these details must have been placed with the intention of rendering them interpretable. The underlying notion is that the interpreter of rock art somehow 'communicates' with the 'mind' of the rock art producer.

Vision of the type used by primates derives from a complex neural system involving the eye, the optic nerve and chiasm conveying the information to the thalamus (lateral geniculate nucleus), and the primary visual cortex in the occipital lobe, from where it is disseminated through the cortical hierarchy of the visual cortex and visual association cortex. According to the two-streams hypothesis (Mishkin & Ungerleider 1982), the ventral stream, connecting to the medial temporal lobe, limbic system and dorsal stream, is involved in recognising, identifying and categorising visual information.

However, the effectiveness of this process of detecting meaningful patterns in the visual data and interpreting them is determined by the state of interconnectedness of the various brain regions involved as well as other factors, such as the degree of integration between the left prefrontal cortical areas and memory. The level and volume of prefrontal cortex activity is widely

variable among human brains and, depending on the amount of integration it facilitates, degrees of constellated psychic contents are more or less available for conscious analysis. Having evolved in a patterned world, the brain inevitably has the stamp of patterns built into its structure, and it is patterns it seeks. This can result in apophenia, the experience of seeing meaningful patterns or connections in random or meaningless data, a Type 1 error. (Archaeology, obviously, is very much preoccupied with detecting patterns in data.) Of particular relevance here is a special form of it, pareidolia, in which iconographic patterns are detected in random phenomena. It is most strongly developed in individuals whose brains are sub-optimally integrated and provide limited sophistication of their cause and effect reasoning.

In the scanning of rock art imagery by human vision, much the same neural structures as those causing pareidolia are involved. The neurophysiological limitations of rock art interpretation are somewhat different, but there are also parallels. The low connectivity between the hemispheres responsible for what neuroscientists call 'magical thinking' (association-based causal reasoning) contributes to susceptibility to pareidolia. In rock art interpretation, it is the susceptibility to autosuggestion that contributes to the conviction that the modern beholder's visual perception is capable of extracting emic meaning from pigment traces or petroglyph marks made in pre-History. This *misconception* seems to be attributable to the view that modern mentality and behaviour can be attributed to all humans since about 30 or 40 millennia ago. That error is so ingrained in orthodox archaeology that it seems almost impossible to correct, and yet it is self-evident that practically all rock art was created by non-literate people. They most certainly had no 'modern minds' (Bednarik 2012b). Helvenston (2013) has masterly explained that the brains of literates and of people with oral-aural traditions are very differently organised and connected. Those of non-literates operate largely through magical thinking, whereas the operation by cause and effect reasoning is acquired ontologically. Therefore the most reliable modern interpreters of rock art should be infants, followed by illiterates. The least qualified are modern academic sophisticates, especially archaeologists. And yet it is the latter who keep telling us what rock arts mean (Chippindale 2001).

In the history of rock art research there has only been one blind test of an academic's determinations of what had been depicted in rock art. But he was much better qualified than archaeologists to present these; he was a distinguished professor of anatomy. Macintosh (1977) had become aware that the makers of a large Australian painting site of biomorphs he had twenty years previously recorded were still alive, so he asked them to identify each motif at

the site he had earlier 'identified'. He found that about 90% of his expert interpretations had been false. Thus Macintosh demonstrated that his intimate understanding of anatomy was no help in establishing the correct identities of a large series of human and other animal images. Since then, the Australian rock art researchers have universally adopted the convention of placing all rock art motif determinations in quotation marks to indicate that they are merely fictional names. This has not yet been understood by many of those working elsewhere, which is unfortunate when one considers that it is only in Australia that substantial and comprehensive ethnographic and emic meanings of rock art are readily available. This wealth of reliable information about rock art interpretation has shown in countless examples that the perception of cultural aliens is not capable of interpreting any rock art reliably.

Elsewhere archaeologists continue the practice of telling everyone else what the rock art means and depicts, in the safe knowledge that their pronouncements cannot be tested, cannot be falsified, being fundamentally unscientific propositions. This has led to thousands of claims that range from the likely to the nonsensical and the absurd. Not only do these self-appointed interpreters of rock art tell us what is depicted, they even claim to know that the subject is running, falling, swimming, pregnant, praying, dead or whatever else they happen to perceive in the biomorph motifs.

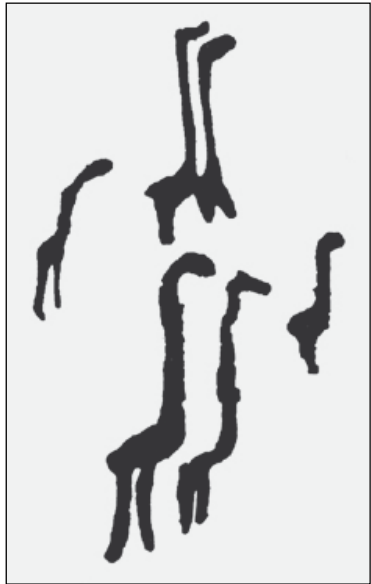


Figure 3. 'Giraffe' petroglyphs in China 'of the Tertiary'.

Some motifs in China were interpreted as depicting giraffes (Figure 3), and since this species became extinct there before the Pleistocene, the petroglyphs in question were dated to the Tertiary period. And why not, there are countless precedents where archaeologists have dated rock art through their 'identifications' of objects depicted. An Australian example of apparent giraffes in rock art (Figure 4) has been contributed only recently, but without yielding claims of giraffes in the Antipodes. The astute researcher in question, David Welch, looked into the ethnography and determined the correct interpretation of these enigmatic figures (Welch 2012). Thousands of other examples of unsubstantiated and absurd claims of this kind, ranging from zoomorphs to 'shamans' to the purported attitudes of biomorphs

could be cited in the archaeological literature. And all too often they are somehow interwoven with chronological contentions or connotations.

Provided that all these interpretations are offered for the purpose of creating an entertaining folklore about the art, a new mythology, one could not possibly object to them. Indeed, such interpretations may even be useful to the neuroscientist, because from them s/he can learn about the perception of the person seeking to interpret the palaeoart. If the rock art interpreter speaks her/his language and is capable of analysing her/his own responses to the palaeoart (to tell, for instance, very precisely why s/he thinks an animal figure is of a dying individual), an analysable example of an ethnographic reaction to an alien art becomes available. Indeed, an ethnographic or neuroscientific examination of archaeological claims seems to hold a great deal of promise in learning why archaeologists engage in rock art interpretation. An ethnography of archaeologists is long overdue and this is where it could begin usefully. Provided archaeologists indulge in interpretation without physical interference with the rock art it is a perfectly harmless pastime, and there can be no objection to it. Rock art interpretation is highly stimulating, it has been practised for millennia, it enriches our experience and it can embellish our own art, culture



Figure 4. Australian 'giraffes'. For correct identification see Welch (2012).

and existence. It can help us create more myths about the past; we can invent our own favoured story of what happened in that past. Provided that in the process we do not belittle any other culture or inflict any damage on the rock art, there can be no objection to such quests – as long as we make no attempt of presenting them as *science*.

## Discussion

One of the many false assumptions made in archaeology is that Pleistocene hominins that created the Franco-Cantabrian cave art must have had a 'modern mind' because we can understand what they intended to convey with their imagery. Indeed, the latter assumption is the basis of interpreting this palaeoart corpus. But both assumptions are unsupported: the 'mind', whatever this word is meant to refer to, of contemporary people differs significantly from the mental processes and neural structures of humans 30,000 years ago; and the surviving body of their engravings and paintings cannot be scientifically interpreted. Apparently iconic rock art motifs are abstractions of the visual characteristics of real objects rather than faithful likenesses of them. It is then essential to decide which attributes of an image are diagnostic for its identification, and which are not. The strategy of the beholders is to scan the image for clues they think they can identify, and these are then assumed to be diagnostic in identifying what the figure depicts. Needless to say that the conventions of selecting categorising attributes are culturally and ontogenically determined, which means that there is no reason to assume that modern people share them with ancient societies.

Certain rock art traditions, such as the Upper Palaeolithic cave art or the southern African paintings attributed to the San Bushmen, are more likely than others to be confidently interpreted by modern, westernised conspecifics, but even this assumption is probably a self-deception. The appearance of graphic naturalism does not warrant the conjecture that the cognitive or perceptive strategies of the artist are shared by the modern beholder. Lack of falsifiability of these beliefs renders them unreliable and scientifically irrelevant.

It follows from these observations that in focusing on interpretation and recording of rock art, traditional archaeology has contributed little of scientific value to rock art research. These two approaches are intimately entwined, in that much recording amounts to interpretation. Even when the marks on the rocks are faithfully recorded – which is frequently not the case – any quantification of the documentation is susceptible to misinterpretation. In particular, any such record can only be of a present state of the evidence, it is not a representative sample for defining aspects of the living system that



produced the rock art in question. To generate a viable sample requires the application of taphonomic logic (Bednarik 1994b) to the documentation, otherwise whole fictional traditions of rock art can be invented. For instance if a small portion of major art traditions of the Pleistocene were executed in deep limestone caves, where it could survive, but none of the arts of these traditions survived anywhere else, precipitate interpretation would tend to view this as evidence of traditions executed exclusively in caves. Archaeology then tends to reinforce such misconceptions by basing on it catenulate construals, such as the contention that the exclusive occurrence in caves implies religious functions, which then invokes shamanistic and similar derived interpretations. From an epistemological perspective, this chain of misconstructions began with the misidentification of the 'common crucial denominator of the phenomenon category' (Bednarik 1990/91): the CCD of Franco-Cantabrian 'cave art' is probably not location; more likely it is selective survival (taphonomy).

Similar forms of reasoning can be applied to many other forms of interpretation in archaeology. The epistemological discrepancies between an unfalsifiable humanistic pursuit and the sciences are too great to expect a reconciliation between the two, just as there can be no connection between science and religion. One system of understanding is based on confirmation and faith (and the reasoning of magical thinking), the other on disconfirmation and scepticism (and on cause and effect reasoning). Archaeology and rock art science have no choice but to pursue different paths to understanding.

## References

- Ampoulange, U. & R. C. Pintaud (1955): Une nouvelle gravure de la grotte de La Grèze (Dordogne). *Bulletin de la Société Préhistorique Française* 52: 249–251.
- Anati, E. (1976a): *Evolution and style in Camunian rock art*. Archivi 6, Capo di Ponte.
- Anati, E. 1976b): *Metodi di rilevamento e di analisi dell'arte rupestre*. Studi Camuni 7, Edizione del Centro Camuni di Studi Preistorici, Capo di Ponte.
- Anati, E. (1981): *Felskunst im Negev und auf Sinai*. Gustav Lübke Verlag, Bergisch Gladbach.
- Anati, E. (1994): *Valcamonica rock art: a new history for Europe*. Studi Camuni 13, Edizione del Centro Camuni di Studi Preistorici, Capo di Ponte.
- Arcà, A. (1995): Rilevamento e documentazione. In A. Arcà et al. (eds), *Rupe Magna: la roccia incisa più grande delle Alpi*, pp. 111–117. Consorzio per il Parco delle Incisioni Rupestri di Grosio, Sondria.

- Arcà, A., R. G. Bednarik, A. Fossati, L. Jaffe & Simões de M. Abreu (2001): Damned dams again: the plight of Portuguese rock art. *Rock Art Research* 18: i–iv.
- Bahn, P. G., R. G. Bednarik & J. Steinbring (1995): The Peterborough Petroglyph Site: reflections on massive intervention in rock art. *Rock Art Research* 12: 29–41.
- Bednarik, R. G. (1987): The chalking of petroglyphs: a response. *La Pintura* 15(2+3): 12–13.
- Bednarik, R. G. (1989): On the Pleistocene settlement of South America. *Antiquity* 63: 101–211.
- Bednarik, R. G. (1990): Sobre la practica de tizar los petroglifos. *SIARB Boletín* 4: 24–26.
- Bednarik, R. G. (1990/91): Epistemology in palaeoart studies. *Origini* 15: 57–78.
- Bednarik, R. G. (1994a): Conceptual pitfalls in dating of Palaeolithic rock art. *Préhistoire Anthropologie Méditerranéennes* 3: 95–102.
- Bednarik, R. G. (1994b): A taphonomy of palaeoart. *Antiquity* 68(258): 68–74.
- Bednarik, R. G. (1995a): The Côa petroglyphs: an obituary to the stylistic dating of Palaeolithic rock-art. *Antiquity* 69: 877–883.
- Bednarik, R. G. (1995b): Refutation of stylistic constructs in Palaeolithic rock art. *Comptes Rendus de L'Académie de Sciences Paris* 321 (série IIa, No. 9): 817–821.
- Bednarik, R. G. (1998a): The technology of petroglyphs. *Rock Art Research* 15: 23–35.
- Bednarik, R. G. (1998b): Cosmogenic radiation nuclides in archaeology: a response to Phillips et al. *Antiquity* 72: 811–815.
- Bednarik, R. G. (2001): *Rock art science: the scientific study of palaeoart*. Brepols, Turnhout (2nd edition 2007, Aryan Books International, New Delhi).
- Bednarik, R. G. (2002): Paläolithische Felskunst in Deutschland? *Archaeologische Informationen* 25: 107–117.
- Bednarik, R. G. (2004): Public archaeology and political dynamics in Portugal. *Public Archaeology* 3(3): 162–166.
- Bednarik, R. G. (2005): Church Hole: a controversial site. *International Newsletter on Rock Art* 42: 19–21.
- Bednarik, R. G. (2006a): The cave art of Mladeč Cave, Czech Republic. *Rock Art Research* 23: 207–216.
- Bednarik, R. G. (2006b): *Australian Apocalypse. The story of Australia's greatest cultural monument*. Occasional AURA Publication 14, Australian



- Rock Art Research Association, Inc., Melbourne.
- Bednarik, R. G. (2009a): Fluvial erosion of inscriptions and petroglyphs at Siega Verde, Spain. *Journal of Archaeological Science* 36(10): 2365–2373.
- Bednarik, R. G. (2009b): To be or not to be Palaeolithic, that is the question. *Rock Art Research* 26(2): 165–177.
- Bednarik, R. G. (2012a): Editorial: Rendering humanities sustainable. *Humanities* 1(1): 64–71.
- Bednarik, R. G. (2012b): An aetiology of hominin behaviour. *HOMO - Journal of Comparative Human Biology*, doi.org/10.1016/j.jchb.2012.07.004
- Bednarik, R. G. (2013): *Creating the human past*. Archaeopress, Oxford.
- Bednarik, R. G. & E. K. Devlet (1993): Konservatsiya pamyatnikov naskal'nogo iskusstva verkhnēi Leny. *Pamyatniki naskal'nogo iskusstva*, pp. 7–24. Biblioteka Rossiiskogo Etnografa, Rossiiskaya Akademiya Nauk, Moscow.
- Bednarik, R. G., G. Kumar, A. Watchman & R. G. Roberts (2005): Preliminary results of the EIP Project. *Rock Art Research* 22: 147–197.
- Bock, A. J. (1981): To chalk ... or not to chalk ... response. *La Pintura* 7(4): 13–14, 17.
- Bustamente Diaz, P. (2006): Rock art destruction at El Mauro, Chile: one of the world's largest mining waste dams. *Rock Art Research* 23(2): 261–264.
- Cannon, W. J. & M. J. Ricks (1986): The Lake County, Oregon, rock art inventory: implications for prehistoric settlement and land use patterns. *Contributions to the Archaeology of Oregon* 3: 1–23.
- Capitan, L., H. Breuil & D. Peyrony (1912): Les gravures sur cascade stalagmitique de la grotte de la Mairie à Teyat (Dordogne). *Congrès International d'Anthropologie et d'Archéologie Préhistorique, 16e session*, pp. 498–514. Geneva.
- Chaffee, S. C., M. Hyman & M. Rowe (1993): AMS 14C dating of rock paintings. In J. Steinbring and A. Watchman (eds), *Time and space: dating and spatial considerations in rock art research*, pp. 67–73. Occasional AURA Publication 8, Australian Rock Art Research Association, Melbourne.
- Chippindale, C. (2001): Studying ancient pictures as pictures. In D. S. Whitley (ed.), *Handbook of rock art research*, pp. 247–272. AltaMira, Walnut Creek, California.
- Crivelli Montero, E. A. & M. M. Fernández (1996): Palaeoindian bedrock petroglyphs at Epullán Grande Cave, northern Patagonia, Argentina. *Rock Art Research* 13: 112–117.
- Daleau, F. (1896): Les gravures sur roche de la caverne de Pair-non-Pair. *Actes de la Société Archeologique de Bordeaux* 21: 235.

- David, P. (1934): Abri de la Chaire à Calvin. *Congrès Préhistoire de France, 11e session*, pp. 372–378. Périgueux.
- Edwards, R. (1964): Rock engravings and stone implements of the Pitcairn Station, northeastern South Australia. *Records of the South Australian Museum* 14: 645–662.
- Francis, J., L. L. Loendorf & R. I. Dorn (1993): AMS radiocarbon and cation-ratio dating of rock art in the Bighorn Basin of Wyoming and Montana. *American Antiquity* 58: 711–737.
- Genge, P. (1990): Bravo Bednarik. *Pictogram* 3(2): 18.
- Gonçalves, M. E. (1998): Science, controversy and participation. The case of the Foz Côa rock art engravings. *Journal of Iberian Archaeology* 0: 7–31.
- Hale, H. M. & N. B. Tindale (1930): Notes on some human remains in the lower Murray valley, South Australia. *Records of the South Australian Museum* 4: 145–218.
- Helvenston, P. A. (2013): Differences between oral and literate cultures: what we can know about Upper Paleolithic minds. In R.G. Bednarik (ed.), *The psychology of human behavior*. Nova Science Publishers, New York, 59–110.
- Ives, G. A. (1986): Rock art of the Dolores River valley. In A. E. Kane, W. D. Lipe, T. A. Kohler and C. K. Robinson (eds), *Dolores Archaeological Program: research design and initial survey results*, pp. 235–252. U.S. Department of the Interior, Bureau of Reclamation, Denver.
- Kearns, T. M., M. R. Polk & L. S. Teague (1975): Archaeological resources, Orme Reservoir, Phase II, Verde Arm. In V. Canouts (ed.), *An archaeological survey of Orme Reservoir*, pp. 275–373. Cultural Resource Management Section, Arizona State Museum, Tucson.
- Kuhn, T. S. (1962): *The structure of scientific revolutions* (1st edn, 2nd edn 1970). University of Chicago Press, Chicago.
- Lalanne, G. & H. Breuil (1911): L'abri sculpté du Cap-Blanc à Laussel, Dordogne. *L'Anthropologie* 21: 385–402.
- Leen, D. (1981): To chalk or not to chalk. *La Pintura* 8(3): 11.
- Lemozi, A. (1920): Peintures et gravures paléolithiques découvertes dans les grottes des communes d'Espagnac, de Sainte-Eulalie et de Cabrerets. *Bulletin de la Société Préhistorique Française* 17: 256–263.
- Loendorf, L. (2001): Rock art recording. In D. S. Whitley (ed.), *Handbook of rock art research*, pp. 55–79. AltaMira Press, Walnut Creek, California.
- Löfvendahl, R. & J. Magnusson (2000): Research and development – degradation and care. In K. Kallhovd and J. Magnusson (eds), *Rock carvings in the borderlands*, 47–72. INTERRED IIA Project, Bohuslän /Dalsland and Østfold.

- Lorblanchet, M. (1992): Introduction. In M. Lorblanchet (ed.), *Rock art in the Old World: Symposium A of the First AURA Congress, Darwin*, pp. xv–xxxii. Indira Gandhi National Centre for the Arts, New Delhi.
- Macintosh, N. W. G. (1977): Beswick Cave two decades later: a reappraisal. In P. J. Ucko (ed.), *Form in indigenous art*, pp. 191–197. Australian Institute of Aboriginal Studies, Canberra.
- Mensan, R., R. Bourrillon, C. Cretin, R. White, P. Gardere, L. Chiotti, M. Sisk, A. Clark, T. Higham and E. Tartar 2012. Une nouvelle decouverte d'art pariétal aurignacien in situ a l'abri Castanet (Dordogne, France): contexte et datation. *Palaeo* 23: 171-188.
- Mishkin, M. & L. G. Ungerleider (1982): Contribution of striate inputs to the visuospatial functions of parieto-preoccipital cortex in monkeys. *Behavioural Brain Research* 6(1): 57–77.
- Moore, R. A. (1992): The lithic assemblage from a Pueblo petroglyph site. In M. S. Duran and D. T. Kirkpatrick (eds), *Artifacts, shrines, and Pueblos: papers in honor of Gordon Page*, pp. 167–182. Archaeological Society of New Mexico 20, Albuquerque.
- Morwood, M. J. (1994): Handy household hints for archaeological excavations at rock art sites. *Rock Art Research* 11: 10–12.
- Mulvaney, J. D. (1969): *The prehistory of Australia*. Thames and Hudson, London.
- Passemard, E. (1944): La caverne d'Isturitz en pays basque. *Préhistoire* 13: 1-95.
- Pessis, A.-M. (1999): The chronology and evolution of the prehistoric rock paintings in the Serra da Capivara National Park, Piauí, Brazil. In M. Streckler and P. Bahn (eds), *Dating and the earliest known rock art*, pp. 41–47. Oxbow Books, Oxford.
- Roberts, R. G., M. Bird, J. Olley, R. Galbraith, E. Lawson, G. Laslett, H. Yoshida, R. Jones, R. Fullagar, G. Jacobsen & Q. Hua (1998): Optical and radiocarbon dating at Jinmium rock shelter in northern Australia. *Nature* 393: 358–62.
- Rosenfeld, A., D. Horton & J. Winter (1981): *Early Man in north Queensland*. Terra Australis No. 6, Australian National University, Canberra.
- Saint Mathurin, S. de (1975). Reliefs magdaléniens d'Angles-sur-l'Anglin (Vienne). *Antiquités Nationales* 7: 24–31.
- Searle, J. R. (1995). *The construction of social reality*. Allen Lane, London.
- Steinbring, J., E. Danziger & R. Callaghan (1987): Middle Archaic petroglyphs in northern North America. *Rock Art Research* 4: 3–16.
- Swartz, B. K. (1997): An evaluation of rock art conservation practices at Foz Côa, northern Portugal. *Rock Art Research* 14: 73–75.

- Thackeray, A. I., J. F. Thackeray, P. B. Beaumont & J. C. Vogel (1981): Dated rock engravings from Wonderwork Cave, South Africa. *Science* 214: 64–67.
- Wallace, H. D. & J. P. Holmlund (1986): *Petroglyphs of the Picacho Mountains, south-central Arizona*. Anthropological Papers 6, Institute for American Research, Arizona.
- Watchman, A. (1995): Recent petroglyphs, Foz Côa, Portugal. *Rock Art Research* 12: 104–108.
- Watchman, A. (1996): A review of the theory and assumptions in the AMS dating of the Foz Côa petroglyphs, Portugal. *Rock Art Research* 13: 21–30.
- Welch, D. (2012): Oh dear! No deer! *Rock Art Research* 29(2): 171–177.
- Wilman, M. (1968): *The rock-engravings of Griqualand West and Bechuanaland, South Africa* (2nd edn). A. A. Balkema, Cape Town.