Rock Art

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Contributor: Robert Bednarik

The term ‘rock art’ defines non-utilitarian humanly made markings on natural rock surfaces, caused either by an additive (pictograms, made by the application of material) or a reductive process (petroglyphs, made by the removal of rock material). The former include rock paintings, pigment drawings, stencils, and beeswax figures; the latter term covers engravings, percussion petroglyphs, and finger flutings. Rock art occurs in nearly all countries. Its uneven distribution is attributable to differences in cultural conventions as well as a taphonomic attribute, i.e. a result of preservation bias. Prehistoric rock art represents by far the largest body of evidence we possess of humanity’s cultural, cognitive, and artistic beginnings. Through its relative permanence, it has profoundly influenced the beliefs and cultural conventions of subsequent societies up to the present. It is, therefore, an integral part of humanity's collective memory and the most significant surviving witness of our cultural evolution.

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1. Brief history of rock art studies

Although the earliest literary mentions of rock art are from China, no publication about Chinese rock art had appeared in English until 1984. The philosopher Han Fei (280–233 BCE) provided the first known reference to rock art, while the geographer Li Daoyuan (386–434 CE) described numerous rock art sites in China and even mentioned occurrences in India. In South America, Captain De Carvalho found rock art in 1598 in what is now Brazil and published his recordings in 1618. In Europe, the first known recordings, made by Peder Alfssön in Denmark in 1627, were not published until 1784. More determined scholarly efforts commenced during the 19th century, focusing initially on Russia, Scandinavia and northern Africa, later on, southern Africa, parts of South America, Australia and eventually India.

With the beginning of the 20th century, after archaeology accepted the authenticity of Paleolithic cave art it first rejected, the study of rock art became nominally integrated into mainstream archaeology. This promoted the proliferation of stylistic constructs and the development of various approaches. For instance, some archaeologists considered that taxonomic constructs and statistical analyses of stylistic or morphological matrices of motif types would provide empirical interpretations, in the same way other artifacts were classified and interpreted statistically. However, rock art usually lacks archaeologically perceptible time depth, and most major rock art sites are cumulative assemblages deriving from different eras. Lumping these various traditions together and treating them as a 'style' because they happened to occur at the same place served no research purpose. Thus the most significant barrier to integrating rock art successfully into archaeology was the intractability of its dating. Worldwide, there have been far more dubious claims about rock art dating than credible estimates, and only about twenty instances of reasonably convincing minimum dating of rock art under supposedly datable sediments.

Archaeological age estimations, generally by considerations of style and 'content', have varied dramatically for specific corpora. For example, there is a distinctive tradition of shelter paintings in eastern Spain, called the Levantine genre. Throughout the second half of the 20th century it has been attributed to every single archaeologically perceived cultural period from the Perigordian to the Iron Age (i.e. to every age from about 35,000 to 2500 years ago), yet its actual age, now thought to be Neolithic or later, remains still unknown. Much the same applies throughout Eurasia. In Portugal and Spain, a corpus of petroglyphs known to be no more than a couple of centuries old is consistently described as being from 20,000 to 30,000 years old. The tendency to ascribe Pleistocene ages to rock art of much more recent times is widespread across all of Eurasia, sometimes also evident in Australia. Similarly, some researchers have used questionable methods such as cation-ratio analysis, uranium-series analysis and radiocarbon dating of unsuitable samples to postulate wildly excessive ages for rock art.

The paradox is that, without some idea of its age, rock art has little archaeological relevance, and it is difficult to separate components of different traditions at sites. Some archaeologists have suggested that the study of rock art should best be left to ‘specialists’; others have vigorously opposed this view. The last few decades of the 20th century witnessed the emergence of rock art research organizations in many parts of the world, beginning in North America, Australia and Western Europe. In 1988 these bodies formed the International Federation of Rock Art Organizations (IFRAO), which currently has about sixty affiliated member associations, covering in effect most of the world. One of their principal aims is to introduce scientific methods, grounded in such diverse disciplines as geology, semiotics or cognitive science. This trend is currently replacing interpretative endeavours with contextual studies, and concerns with meaning are giving way to epistemological rigour.

2. The science of rock art

One of the priorities in contemporary rock art research is the development of methods for estimating the age of rock art motifs. During the 1980s, this led to the replacement of stylistic or iconographic dating by forms of 'direct dating', in which the age of dating criteria physically and directly related to the rock art is determined. Propositions of the chronological relationship of these criteria with the rock art must be testable, i.e. refutable. The dating criterion may be of the same age as the rock art (e.g. an organic binder contained in the paint residue of a pictogram, or the fracture surfaces caused by the impact that occurred when a petroglyph was made). Alternatively, it may be older than the rock art (e.g. its support surface, or a lichen thallus dissected by an engraved line); or it may be younger than the rock art (e.g. a superimposed insect nest, or a mineral accretion concealing the art). There are numerous types of such directly relatable criteria, most of which have been provided by geochemistry so far. However, direct dating offers no actual ages of rock art; it merely generates testable propositions about the relevance of specific physical or chemical data to the actual age of rock art. The interpretation of this relationship demands an understanding of the method used, of the circumstances of sample collection, and of the limitations applying to stated results. The principal difficulty experienced with this approach is that the interpretation of its results is usually contingent on such complex qualifications that they are difficult to relate to immediate concerns of archaeology. To practitioners seeking certainties, expressions of probabilities, or intricate formulations of explanatory scenarios are frustrating and seem to limit the practical use of such data.

The first method used in this quest was radiocarbon analysis of mineral accretions containing atmospheric carbon, such as carbonates and oxalates. These are often found in direct physical relation with rock art, but a complex set of qualifications limits the utility of their results. Uranium-series dating (thorium-uranium) has also been applied to carbonate. However, its use on thin layers of speleothem has been shown to yield unreliable results because of several factors of uncertainty. Most widely used has been the carbon-isotope analysis of inclusions in mineral accretions or paint residues, and the determination of the age of charcoal pigments. Here, the qualifications are somewhat more straightforward. In the former method, the principal limitation is that to obtain valid estimates, the nature of the analyzed substance must be determined, either at the object or molecular level. Nearly all such determinations have so far referred to bulk samples, i.e. without isolating the dated substance.

The determination of carbon ages of charcoal pictograms is a straightforward method. Still, unfortunately, the date refers to the time when the tree in question assimilated carbon from the atmosphere, not to the time of rock art production. Ancient charcoal might have been used in this and often was, which introduces a severe limitation to such results. The most reliable results from any pictograms so far are 137 carbon isotope determinations obtained from beeswax figures in northern Australia. An experimental approach is to use sand grains embedded in wasp or termite nests directly related to rock art to determine when they were last exposed to light, using the optically stimulated luminescence method.

Figure 1. Microerosion analysis of Neolithic petroglyph at Rupe Magna, Valtellina, northern Italy.

Petroglyphs may be more difficult to date than paintings because they offer no substance relating to the time of their execution. The mineral dust then yielded is probably not recoverable. Nevertheless, the surfaces freshly exposed and the mineral crystals broken or truncated at that time experience significant changes over time, which are utilized in microerosion analysis (Fig. 1). Two forms of this method have been used so far: the determination of erosion on rocks with components that weather at very different rates, and the measurement of micro-wanes on fractured mineral crystals. The second version is the more developed, but its use is limited to very erosion-resistant rock types containing crystalline quartz or feldspar, such as granite, whereas sedimentary rocks are most often unsuitable. A very robust analytical method, microerosion analysis yields reliable dates for petroglyphs manufacture, but they are typically imprecise and several preconditions need to be met. Digital colourimetry has been applied to both patinated petroglyphs and pictograms after surprisingly consistent results were secured from historical inscriptions of known ages. Other credible approaches, so far not effectively applied, would be to use lichenometry or rock surface retreat for estimating the ages of petroglyphs, or the use of weathering zone growth rates and macro-wanes. There is thus considerable scope for extending the range of viable direct dating methods.

While the scientific study of rock art may still be in its infancy, it is not limited to issues of antiquity. Investigations of the technology of rock art have involved several productive approaches, including the study of the tools used in making petroglyphs, of paint recipes, of microscopic inclusions found in paint residues, and of the sourcing of pigment materials. Nano-stratigraphy—the microscopic excavation of strata of paint residues, mineral accretions or weathering and patination zones—was first introduced in the 1970s, and has been developed to great sophistication already, especially in Australia. Its principles are somewhat similar to those of archaeological stratigraphy, but its methods, obviously, are very different. To some extent, this method might even overcome the limitation of rock art being, in contrast to archaeological sediment strata, apparently two-dimensional.

Various other issues have been explored by rock art science in recent decades, such as the establishment of criteria for the effective discrimination between humanly made rock marks and natural markings on rocks. This had been a significant problem in archaeology, with hundreds of cases of misidentification of both types of rock markings. Most of these mistakes refer to petroglyphs and natural markings resembling them, but there are also a few prominent cases of pictogram misidentifications on record.

One of the most promising areas of scientific investigation of rock art concerns the holistic analysis of its physical, cultural and cognitive contexts. This includes the examination, often by field microscopy, of traces related to the production of rock markings, especially in well-preserved condition (particularly in caves). The methods used closely resemble those of forensic science (matching of microscopic striae, identification of microscopic organic traces and so forth) and tribology, and are designed to determine the gestures involved in making the rock art. Their results can be correlated with other evidence in the same context (e.g. underground mining of flint and possible medicinal use of speleothems).

A trend has also become evident to explore the cultural and cognitive development of humans through rock art, especially of the Pleistocene period. Cognitive evolution, informed by advances in neuroscience and psychology, is increasingly becoming relevant to the understanding of the earliest art. Pleistocene rock art and portable art-like productions can provide evidence that may help test particular models of how human cognition may have eventuated. Underlying principles and universals need to be identified, and the material of the Middle and Early Upper Pleistocene requires much more attention than has been evident in the 20th century. This reflects another change from traditional preoccupations to new approaches. It can perhaps place Pleistocene paleoart into the context of cognitive evolution, explore its semiotic dimensions, and consider implications for technology and culture during the Paleolithic period.

3. The recording of rock art

Since rock art has begun to be recorded, centuries ago, the purpose of such records has always been to create a visual register of those aspects of the art that were deemed important. This has remained so until relatively recently, and it follows that rock art recordings are usually interpretations of individual observers, not objective data. Indeed, this principle is embodied in a ruling of the High Court of Austria in 2003, that rock art recordings are copyrighted because they are individual interpretations by the recorder. Recently this has changed with the introduction of sophisticated digital recording systems that yield much more objective results.

Nevertheless, the ready availability of computer equipment and electronic image manipulating software does not necessarily obviate other recording techniques. The discipline has, in the past, made the mistake of ignoring useful approaches, such as rock surface cartography. In addition to the rock art, all other features of the rock panel are recorded in this approach, such as fissures and topographic aspects, weathering, glacial striae, accretionary deposits, lichen, fire damage, exfoliation and so forth. It would be precipitate, therefore, to disregard all earlier methods, but it is undoubtedly appropriate to discard all those that are invasive or threaten the research integrity of rock art. Many of the latter have been used extensively in the past, but there is no justification to continue any of them. These physical enhancement methods have included the application of clear liquids to close the pores of silica skins or other thin accretions, thus improving photographic records. The fluids used in this have ranged from water to motor oil, from kerosene to clear lacquer. Another common practice has been the outlining of rock art with chalk and a variety of other markers, including dye, pencil, lipstick, and felt pen. Archaeologists have contaminated the geochemical fabric of thousands of square metres of petroglyphs by applying organic white and black paints to facilitate manual recording. The use of pressure-sensitive films, rubbings made with a variety of materials, the production of casts from latex, plaster of Paris, *paper mâché*, thermoplastic resin and so forth have all been found to affect the rock art, and in some cases have caused spectacular damage to it (Fig. 2). The use of transparent film to copy the art can also be damaging because these sheets tend to be electrostatic, and the movement of pens or fingers can attract small flakes of material from paintings. Even the use of aluminium foil tamped gently into petroglyphs before it is backed by stiffer material, regarded as a reasonably safe method, has been opposed by a chemist working with rock art.

Figure 2. Damage caused to petroglyphs by contact recording, Vorobiovo site, Siberia.

There is one straightforward rule now in recording: unless the rock art in question is about to be destroyed by other factors, no invasive method and no contact is acceptable. The first consideration in all rock art recording work must be that it would be selfish to prejudice any future analytical methods rock art scientists will bring to bear upon the rock art, centuries from now. Since we have not the faintest idea what these future methods will involve, there is only one possible solution: all rock art recording today must be by non-invasive methods, except in circumstances where the rock art is subject to other imminent threats.

There is no need to resort to damaging and superseded methodology. Photography, sometimes in combination with non-contact enhancement techniques, is now universally available. Raking light photography (oblique lighting at night) is far more effective in recording petroglyphs than manual recording, which is a cumbersome and subjective procedure. It can be most conveniently accomplished with battery-powered movie lights. A variety of filters and special films are available to improve photographs of rock art. Cross-polarized photography, using two light sources with polarizing filters, can enhance contrast. A calibrated colour and grayscale must be included on all rock art photographs, the most widely used being the IFRAO Standard Scale. This has several purposes, the foremost being the facility of colour re-constitution. All photographic records are of distorted colour, and all of those on film or paper fade with time, therefore a colour profile included on a photograph permits the digitized recovery of the original colour of the object at the time the image was taken.

The equipment now widely available to rock art recorders includes high-resolution digital cameras which, combined with the use of laptop computers in the field, have revolutionized rock art recording. Photographs can now easily be colour corrected on-site, as soon as they are taken, right at the panel being recorded. The digital image processing programs now available have replaced the laborious enhancement procedures of the 1980s. In addition to this basic system, several more sophisticated recording options have recently become available. Some remain expensive, but it is only a matter of time before they also become stock-in-trade, and ever more powerful tools are introduced at the high end. The use of photogrammetry, which has been sporadic in rock art survey work, has experienced a revival due to the introduction of digital elevation model software. This can generate accurate three-dimensional recordings of petroglyphs. An alternative approach is the use of laser scanners to produce virtual digital models of great accuracy and versatility. This technique evolved from the need to record the topography of groove shapes, such as those of Scandinavian rune stones. Manual groove topography of petroglyphs, still done in the late 1990s, has been superseded by automated laser scanning. It yields visualization algorithms that facilitate the use of such recordings in the application of computer-assisted drawing programs to rock art, which can create virtual rock art sites. Micro-topography of rock art has also been attempted with a CCD camera by obliquely projecting a fine grating grid over the rock art.

The alternative method of reproducing panels or sites is the production of physical rock art facsimiles. This has been used for several decades, but only sporadically because of the high cost involved. The best-known site facsimiles are the copies of Lascaux, Altamira and Chauvet Caves. Their costs have run into dozens of millions of dollars each, but they have been recovered through tourism within some years. Facsimiles are constructed by first acquiring the necessary topographic data, traditionally either by photogrammetry or the use of precision theodolites, but more recently by laser equipment. The rock panel is then recreated, and the rock art projected onto it. This process is very laborious and involves considerable artistic skills.

4. Conservation and site management

Humanity lavishes billions of dollars annually on its art objects, art repositories and art industry. By comparison, its endeavours to look after its oldest and most valuable art treasures are minuscule. Despite its appearance of relative robustness, rock art is quite fragile, and what we see today is only the tiny surviving fraction of what was once created. Two factors need to be distinguished in the deterioration of rock art: the effects of natural processes, and the damage occasioned by human agency. The mitigation of the former is often difficult, whereas that of anthropic destruction is, in most cases, easily achievable. Significantly, deterioration by humanly introduced factors far outweighs natural degradation. In understanding the interplay between these two factors, it is essential to appreciate that the rock art that exists today does so because it has survived a great many natural decay processes, often surviving in a state of relative equilibrium with its ambient environment. Hence, it is likely to persist much longer unless there is a significant change in its preservation conditions, especially one introduced by human intervention. This may be as simple as the introduction of human visitation to a formerly pristine site, or as complex as the occurrence of acid rain caused by industrialization.

The principal natural agent of rock art loss is moisture, mainly in the form of rainwater, capillary water in porous rock, condensation in caves and shelters, freeze-and-thaw cycles, surface run-off, and secondary effects such as salt efflorescence or exfoliation. Physical weathering of rock art panels occurs as insolation (solar radiation), lightning strikes, brushfires, *Kernsprung*, tectonic adjustments and kinetic damage (aeolian, gravity or water induced). Many forms of biological factors can contribute to weathering, including bacteria, fungi, lichens, algae, mosses, larger plants, insects (mud-daubing wasps, termites, bees), nesting birds and various larger animals, mostly domestic and feral species. For many of these threats, protective measures have been found. Site hydrology, for instance, can be controlled by artificial silicone driplines in shelters; condensation can be eliminated by climate control.

One animal, however, is causing far greater rock art destruction than all other factors taken together. Of the many forms of damage occasioned by humans the perhaps most repulsive is that occasioned by researchers, be it through misguided recording activities or through their role in permitting or condoning the destruction of rock art by industrial or infrastructure development. The former has been largely eliminated in recent decades, but the latter continues unabated. At one Australian site complex alone, in the Dampier Archipelago, it has been responsible for the obliteration of about 100,000 petroglyphs. Tourists and site visitors contribute to rock art deterioration, though it has often been found necessary to sacrifice some sites to them to preserve many others. The locations of new sites are no longer made public, and well-known pristine sites such as Chauvet, Cussac and Cosquer Caves in France are closed to all, except a few researchers who only enter these sites with careful precautions to prevent contamination. For instance, researchers are not allowed to walk on the floor of Chauvet Cave. In Australia, most of the cave art sites are only accessible to two or three researchers, and their locations are generally confidential.

There are very few professional rock art conservators worldwide, and the standards they apply vary from one region to another. Their tasks include graffiti removal, moisture and climate monitoring and control, and the design of site management measures. The latter differ according to local circumstances and include such measures as the erection of fences to keep out animals, the installation of visitor boardwalks and paths, and in some regions protective grilles. In modern site management practice, the concept of 'site fabric' is paramount, referring to all physical and non-physical aspects of a place, including accretionary deposits on the rock, even its ambience or religious significance. The primary principle of intervention at a rock art site is that any modifications must be fully reversible. Today's site conservation and management practices may well be superseded tomorrow, and the cultural resource in question is, after all, not renewable.

5. Global distribution of rock art

The pre-eminence of the Franco-Cantabrian cave art has, in some respects, overshadowed the appreciation of the many other rock art traditions of Europe. In France, for instance, the extensive corpus of Fontainebleau receives scant attention, simply because it is of the Holocene rather than the Late Pleistocene. Much the same can be said about Spanish traditions, such as the Galician petroglyphs or the Levantine paintings. Alpine petroglyphs have fared somewhat better, especially in the western Alps at Mont Bégo and the southern Alps in the Tellina and Camonica valleys. There are scattered sites or smaller concentrations in nearly all European countries, but the only other major series of European sites extends across Scandinavia, from Denmark to Karelia. It comprises mostly petroglyphs, but pictograms do occur, especially in Finland. Little is known about the rock art of the Balkans and Greece, but there appears to be a fair amount of it. Portugal, Britain and Ireland are well endowed with non-figurative petroglyphs. Most of the European rock art has been attributed to the Metal Ages, some may be older, and more recent traditions certainly exist. It needs to be cautioned that credible dating is rarely available, and revisions still have to be anticipated. For instance, the Scandinavian petroglyphs are mostly attributed to the Bronze and Iron Ages. Still, it is possible that more recent people, such as the Vikings or the Saami, were involved in their making.

Asia, of which Europe is only a small appendage, comprises several large bodies of rock art that surpass numerically any European regional corpus. Most of the countries of the Middle East are rock art-rich, especially Saudi Arabia, Jordan, Iran, Egypt, and Israel. Here, early inscriptions often occur alongside petroglyphs, helping to unravel the chronology, and suggesting that much of the art dates from between 3000 and 1400 BP. With the advent of Islam, rock art production was severely reduced although practices did continue up to the present, for instance, in Saudi Arabia. The rock art of the Caucasus region has only begun to attract interest recently, and relatively little is known about Turkish or Yemeni rock art. Researchers have noted the occurrence of concentrations in Pakistan. Still, so far no research of substance has been conducted there, while in the several countries to the north, it has only begun in the most recent years. Across central Asia, including the Tibetan Plateau, there are numerous reports of rock art, but a great deal has been destroyed by Moslems, for instance along the Silk Road. Much better explored is the rock art of Siberia, of which concentrations appear along the Yenisey (impact petroglyphs) and Lena rivers (abrasion petroglyphs and few paintings). In Mongolia, the most significant assemblages are found in the Altai Mountains. The impressive iconography of the central Asian regions, sometimes dominated by apparently human faces described as 'masks', or by extraordinarily ornate 'deer stones', continues into China, especially in Xinjiang, Ningxia, Henan, Qinghai, Guangxi, and Inner Mongolia. Among the more than 10,000 Chinese known sites, those in the north are mostly of impact petroglyphs, while the situation is reversed in southern China. Most rock art there is of pictograms, especially in the rock art-rich Yunnan Province, or in Guangxi Zhuangzu with its incredible site at Huashan, where monumental paintings extend to forty metres height at the most extensive rock art panel in the world.

Japanese rock art is mainly found in small occurrences on boulders and stelae, but the available information is often unreliable. The countries of South-East Asia all feature rock art, though publications are sparse and no researchers have worked in many areas. A notable exception is Borneo, with its numerous limestone cave art sites of paintings and stencils. In the Philippines, sound ethnographic observations concerning cave paintings are available from Palawan. India offers one of the largest and best-explored rock art bodies in Asia, with paintings dominating in all provinces except in the far north and northwest, in the Deccan and the extreme south. The richest repositories are found in the rock shelters of the central regions, particularly in Madhya Pradesh. They include the best-known Indian site complex, Bhimbetka, of about 500 painted shelters.

Africa, too, boasts some massive rock art concentrations. These begin with the several art regions of the Sahara, extending from Morocco to Egypt. The arid conditions have greatly facilitated the preservation of rock art of the last six millennia. In terms of its artistic finery, Saharan rock art is matched by few traditions, one of them being the Bushmen/San rock paintings of southern Africa. Other painting and petroglyph traditions also occur in that region, and the Pleistocene finds of portable paintings in Apollo 11 Cave, Namibia, imply that very early traditions once existed. However, no African rock art has been convincingly demonstrated to be of the Pleistocene. There are extensive corpora of rock art in Tanzania, Zimbabwe, Kenya, Gabon, Sudan, Ethiopia and smaller occurrences in probably all remaining African countries. As in Asia, there are also significant gaps in our knowledge of distribution.

The situation is considerably better in Australia, where all major rock art regions have been identified, and the issue of antiquity is somewhat more transparent. The major bodies in the rock art-richest country are the petroglyphs of the Pilbara, the paintings of the Kimberley and Arnhem Land, and the mixed rock art of the Victoria River District and the Cape York Peninsula. Other notable complexes are the stencil-dominated sites of central Queensland, the Sydney sandstone petroglyphs and those of the Olary-Flinders Ranges district in South Australia. In general, the number of sites increases from south to north, with the limestone cave art along the southern coast and in Tasmania forming an unusual feature. A remarkably large part of Australian petroglyphs seems to be of the Pleistocene, of an overall corpus thought to be well more than 100,000 sites. Many of the islands of Oceania are also well endowed with rock art, among them New Guinea, New Caledonia, New Zealand, Hawaii and Rapa Nui (Easter Island).

Canada’s rock art is comparatively sparse, with minor concentrations in British Columbia and relatively isolated finds in most other states. The United States, by contrast, features major occurrences, especially in the southwestern states. The Chumash paintings and Coso Range petroglyphs in California, the numerous sites across Utah, Arizona and New Mexico all form a massive body composed of many traditions. Most other states also contain rock art where suitable conditions pertain. In terms of antiquity, North American rock art seems to be consistent with most of the rest of the world: all or nearly all the rock art is of the Holocene. The western art province continues in the neighbouring Mexican states of Sonora and Chihuahua, with notably impressive painting sites in Baja California. Smaller concentrations occur in much of Central America, and there is hardly an island in the Caribbean that lacks rock art. In both regions, paintings, as well as petroglyphs, occur.

All countries of South America feature rock art sites, but the significant corpora are found in the Andean region, from western Venezuela to Patagonia. The largest single site is perhaps Toro Muerto in southern Peru, consisting of several square kilometres of petroglyphs (Fig. 3). Other notable occurrences in Colombia, Bolivia, Chile and Argentina have been subjected to detailed study, as have the extensive traditions of northeastern Brazil. In that country, vast corpora occur in the Amazon Basin and several other regions.

Figure 3. Typical style of petroglyphs at Toro Muerto, southern Peru.

6. Temporal distribution of rock art

The geographical distribution of global rock art is thus relatively well established, even though the regional details are often still of low resolution. Its temporal distribution, however, remains surrounded by uncertainties and controversies. In part, this is due to the limited credible dating work conducted so far, but it is also the result of almost countless unfounded age claims from many parts of the world, and their often specious but strenuous defence. The usually stylistic rock art sequences we have in many world regions are often based on spurious evidence or frivolous notions. To select one example, the chronology of the massive corpus of Saudi Arabian rock art derives from the work of one single scholar who wrote four books about it without ever having set foot in that country. It is based on photographs of one single site complex and unfounded opinions about supposedly depicted objects. When scientific dating and colourimetric sequencing recently tested this chronological sequence, it was found to be false in almost every detail.

This is not an exceptional case; much the same can be reported from many other regions. Eurasia and the Sahara have been particularly fertile grounds for the invention of styles, traditions, and cultures, and for reifying these constructs by providing them with names, identities, and notional datings. In particular, there has been a tendency to claim Pleistocene antiquities for rock art that is, in fact, significantly younger. This has commonly occurred across northern and central Asia, where at present no confirmed Ice Age rock art is known, as well as in parts of Europe. Ice Age rock art occurs at many sites of southwestern Europe, but it is thought to be far more common in Australia, where favourable environments and a historical absence of iconoclastic traditions have facilitated preservation. All Pleistocene rock art of Australia is of cultures of Middle Paleolithic technologies, whereas in Europe nearly all of it seems to belong to Upper Paleolithic tool industries.

Figure 4. Part of the southern wall of the quartzite cave Daraki-Chattan, India, bearing some of the oldest known rock art of the world.

The oldest currently known rock art, however, was found in the Indian state Madhya Pradesh. So far, the Lower Paleolithic antiquity of about 550 cupules and four engraved lines in two quartzite caves, Auditorium Cave (Bhimbetka) and Daraki-Chattan, has been confirmed by excavation (Fig. 4). Similar petroglyphs found in the Kalahari of South Africa have been suggested to be 410,000 years old. Remarkably, the oldest known rock art of both Americas, although significantly younger than that found in the three Old World continents, also consists typically of cupules and linear grooves.

Globally, rock art of the Pleistocene remains a rare phenomenon, always limited to exceptionally favourable preservation conditions. Its surviving instances do, however, increase in number towards the end of the Pleistocene. Present indications of rock art ages suggest a significant increase in quantity during the early to mid-Holocene, perhaps 7000 or 6000 years ago. Large corpora in arid regions begin simultaneously around that time, which is probably a taphonomic phenomenon rather than an indication of cultural practice. In temperate areas, large bodies of surviving rock art first appear by the Neolithic or Bronze Age, where local lithologies are suitable. Finally, in regions of limestone and other less weathering-resistant rock types, rock art at open sites typically begins occurring after 2000 years BP. Therefore, the temporal distribution of rock art is universally related to preservation issues, especially those of lithology and climate.

7. The interpretation of rock art

The interpretation of the iconography of rock art, i.e. what it is thought to depict, its meaning and its cultural role in ancient societies have been the primary preoccupations of researchers for centuries. There are, however, significant limitations to our access to these intractable dimensions of rock art. Most rock art motifs are not adequately detailed naturalistic depictions of objects to permit reliable identifications, and such pronouncements are rarely testable for prehistoric rock art. The only blind test ever conducted of the ability of an alien researcher to effectively identify meaning in rock art, by N. W. G. Macintosh in 1977, concerned the rock paintings in Beswick Cave, northern Australia. More than 20 years after he, an anatomist, had ‘identified’ the numerous zoomorphs and anthropomorphs depicted at this site, he discovered that some of the artists or their immediate relatives were still alive, so he took these experts to the site to tell him what each motif depicted. He found that 90% of his identifications had been wrong, and he discovered that a beholder who is not an intimate participant of the culture could not determine the relationship of apparently juxtaposed images. He also reported that to correctly associate and integrate individual motifs into a whole to 'express the purpose and thought context of the paintings' was dependent upon direct cultural information. Such access is, of course, impossible to prehistoric cultures; therefore, it would be imprudent to rely on the 'identifications' of scenes, figures or artistic intentions by contemporary scholars posing as experts. Our interpretations are freestanding constructs involving autosuggestion, reflecting our interpreting intellect and perception. They are not necessarily false, but their integrity is untestable. On balance, they need to be regarded as reflections of the way we interpret reality—which we need to assume differs from the reality construct, cognition, and visual or mental perception of the now mute rock artist.

Valid ethnographic interpretation of rock art is very limited indeed and is restricted mainly to Australia, although a few isolated cases elsewhere are known. It has been given much less prominence than the fanciful interpretations of rock art by humanist scholars, which usually involve shamans, trance visions, space travellers, rituals, religion, head-hunting, cannibalism, and a whole gamut of less entertaining variations. These interpretations provide insights into the perception, cognition, and cultural and academic conditioning of the interpreter.

Other forms of rock art interpretation have been neglected but are more promising. For instance, semiotic analysis to examine the syntax of rock art seems viable, and the study of work traces and of contextualizing rock art within spatially related evidence of other activities is most promising in cave sites. Secure ethnographic information about the meaning of rock art can be gained in regions where vast numbers of rock inscriptions occur together with rock art, sometimes referring to specific images (Fig. 5). As in all areas of rock art research, there is much room for improvement, which is precisely what renders this discipline so exciting and promising.

Figure 5. Petroglyphs, Thamudic scripts and recent bullet impacts, covering a period of about two millennia, Hima Cultural Precinct, Saudi Arabia.

8. Further reading

Bednarik, R. G. (2001). *Rock art science: the scientific study of palaeoart*. Brepols, Turnhout (2nd edn Aryan Books International, New Delhi 2007; Chinese edn Shaanxi People's Education Press, Xi'an 2020).