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ROCK ART SCIENCE

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This symposium will follow the established format of the successful previousIFRAO Congress science symposia chaired by us that focused on the scientificmethodology gradually becoming available to study rock art. The following papers are based on the testable and refutable evidence and hypotheses cast in terms of cause and effect reasoning on topics concerning the science of both rock art and portable palaeoart, but the following subjects are of particular interest:

1. The current proliferation of sophisticated rock art recording methodology.
2. Results and technical aspects of new studies in direct rock art age estimation.
3. The establishment of accepted standard protocols in rock art dating work.
4. New studies of the technology of rock art production.
5. Forensic studies of sites and replication of rock art phenomena.
6. New progress in the development of rock art conservation methodology.
7. New insights into the taphonomy and the significance of quantifiable variables of rock art.
8. The discrimination between natural and anthropogenic rock markings.
9. Any other topic about rock art or portable palaeoart that addresses testable propositions about these phenomena.

The neuroscience of rock art interpretation

The iconographic interpretation of rock art motifs is examined from a scientific perspective. An examination of the operation of the visual system reveals that it can only function because the process of identifying visual stimuli relies greatly on internally stored imagery and lacks an error-detecting governor to modulate the brain's pattern-recognition engine. In the disambiguation of marks on rock surfaces, this encumbrance has led to many false interpretations, some of which are considered in this presentation. Ethnographic evidence of various types has shown that the secure identification of rock art motifs by cultural aliens is not possible. For instance, both the structure and the chemistry of the brains of literate people differ significantly from those of illiterate people. Moreover, the epistemology of rock art interpretation is challenged by the impossibility, in most cases, of testing such pronouncements that are made from authority.

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Keywords: rock art, interpretation, neuroscience, pareidolia, visual system

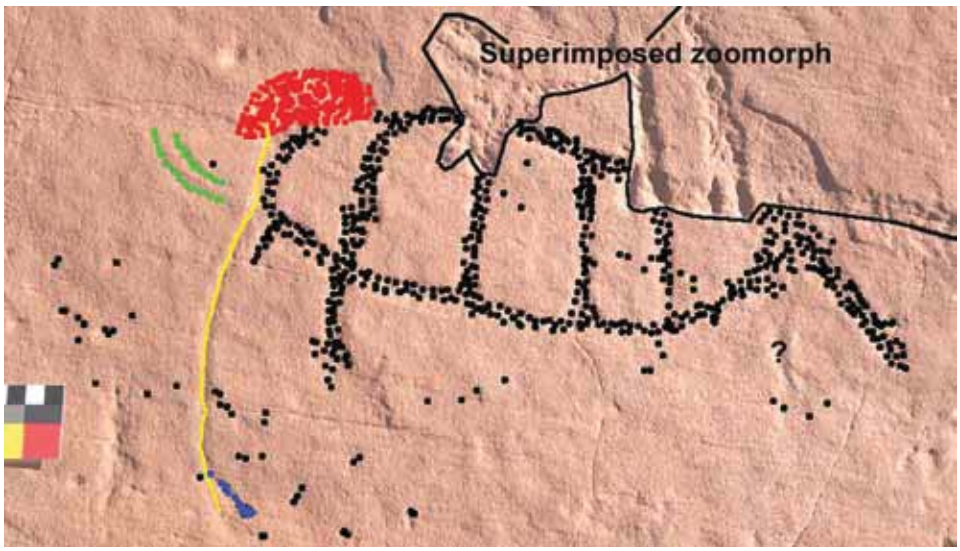

Fig.1 - Deconstruction of 'mammoth' motif, Upper Sand Island, Utah, USA: separate motifs and natural fissure forming a random arrangement

Mobiliary art of Pampacolca, Peru — a palaeoart unique in the world

Whereas most of the forms of rock art, such as cave art, cupules, geoglyphs and petroglyphs are well known throughout the world, this kind of mobiliary art is little known or studied. The typical iconographic pattern throughout the designs is very simple, yet orderly, neat and precise. This style in southern Peru, called Antimpampa, appears to have followed a strict iconographic design, though each. Each tablet was unique. The main motifs are representations depicting anthropomorphs and zoomorphs. There is a persistent pattern between the human and animal figures, generally denoting one animal for each human. Assorted abstract symbols, located around the main motifs, complete the pictorial frame. All tablets were painted using a multicolour variety of pigments, made of ochre and ground minerals mixed with an undetermined binder. Regarding the dating of this art the analysis provided the thermoluminiscence date of 2800±20 years old, of a painted tablet from Peña Blanca, and the radiocarbon date of 2490±30 years BP from the Campanáyoc earth mound. These preliminary results correspond to the Formative Period.

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Keywords: painted stone tablet, iconographic design, mobiliary art, iconography, palaeoart, laja pintada, Pampacolca

Fig.1 - Painted stone tablet from Peña Blanca, Pampacolca.
Fig.2 - Painted stone tablet from Yato, Pampacolca

What is rock art? A proposal to look at all its components

Even today, after decades of investigation, rock art is often presented as a manifestation related to a hodge-podge of imagined spiritual activities of peoples long gone. In particular, many have suggested that shamanism is at the root of all rock art creation. These interpretations share a belief that rock art is a unitary and unchanging phenomenon that can be "explained" irrespective of material evidence and cultural milieu.

By looking at rock art from different parts of the world and China in particular, I suggest that though this phenomenon has uniting characteristics (land and rocks as natural containers for the images, processes and materials, the role of signs as recording and communication devices), inevitably it also features cultural and historic elements and idiosyncrasies that cannot be ignored in favor of totalizing "explanations." Once material and archaeological evidence as well as historic or ethnographic literature are taken into consideration, the panorama of meaning of global rock art becomes more complex and less likely to be narrated with the recourse to mysterious otherworldly activities.

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Keywords: explanations, materiality, landscape, China

The 3D-reconstruction of a modified ochre fragment trapped inside a micromorphological block sample from the Middle Stone Age levels of Blombos Cave, South Africa

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Keywords: Middle Stone Age, Ochre, Blombos Cave, micro-CT, micromorphology, South Africa

One of the most striking aspects of the Middle Stone Age (MSA) assemblage recovered from Blombos Cave (BBC) is the quality and abundance of anthropogenically modified iron-rich rocks (i.e. ochre) that occur throughout the entire sequence. Of the more than 8,000 recovered ochre pieces, many show traces of intentional use and processing, including grinding striations for pigment powder production and deliberate engravings. Here we report on the accidental recovery, and the subsequent analysis, of a bright red, iron-rich rock fragment (30 x 40 x 80 mm in size). This ochre piece was unintentionally included inside a micromorphological block sample that was collected from Still Bay levels in BBC (dated to c. 77 ka ago). Due to its size, shape and morphology, it is possible that the trapped ochre piece was modified by humans. Given its location and proximity to other previously reported engraved pieces, it could also be that this piece has striations, markings or informative engravings. To consider these possibilities, we conducted Micro-computed tomography (micro-CT) on the micromorphological block, with the trapped ochre piece in it, and compared the surface information we obtained to micro-CT scans of conventionally recovered MSA ochre pieces.

Cussac cave. Choosing the location of the decorated panels: geological determinism or cultural determinism?

In order to better understand the relationship that the Prehistoric people had with parietal art, we need to understand which factors had an impact on the construction of the parietal arrangements, the choice of the decorated surface, and their layout. The points of view for observing the panels can also be relevant to the targeted viewer as well as other aspects relating to this art. Within the framework of the Cussac cave (Dordogne, France) research program (Dir. J. Jaubert), a database was built to record multidisciplinary criteria (geology, walls' taphonomy, topography, surroundings of the panels, ichnology, accessibility and visibility of the rock art) of 31 decorated panels. By associating a statistical study of the database with the study of topographic documents completed on site, three groups of panels have been brought to light. Each set seems to be determined by a different set of criteria. By describing the specific features of each group, the choices made by the Prehistoric people are made clearer. In this paper, we propose to take a closer look at the method employed before presenting the results achieved.

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Keywords: Cussac cave, Gravettian, parietal art, parietal structuration

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

There are certain basic questions in rock art studies to be answered scientifically, such as how can we use it for understanding cognitive and cultural development, place rock art in proper chronological order, or effect its conservation and protection. After so many decades of applying the traditional archaeological approach it has helped us little in answering significant research questions. The situation is much the same in many countries. To answer these questions properly, we have to change our mindset and adopt a scientific approach. That means that our studies should be based on testable propositions. We need to understand the lithology, taphonomy, topography, and the sedimentology and palaeoclimate of the sites. We also need to be able to effectively discriminate between natural and anthropic rock markings and use modern recording methodology, apply scientific dating methods and know how to collect samples and analyse them properly. We also need to learn how to conduct rock art replication. I will discuss some of these aspects in the light of my experience while working in India and China.

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Keywords: rock art, science, epistemology, methodology, research mindset

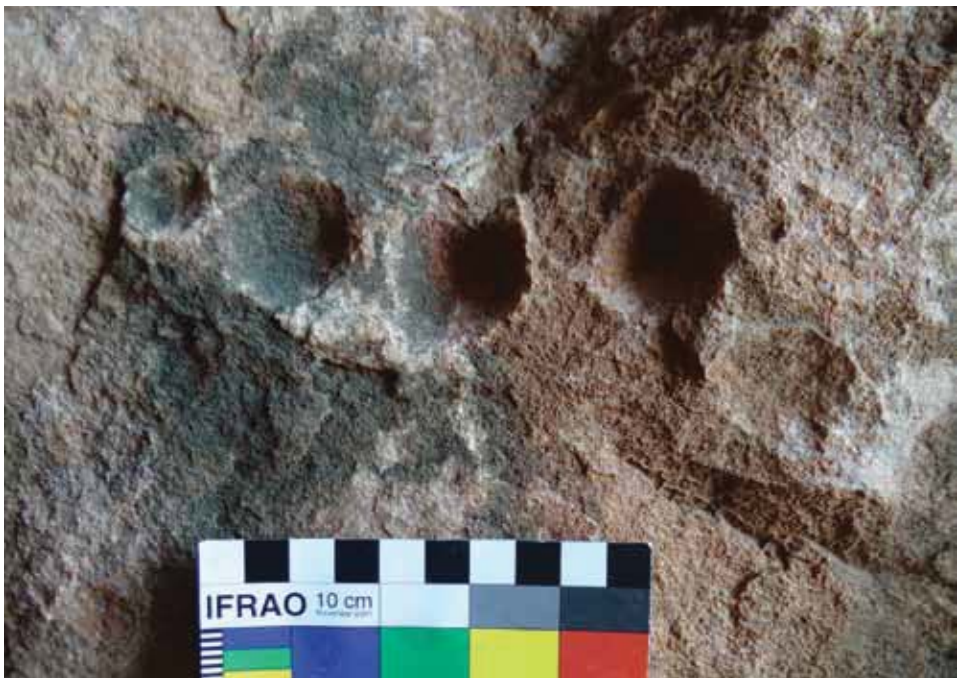

Fig.1 - Weathering deforming the cup marks.
Fig.2 - Kinetic energy metamorphosis making the cup marks surface more resistant to weathering.

Evaluating conservation practices with pXrf in Kakadu National Park, Australia

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Keywords: rock art conservation, conservation science, pXrf analysis, artificial silicon driplines

Rock art conservation practices in Australia commenced in the 1970s, with numerous trials undertaken in the newly-formed World Heritage Area of Kakadu National Park. While these studies continued into the 1980s and included extensive use of techniques such as the installation of artificial silicon driplines, monitoring and evaluation of the techniques had not been undertaken until recently. The introduction of an annual monitoring and maintenance program by the Park, as well as more detailed work through the doctoral research of Melissa Marshall at handful of sites in the area, has led to the development of a pilot program of conservation practices informed by non-invasive scientific analyses such as portable x-ray fluorescence (pXRF).

Rock art panels were analysed at eight sites, in the field, using pXRF in locations where no interventions had occurred, as well as in areas where conservation treatments were trialed, and above and below the trials. Environmental factors, landscape contexts and cultural parameters were considered when interpreting the spectra obtained. Chemical signatures relating to the interventions, and the monitoring program more broadly, have yielded lessons of benefit to Traditional Custodians, the Kakadu National Park and conservation practitioners worldwide.

Fig. 1 – Melissa Marshall using the pXrf at Nanguluwurr, Kakadu National Park, Australia. (© Kadeem May)
Fig. 2 – Melissa Marshall and Kadeem May using the pXrf at Nourlange, Kakadu National Park, Australia. (© Gabrielle O'Loughlin)

Preliminary results of the OSL dating of deposits yielding early petroglyphs and Lower Palaeolithic artefacts at Daraki-Chattan Cave in central India

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Keywords: OSL dating, Daraki-Chattan Cave, India, Palaeolithic, rock art

Efforts are being made to obtain scientific dates for the early petroglyphs found in the excavations at Daraki-Chattan Cave (DC) in the quartzite buttresses of the Indragarh Hill, India. This work is part of the project, 'Scientific dating of the world's earliest rock art of the world' jointly with the Rock Art Society of India (RASI), Australian Rock Art Research Association (AURA) and the Madhya Pradesh Council of Science and Technology (MPCST), Bhopal (India). We collected twelve samples for Optically Stimulated Luminescence (OSL) Dating, ten from older alluvium sediments yielding Lower Paleolithic artefacts. The samples were processed at the Birabal Sahani Institute of Paleosciences, Lucknow (India) to isolate quartz/feldspar grains for OSL dating. The samples collected from the sites were treated with 2N solution of HCl to remove carbonates and with H2O2 to take away organic materials. The fine grains (4-11 mm) aliquots were prepared on the Al discs after Stokes' Law. The aliquots were investigated on TL/OSL Reader at Madhya Pradesh Council of Science and Technology (MPCST), Bhopal (India) to determine the equivalent dose from luminescence signals of the polymineral fine grains. The age estimation was made after finding the radiation dose rate from measurements of radioactive elements (K, U, Th and Rb) using a high pure Ge detector.

Brazilian Mur-e? On Percussion Lithic Tools Possibly Applied in Petroglyph Production found in Rio Grande do Norte State, Northeast Brazil

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Keywords: Mur-e, direct percussion, petroglyphs, Brazilian Northeast

Mur-e is an aboriginal term found in archaeological literature to designate lithic tools used in petroglyph production. Inspired by the same concept, this work presents a preliminary analysis of a sample of lithic tools bearing direct percussion facets and step flaking scars found in petroglyph sites in Rio Grande do Norte state, northeastern Brazil. Experimental replication on petroglyph production in different lithologies have shown that step flaking scars on hammerstones involved in direct percussion are the most common result considering this task. This in turn, suggests the possible application of this type of flaking as a diagnostic feature to deduce implication in petroglyph production, given the additional contextual associations with rock art sites and panels. The sample analyzed was recovered from the immediate vicinities of granite boulders and outcrops with petroglyphs that have been recently submitted to a microerosion direct dating procedure and age results spanned from 5.000 BP to 476 BP, showing multiple instances of petroglyph production in the same sites over this period. Notwithstanding, contextual information regarding material culture associated to rock art is still scarce in the corresponding archaeological record. Therefore, studies on lithic tools associated to rock art production can importantly increase our knowledge within this gap.

U/Th dating of rock paintings of the Jinshajiang River, Yunnan, China

The rock art and the associated 71 sites located in the Jinshajiang River valley, in the north of Yunnan Province, southern China, are receiving an increasing amount of attention by scholars. The valleys, with luxuriant vegetation, were mainly formed by many multilayered carbonate rocks which were deeply cut by the rivers. White, yellow, red and black mineral pigments were used to produce the paintings on the panels in the limestone caves and shelters. The theme of the rock art includes various animals such as 'buffaloes, cervidae, monkeys, tapir, boars' and some geometric patterns. To determine the age of the rock art, 13 secondary carbonate layers above and 2 below the paintings were studied for their mineralogy, oxygen and carbon isotopic compositions and dated by the 230Th/U method. Four results with the earliest 230Th/U dating results, 23789±5033, 20077±2742, 14733±783, and 14930±637 yrs. BP, demonstrate that the ages of the rock paintings could be as early as the Palaeolithic age.

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Keywords: China, Jinshajiang River valley, U/Th dating, rock art, Palaeolithic

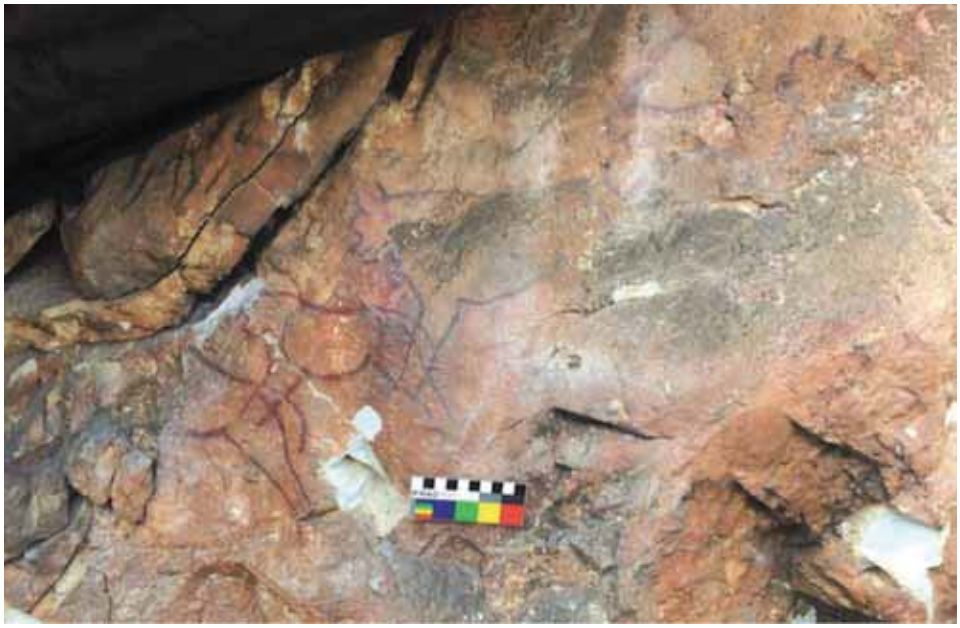

Fig.1 - The rock art, bovidae and cervidae, from the Jinsha Valley, Yunnan, China. (photo Tang Huisheng)
Fig.2 - Monkey images of the rock art from the Jinsha Valley, Yunnan, China. (photo Tang Huisheng)

Characterisation of the geological environment of rock paintings in San Jose del Guaviare, Colombia

The recent research of GIPRI (Research Group of Indigenous Rock Art) in agreement with GEGEMA (Group of Studies in Economic Geology and Applied Mineralogy) has enabled us to undertake rigorous studies of the geological rock art supports and orography of the Serranía de la Lindosa (Guaviare, eastern plains of Colombia). The results of this research will be the subject of this paper. The relationship between the geomorphology and possible site interactions since prehistory, the lithic bases chosen to make the pigments, the possible sources of raw materials for pigments and transit routes during prehistory are some of the results that will be presented. Each of these aspects are part of the considerations in trying to understand rock art in its relationship with the natural and geological environment. It is evident that those who made the rock art murals thought about their environment, and that the selection of the spaces to alter was not random or neglected; on the contrary, everything indicates that there was a clear awareness of the geological rock art support, and the implications that this had for the application of pigments.

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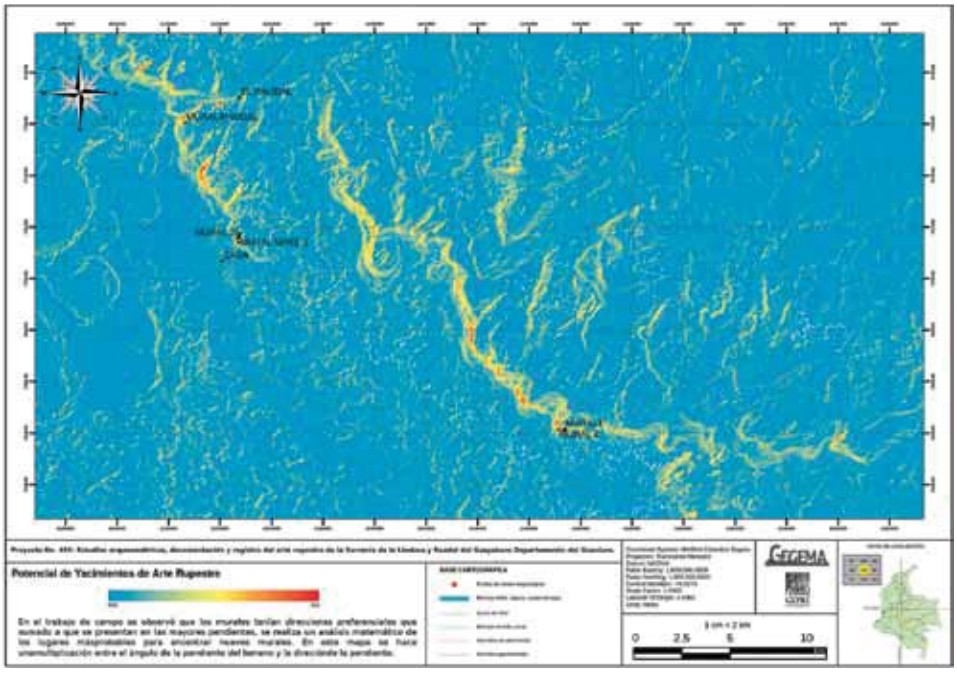
Keywords: geology, morphology, travel routes, lithic supports, raw materials, rock painting



Illumination, embodiment, and cooperation among Upper Paleolithic Cave Artists

Finger flutings – lines drawn in the soft surfaces of cave walls and ceilings – leave behind evidence of unique individuals and their engagement with cave environments. Found in over fifty caves in Europe, this paper looks at issues of embodiment (i.e. how people moved through the caves, how they use their hands, feet, bodies) in the creation of finger flutings. It also considers the role of light by asking questions of how panels were created and how individuals navigated often challenging physical environments with small lamps or torches. Sharing recent experimental work on tallow candles, lamps, and light spectra, this paper literally sheds light on the process of finger fluting and the role of cooperation among finger fluters in the Upper Paleolithic.

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Keywords: finger flutings, caveart, Europe, Upper Paleolithic, embodiment, illumination

Fig. 1 - Rouffignac Cave, France. (photo Leslie Van Gelder)
Fig. 2 - Rouffignac Cave, France. (photo Leslie Van Gelder)