a5

MADE FOR BEING VISIBLE. DEVELOPING 3D METHODOLOGIES FOR THE STUDY OF ROCK ART CARVINGS

Miguel CARRERO-PAZOS, *Departamento de Historia, GEPN-AAT, Universidade de Santiago de Compostela, Spain*

Benito VILAS-ESTÉVEZ, *Departamento de Historia, Arte e Xeografía, Universidade de Vigo, Spain*

Alia VÁZQUEZ-MARTÍNEZ, *Departamento de Historia, GEPN-AAT, Universidade de Santiago de Compostela, Spain*

Contact email: miguel.carrero@usc.es; benito.arborearqueoloxia@gmail.com; alia.vazquez.mtnez@gmail.com; miguel.carrero.pazos@gmail.com

Doubtless, the expansion of computer research throughout archaeological science has contributed to the growth of new different approaches in archaeological research, and one of them had been the representation and study of archaeological sites and objects by their virtual reconstruction (3D). This is particularly clear in rock art studies where 3D modelling has been one of the most important revolution, in which corresponds to documentation methods and evaluation of the rocks. However, there is a clear lack of standards concerning which are the best methods to use or which is the basic workflow to ensure the most accurate reproduction.

The purpose of this session will be to present different case-studies, centred on the application of 3D modelling and post processing techniques in relation to the study of rock art carvings. It seeks for examples where the use of different virtual documentation methods has implied a better understanding and knowledge in rock art panels.

In this sense, the aim of the meeting will be to learn from those heterogeneous experiences, and show how the use of 3D techniques might assist in improving rock art research, a main step in which it corresponds to interpretation. Four lines of interest are proposed, such as:

- Current methods for rock art recording. From traditional (hand-made) methodologies to the use of New Technologies (Laser scanner, photogrammetry).
- Constructing the mesh. The first (main?) part of the workflow?
- Post processing techniques. Artificial lights, automatic ways to enhance the motifs.
- Going over the 3D model. Generate virtual tracings of rock art panels.

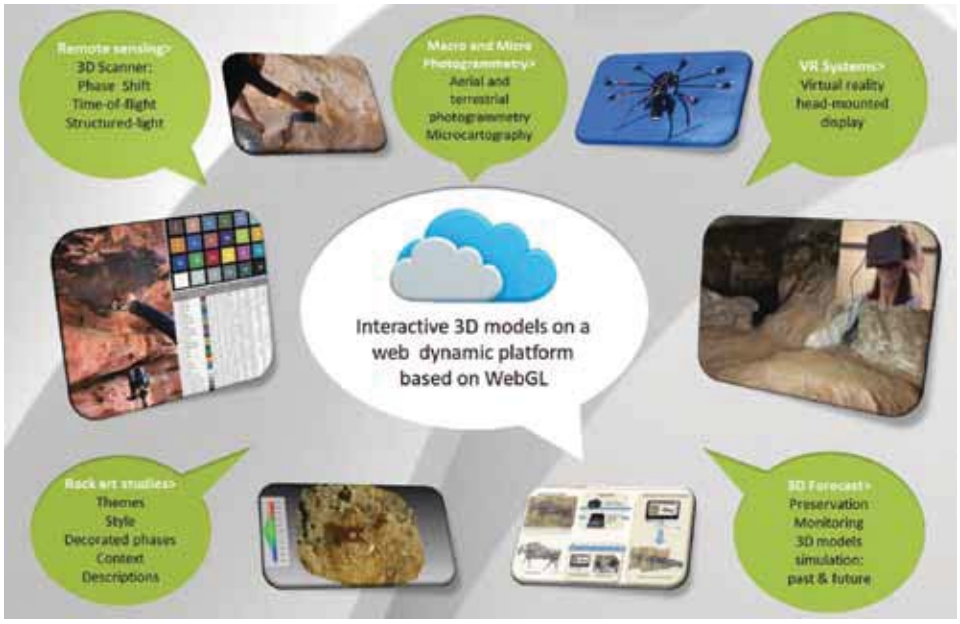
Communications and posters will be welcome. Especially those that deal with new computer approaches to study rock art 3D models. Demonstrations of software or 3D analysis are also welcome in this session, in order to get a more practical meeting rather than a traditional one.

A retrospective view on integration and democratization of 3D models in rock art

Jorge ANGÁS, *Universidad Politécnica de Madrid, Spain*
Hipólito Collado, Manuel Bea, José Ramón Bello
Contact email:
j.angas@3dscanner.es

Keywords: rock art, 3D-Scanner, SfM photogrammetric techniques, 3D models dissemination, WebGL

New technological applications for the recording and representation of rock art is so heterogeneous that it requires the development of new techniques. The complexity of the techniques used hinders interdisciplinary understanding, without enabling the establishment of a standardised methodology. Procedures must be normalised and directed, on the one hand, towards scientific analysis, and on the other, towards dissemination and comprehension of the generated data and its applications. It is necessary to aim the recording process at combined objectives, including aspects of recording, preventive control, conservation and interpretation, to benefit a more complete scientific analysis. In order to achieve full technological implementation, it is necessary to provide methods that are easily disseminated, for example, through the creation of databases in 3D web environments. This kind of data allows for instant viewing and analysis, offering valuable graphic and metric data of the three-dimensional model. Credible data is obtained this way, for control and analysis, while there is also a significant increase in the data obtained when recording. User level interactive databases, stored, for example, in JavaScript files in browsers, which integrate WebGL, favour open access dissemination methods, which render technical and scientific aspects more comprehensible.

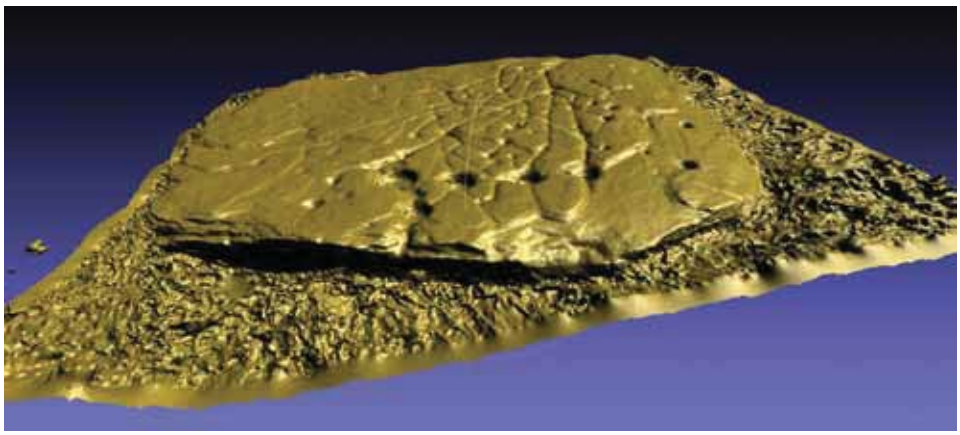


3D modeling demonstrates that some cup-marked boulders were squared off

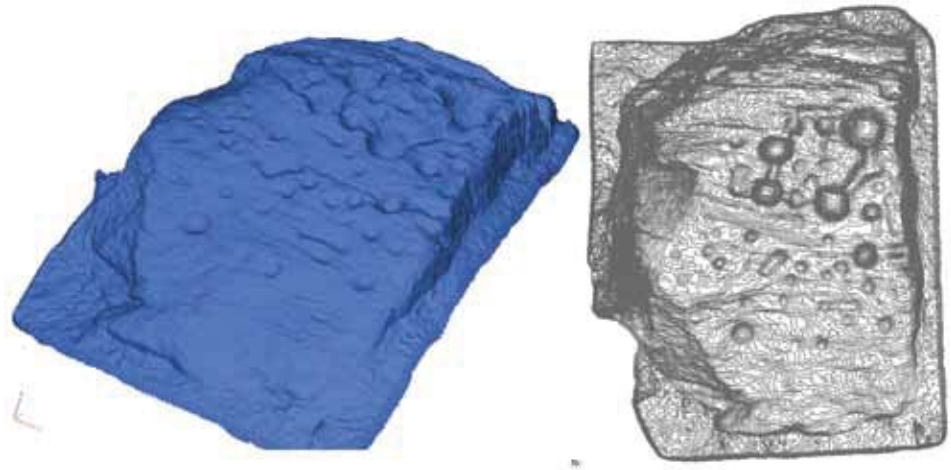
Recent 3D modeling – SfM technique – was performed on some of the most important cup-marked boulders of the western Alps in Italy, mainly from the Iron Age. Among them the Ròch dij Gieugh, Monsagnasco, Pera Crevolà, Crô da Lairi and Bric Lombatera stones. Some post-production features of 3D models, like the obtaining of curve-level drawings from DEM and QGIS, were also undertaken. The effective application used with the more deeply engraved rock art, cup-marks and basins, that can be treated as three-dimensional objects, is the inexpensive SfM-Structure from Motion technique which is more effective than on the shallow pecked figures, which on the contrary may be considered as dotted drawings; for these last a stereo-photometric based 3D model is preferred. Through the analysis of 3D models of cup-marked boulders, not only was a better visual reconstruction of the engraving sequence obtained, but also it was revealed that the boulder itself was in many cases prepared and squared in order to obtain a flat upper surface, well-suited for the purpose of offerings; thanks to the rotation of such three dimensional objects, it is also clear that some boulders were intentionally broken, confirming the ancient written ecclesiastical documents, where such actions over pagan stones and altars was mandated.

Andrea ARCÀ, *Cooperativa Archeologica Le Orme dell'Uomo, Pisa University, Italy*

Contact email:
aa_arca@yahoo.it



Keywords: cup-marks, 3D models, stone tables, boulder squaring off



Multisensor data acquisition and 3D enhancing strategies: the case of the Assa Valley rock art

The rock engravings of the Asiago Plateau (Province of Vicenza, Italy) are located on the calcareous, vertical walls of the Assa valley. For this project, we focus on the main rock of Tunkelbald, measuring ca. 20x4 m. with a chronological range from proto-historic to modern times, but predominantly representing the most recent phases. This paper presents a pilot study aimed at investigating the morphological and morphometric characteristics of a selection of engravings and at guaranteeing better outcomes in terms of public archaeology and touristic attractivity. 3D data acquired via laser scanner and structured-light scanner are used to create textured 3D models with micrometric resolution. Morphometric data is converted and processed with LiDAR-derived enhancing techniques such as multiple hillshading, openness, sky view factor, local relief model and many others. These applications offer the chance to read even the most weathered rock surfaces and better identify the iconographic motifs, but also help to reconstruct the tools used for engraving. Finally, the virtual reconstructions and the physical models obtained with the 3D prototyping system can be used for dissemination purposes in order to offer a direct visual, textural and tactile experience of the most significant representations that lie outside the eyesight of the visitors to the site.

Cinzia BETTINESCHI, *Department of Cultural Heritage: Archaeology and History of Art, Cinema and Music – University of Padova; Dipartimento Valcamonica e Lombardia – Centro Camuno di Studi Preistorici, Italy*

Luigi MAGNINI, Emanuela FARESIN, Giuseppe SALEMI, Armando DE GUIO, *Department of Cultural Heritage: Archaeology and History of Art, Cinema and Music – University of Padova, Italy*

Contact email:
cinzia.bettineschi@phd.unipd.it

Keywords: laser scanning, structured light, LiDAR data processing, rapid prototyping, Assa Valley rock art, public archaeology

Tailoring digital imaging techniques for the study of rock art panels

The application of digital imaging techniques to rock art panels is one of the most prolific research fields in the discipline, not only for the dissemination of 3D models to the general public but also to the researchers, with the development of more robust recoding methods. Thanks to the development of a research project at Campo Lameiro rock art site (Galicia, NW Iberia), more than thirty rock art panels were recorded using dense photogrammetry, later processed in Agisoft Photoscan software to obtain the 3D model of the whole panels. The purpose of this research is to show the application and improvement of cost-effective digital imaging techniques which have allowed us to highlight the grooves within the 3D models, getting an accurate picture of the carved motifs that can be used to carry out better tracings and, therefore, historical studies.

Miguel CARRERO-PAZOS,
University of Santiago de Compostela, GEPN-AAT, Spain
Benito VILAS-ESTÉVEZ,
University of Vigo, Spain
Alia VÁZQUEZ-MARTÍNEZ,
University of Santiago de Compostela, GEPN-AAT
Contact email: miguel.carrero.pazos@gmail.com, benito.arborearqueoloxia@gmail.com, alia.vazquez.mtnez@gmail.com

Keywords: 3D modelling, petroglyphs, radiance scaling, mesh, laplacian smoothing, MeshLab, Galicia

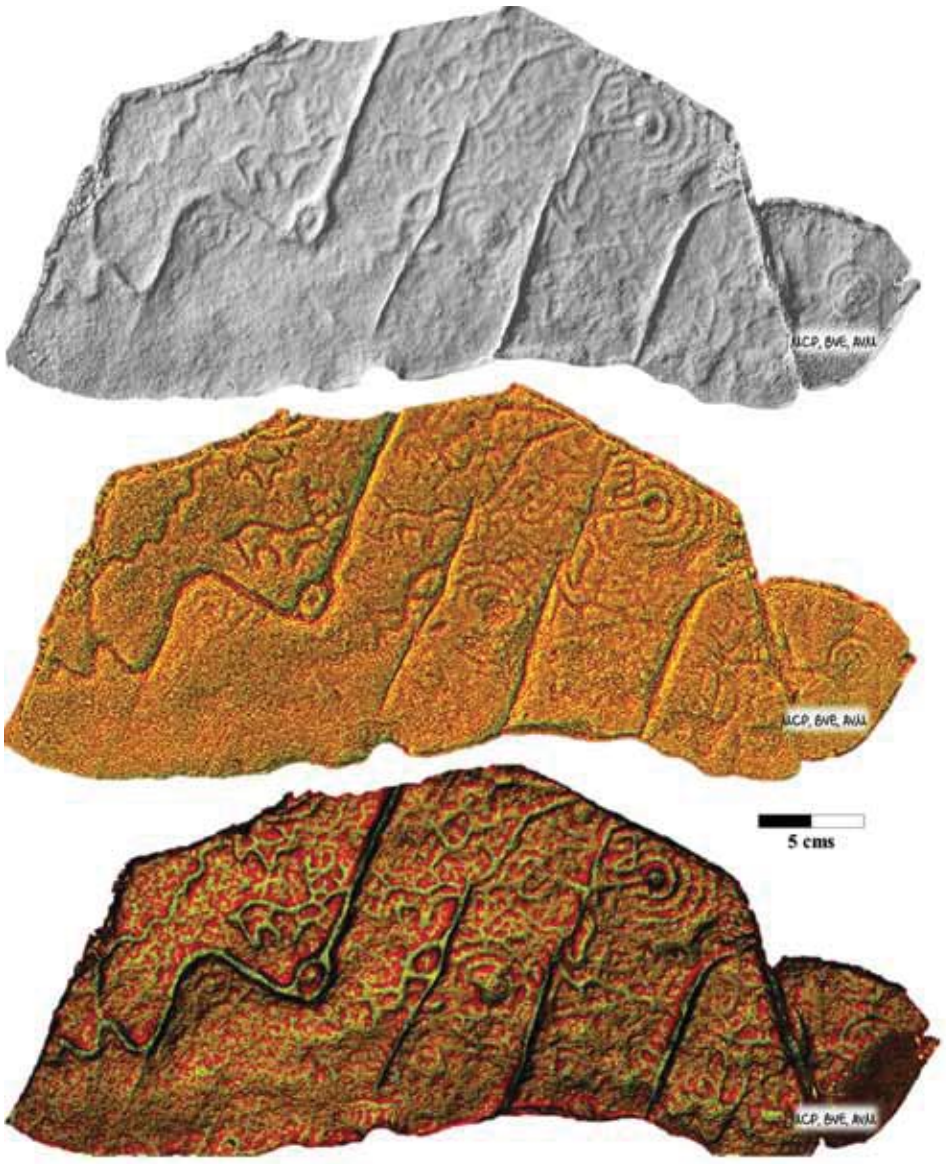


Fig. 1 - Pedra de San Francisco, post-processing images.

Open source software and high performance computing applied to rock art documentation: the case of Santana do Campo (Arraiolos, Portugal)

Between 1914 and 1918 Vergílio Correia identified and published several engraved boulders at Santana do Campo (Évora district, Portugal) in the framework of a research project that he was developing at the megalithic complex of Pavia. To date, the analysis of these sites has only been possible through the tracings and photographs published by Correia (1921). The research was resumed in the framework of more recent works directed by Leonor Rocha and Ivo Santos. The sites have been newly recorded and interpreted through the application of photogrammetric techniques and the numerical analysis of 3D meshes, that offers a new insight into the iconography of engraved motifs. The novelties of the methodology here presented lies in the use of open source software and libraries and the use of high-performance computing (HPC) for processing a large number of photographs.

Enrique CERRILLO-CUENCA, *Prehistoria, Historia Antigua y Arqueología, Universidad Complutense de Madrid, Spain*

Leonor ROCHA, *University of Évora, Portugal*

Ivo SANTOS, *CIDEHUS-University of Évora, Portugal*

Contact email: enrique.cerrillocuenca@gmail.com

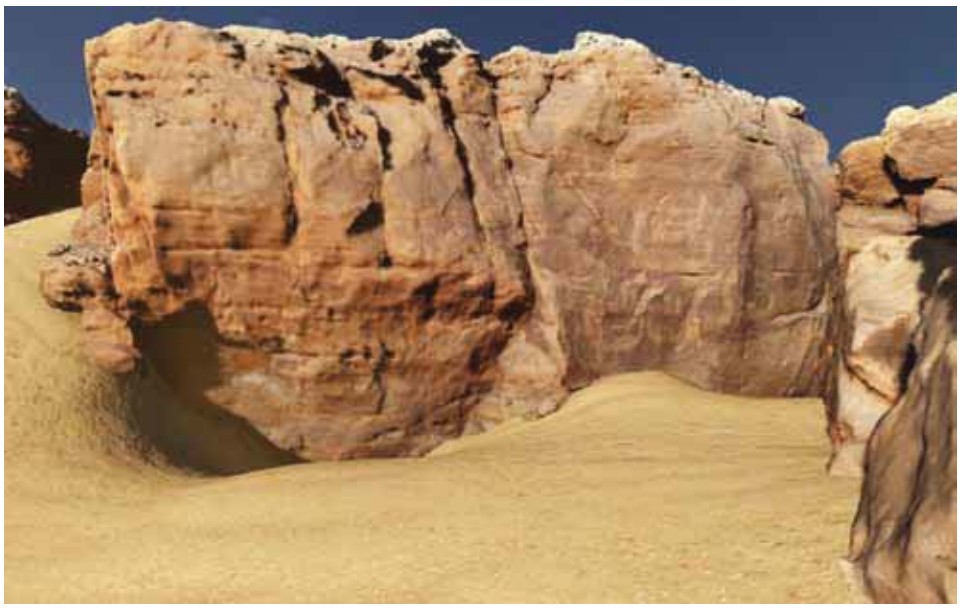
Keywords: photogrammetry, open source, HPC, Santana do Campo, Portugal

Digital imaging techniques for the documentation of archaeological rock art sites: The Aswan – Kom Ombo Archaeological Project field experience

Antonio CURCI, *University of Bologna, Italy*
Alberto URCIA, *Yale University, UK*
Maria Carmela GATTO, *University of Leicester, UK*
Contact email: antonio.curci@unibo.it

Keywords: Egypt, Predynastic, Structure from motion, Panotour, GigaPan

Documenting rock art using imaging-based recording techniques (photogrammetry) and tridimensional survey, beside the classical epigraphic methods, has become the main approach that supports the entire research on rock art by the Aswan-Kom Ombo Archaeological Project. The applied methodological framework is flexible so to be adjusted according to the several types of rock art sites found in our concession. In general terms it consists of geo-locating the archaeological evidence using global or relative coordinate systems; documenting three-dimensionally the landscape if meaningful, documenting details in high resolution (of rock art panels, inscriptions, single figures etc.), and elaborating in a post-processing stage advanced visual-graphic works, such as virtual restauration, 3D reconstructions and Virtual Reality tours and anything that can provide a better understanding of the site in its entirety. Software that has been recently developed (especially those supporting Structure from Motion technique) completely changed the potential and the perspectives of rock art and archaeological documentation. They increase enormously the advantages in terms of acquisition time and quality/quantity of the acquired/processed information. Our contribution will present the digital documentation process applied to the most relevant rock art sites in our concession area, in the region between Aswan and Kom Ombo in Egypt.



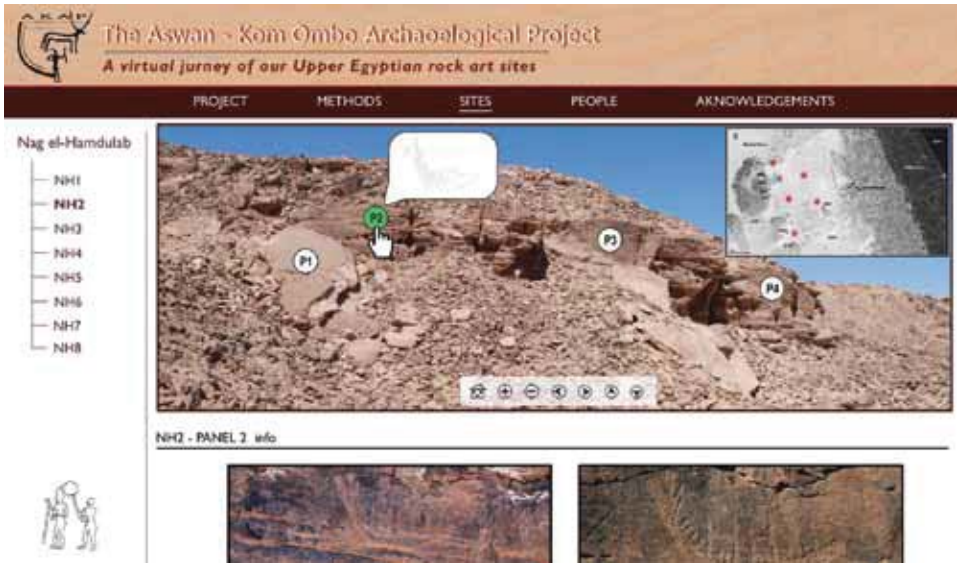


Fig.1 - Virtual reconstruction of the main panel at site Nag el-Hamdulab.

Fig.2 - Preview of the Nag el-Hamdulab virtual tour.

Rock art as microtopography: a cost-effective method to enhance engravings

Discolorations of the rock can obfuscate engravings, rendering traditional recording methods ineffective. Structure from Motion (SfM) photogrammetry and Geographic Information System (GIS) tools can be used to enhance camouflaged engravings. The method makes engravings visible that are not detected in the field, which results in a digitally traced record with a higher level of confidence in the data than a manual recording. Using a GIS algorithm not only highlights the engravings, but also allows for a pioneering way to digitally trace and classify motifs, resulting in a spatially-linked database. The combination of SfM photogrammetry and GIS tools introduces a cost-efficient method to effectively enhance, document, and analyze engraved rock art.

Andrea JALANDONI, *Place, Evolution and Rock Art Heritage Unit (PERAHU), Griffith Centre for Social and Cultural Research (GCSCR) & Australian Research Centre of Human Evolution (ARCHE), Environmental Futures Research Institute (EFRI)*

Maria KOTTERMAIR, *NASA EPSCoR Program, University of Guam*

Contact email: andrea.jalandoni@griffithuni.edu.au; mariakottermair@gmail.com

Keywords: rock art, Structure from Motion, photogrammetry, Geographic Information Systems

SfM and Photometric Stereo, comparison between 3D modelling techniques for accurate rock art recording

Carla MANNU, *Department of Electrical and Electronical Engineering (DIEE), University of Cagliari, Italy*

Michele MAZZURANA, *Laboratorio "B.Bagolini", Dep. Of Humanities, University of Trento, Italy*

Fabio CAVULLI, *Laboratorio "B.Bagolini", Dep. Of Humanities, University of Trento, Italy*

Massimo VANZI, *Department of Electrical and Electronical Engineering (DIEE), University of Cagliari, Italy*

Contact email: ca.mannu@gmail.com

Keywords: 3D modelling, photometric stereo, Structure from Motion, SfM, Pianaura, rock-shelter

The survey of Pianaùra engravings complex (Arco, Trento, NE Italy) has been the occasion to test an integrated recording methodology based on a multilayered approach ("Un approccio multilayered alla documentazione e interpretazione dell'arte rupestre …" in XXVI Valcamonica Symposium 2015). 2D photogrammetry, contact drawing, and frottage, have been applied to the 30 meters slab surface under the rock-shelter where a variety of overlapping symbols are clustered. These documentations have been georeferenced and imported in a GIS platform to be compared and interpreted using digitization. Different 3D recording approaches have been compared in pairs. Photometric stereo, a photogrammetric technique well known in scientific applications and recently used as a fast and cheap method for documenting engravings and reliefs within rock art research, is compared with another well-known 3D photogrammetric technique often used in archaeology: Structure from Motion. The acquisition steps are very easy and the output 3D model enables a meticulous reconstruction in both cases. In this paper, objective and subjective quality tests of the same surface are undertaken, to evaluate the strengths and weaknesses of both methods, for their application in archaeological research.

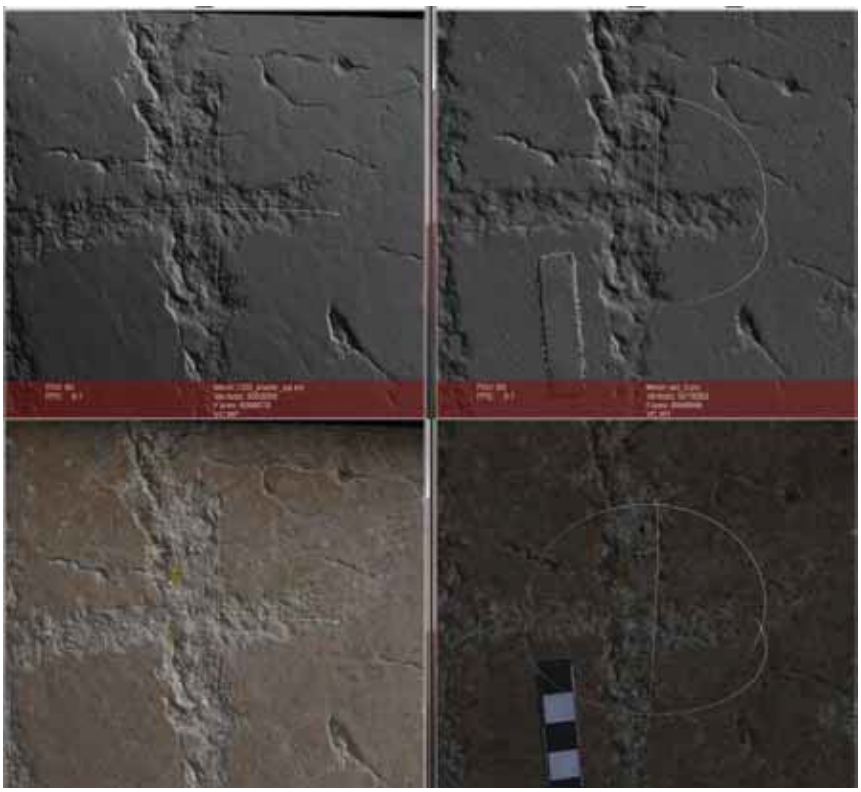


Fig.1 - Pianaùra site, Arco, Trento, Italy.

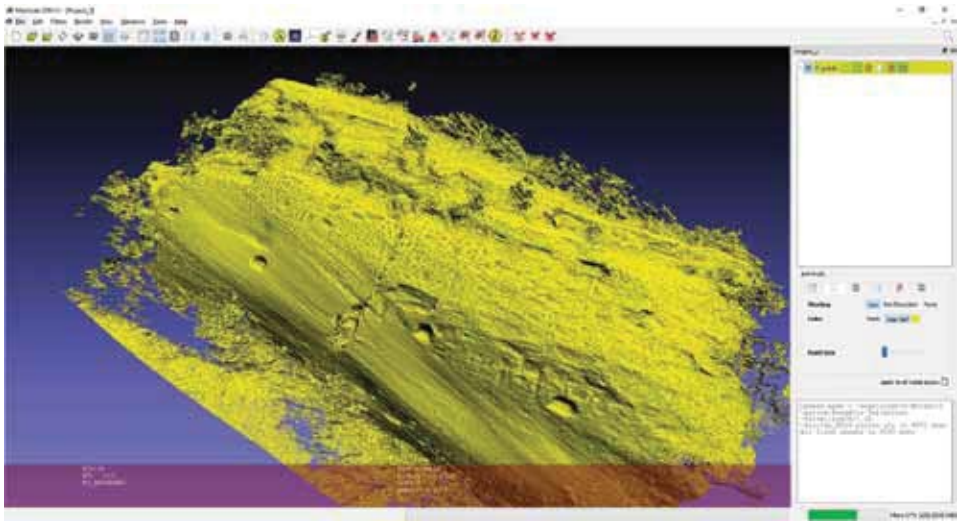
Fig.2 - Engravings comparison between Photometric Stereo and Structure from Motion reconstruction techniques

Close encounters of the third dimension. Recording the three-dimensionality of the "topographic representations" in the Aeneolithic rock art of Valcamonica and Valtellina (Lombardy, Italy)

Angelo MARTINOTTI, *Istituto Archeologico Valtellinese, Italy*
Alberto MARRETTA, *Parco Archeologico Comunale di Seradina-Bedolina, Italy*
Contact email:
angelomartinotti@libero.it;
alberto.marretta@gmail.com

Keywords: Valcamonica, Valtellina, "topographic representations", Copper Age, three-dimensional recording, SfM

In the narrow figurative repertoire on outcropping rock surfaces of the Central Alpine rock art in the Aeneolithic age (second half of IV-III millennium BC), the "topographic representations" – abstract compositions of regular geometric figures commonly considered as portrayals of anthropised landscapes – are one of the most significant and enigmatic subjects. As juxtapositions of modular constituents often arranged in articulated complexes, these representations show considerable compositional solutions of adaptation to the morphology and the natural unevennesses of the rock support: sinuosities, glacial grooves, small ditches, bumps and fractures are purposely exploited in the figural plan through subtle adaptive mechanisms that can acquire meaning also on the interpretative side. This is a peculiarity that the traditional graphic recording methods used for rock art, such as the manual tracing on transparent sheets generally implemented in the alpine region, fail to render successfully due to their bi-dimensional nature, which is indeed able to convey only the planar development of the engraved surface. This study proposes the application of the photogrammetric range imaging technique called "SfM" ("Structure from Motion") to a properly selected sample of Aeneolithic "topographic representations" from Valcamonica and Valtellina in order to record their three-dimensional features connected to the rock surface morphology, aiming to set this aspect off in an exegetical perspective.



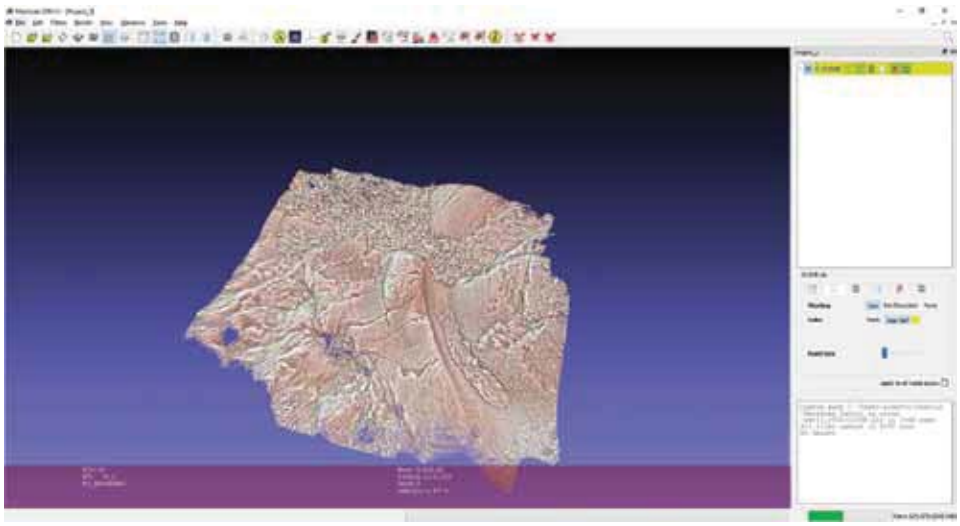


Fig.1 – Grosio (SO, Valtellina), Dosso Giroldo: enhanced three-dimensional rendering of the "topographic representation" on rock 14; middle Aeneolithic age (3000-2500 BC).

Fig.2 – Capo di Ponte (BS, Valcamonica), Seradina II: enhanced three-dimensional rendering of the "topographic representation" on rock 18; Aeneolithic age (3400-2500 BC).

3D scanning and photogrammetry documentation and analysis of rock art panels in the canyons of the Mesa Verde region, Colorado, USA

Radoslaw PALONKA,
Department of American Archaeology, Institute of Archaeology, Jagiellonian University in Krakow, Poland
Boleslaw ZYCH
Contact email:
radek.palonka@uj.edu.pl

Keywords: Ancient Pueblo rock art, Mesa Verde, cliff dwellings, 3D scanning, photogrammetry

The paper focuses on the modern techniques of documentation, such as photogrammetry and the laser scanning of rock art sites (petroglyphs and paintings) located in a number of canyons in the central Mesa Verde region in southwestern Colorado (USA). The research was conducted over the course of several seasons by the Sand Canyon-Castle Rock Community Archaeological Project led by the Institute of Archaeology, Jagiellonian University in Krakow. The petroglyphs and paintings from the project research area include Ancient Pueblo and Fremont rock art depicting shamans and warriors, geometric motifs which are connected with astronomical observations as well as historic Indian petroglyphs, mainly created by the Navajos and Ute, illustrating clan symbols, fighting warriors and hunting scenes with buffalo and deer. The registered data has been used to generate accurate 2D documentation and 3D models (the equipment for scanning included a Faro scanner). The 3D models that were generated have also been used to interpret some details by varying the position of the light (for example with the use of RTI software). Another element is the virtual 3D models that we used in the game engine and Digital Elevation Model that encompasses the sites and the associated environment.

Fig.1 - Site 5MT129 in Sand Canyon, Colorado. (photo R. Słaboński, © by Sand Canyon-Castle Rock Community Archaeological Project)

Fig.2 - Site 5MT13288 (Painted Hand Petroglyph Panel) in Sandstone Canyon. (photo R. Słaboński, © by Sand Canyon-Castle Rock Community Archaeological Project)

Imperfect geometries of Galician Open-air rock art carving

Darío PEÑA-PASCUAL, *University of Santiago de Compostela, Technological Research Institute, Spain*

Contact email: emaildariop@gmail.com

Keywords: rock art, 3D methodologies, photogrammetry, image processing, uncertainty, spatial representation

Open-air rock art carving is one of the best-known and studied tangible entities among those that make up the archaeological record in Galicia. It is characterized by representations of both abstract and naturalist motifs, usually on granite. Among the most novel contributions to his study, we find the development of new methodologies of three-dimensional recording and obtaining of digital tracing by means of digital photogrammetry. These methodologies work with the traditional prehistoric groove model that can be found across the bibliography. An open and very eroded "U" Groove. The starting point of our work is a groove model with a concave geometry at the base and an open and convex geometry on the sides; an imperfect geometry with spatial limits difficult to define or vague. We propose both a methodology of computational analysis of the groove and a way of representing it.

1. Photogrammetrical register of the panel in order to obtain a 3D model.
2. Export a three-dimensional point cloud, from which we interpolate a digital surface model (DSM).
3. Computational analysis, by means of an Octave script, of concavity and convexity in the DSM; and classification of the obtained values, based on the certainty of representing a groove.

Study of Lost Reality: Photogrammetric 3D-modelling of Ancient Art Instances in Ukraine

Simon RADCHENKO, *Kiev National University of Construction and Architecture, Kiev, Ukraine*

Nadiia KOTOVA, *Insitute of Archaeology of National Academy of Sciences of Ukraine, Kiev, Ukraine*

Dmytro KIOSAK, *Odessa I.I. Mechnikov National University, Odessa, Ukraine*

Oleg TUBOLTSEV, *National Reserve of Khortytsia, Zaporizhzhya, Ukraine*

Contact email:
simon.radchenko@gmail.com

Keywords: Mesolithic, Kamyana Mohyla, photogrammetry, 3D modeling, rock art

3D modelling offers a new prospective for studying ancient items regardless of the object's actual state and location. This is supported by the latest research on the Kamyana Mohyla prehistoric site located in the Ukrainian steppes. This site is known as a location with numerous examples of ancient rock art, as such, it is an effective location for research on prehistoric cultures. Finds from the 2016 field season resulted in interpretations of animal-like sculptured images made of local sandstone. According to analysis, the objects belong to the Mesolithic Kukrek Culture layer, which is dated to 8500—7400 calBC. To collect all the available information concerning these finds, qualitative research of their structure and texture was needed. These features were recorded using photogrammetric 3D-modelling including measuring, scaling and referencing. Use of a model is the most productive way to describe the complicated shape of investigated objects. Furthermore, it reveals their original state. Thus, photogrammetric modelling appears to be the way to store visual information about recently deteriorated reality and to make spatial visual reconstructions and assumptions concerning the ancient state of objects. This is extremely important considering that unique and unmatched objects might suffer damage during archeological study.

Fig.1 - Kamyana Mohyla 1. 3D model of snake-like sculpture image before cleaning. (by Simon Radchenko)

Fig.2 - Kamyana Mohyla 1. 3D model of snake-like sculpture image after cleaning. (by Simon Radchenko)

The petroglyph site of the Mount Bego area (Alpes-Maritimes, France): trial for a global modelling project in 3D

Silvia SANDRONE, *Musée départemental des Merveilles, Tende, Alpes-Maritimes, France*
Vincent MADELAIN, *Conseil départemental 06, Direction des Services Numériques*
Jean-Marie STRANGI, *Musée départemental des Merveilles, Tende, Alpes-Maritimes, France*
Contact email: ssandrone@departement06.fr

Keywords: Mount Bego, 3D modelling, photogrammetric, UAV, LIDAR, Reality Capture

Since 2012, The Departmental Museum of Marvels, in collaboration with the Alpes-Maritimes Department Territorial Information Service, have launched a 3D modelling project of the Mount Bégo rock engravings. This was mediation rather than research. Thanks to the multi-resolution 3D models (max. res.: 60 microns) obtained by the photogrammetric 3D capture, and 3D virtual globe technologies, a global virtual project has been initiated. The first application is a 3D real-time application and virtual guided tour of the site, available on a multi-touch screen, in the permanent exhibition area of the museum. Looking to the future, the proposed archaeological operation is built around three different but complementary levels of details: 1. 3D modelling of the Mount Bego's most significant rocks, using the sub-millimetric ground photogrammetric method; 2. 3D photogrammetric modelling of the largest rocks such as the Altar Rock, the Glazed rock face, the Sacred Way, etc. from images provided by drone survey; 3. 3D landscape-modeling by photogrammetry using aerial images provided by microlight (or a small aircraft), or possibly even by using the LIDAR (Light Detection And Ranging) mapping technique. The ultimate aim is the creation of a 3D geodatabase within which to integrate all the results of these field researches.

Fig.1 - Detail of a 3d engraving. (© CD06 – DSN SIT - Musée des Merveilles)

Fig.2 - Field research. (© CD06 - Musée des Merveilles)

An artificial intelligence software platform to understand and preserve the epigraphic complex of Grotta Poesia cave-sanctuary at Roca Vecchia (Melendugno, Lecce, IT)

Teodoro SCARANO, *Ass. Vivarch; Dipartimento di Beni Culturali, Università del Salento, Italy*

Italo SPADA, *CETMA - Virtual, Augmented Reality and Multimedia Department*

Contact email:
teodoroscarano@yahoo.com;
italo.spada@cetma.it

Keywords: cave-sanctuary, rock art, epigraphy, artificial intelligence, photogrammetry, 3D

Many IT systems based on artificial intelligence (AI) as well as accurate relief techniques are essential tools in managing research and valorization projects of the cultural heritage. The more challenging the environmental and working conditions, the more crucial are technologies. The cave-sanctuary "Grotta Poesia Piccola", located in the Roca Vecchia archaeological area in southern Apulia, is part of a karstic system nowadays flooded by the sea. The walls are almost completely covered by graphic and alphabetic evidence, very often engraved one over the other in varying sizes, they begin from the current sea level up to a height of 7 meters. The cave is an outstanding case study to test appropriate tools for the documentation and preservation due to the volume and uniqueness of the rock art and parietal inscriptions. The present work describes the first prototype of a potential AI software platform for the analysis and co-working of captured digital 3D data. The main goal is to update the AI platform with new and innovative tools in an attempt to allow scholars to acquire, decode, share and preserve the figures and parietal inscriptions engraved on these cave walls since prehistory until the Roman Age.

Fig.1 - Virtual Reality interactive platform prototype. (Cetma-Virtual, Augmented Reality and Multimedia Department)

Digital Epigraphy, Metadata and Immersive 3D models: A Virtual Dive into Upper Egyptian Rock Art sites

Alberto URCIA, *Yale University*
Contact email: alberto.urcia@yale.edu

Keywords: Egypt, immersive archaeology, rock art, digital epigraphy, metadata

Since 2014, the Elkab Desert Survey Project (EDSP) has recorded a wealth of rock art and inscription sites in the Eastern Desert of Upper Egypt. During this period, multiple new technologies have become available, and we have continuously developed the use of digital equipment and software to improve and update our documentation. Through extensive field experience and experimentation on one hand, and the increasing need of non-invasive approaches on the other, we could standardize our workflow created to record ancient Egyptian petroglyphs within their topographic context. Computer graphic enable the EDSP to go from site discovery (e.g. el-Khawy) to publication within a single field season, fulfilling all research goals in an effective and accurate manner. Thanks to the new digital epigraphic method that we developed, it is now possible fully to replace the longstanding use of plastic sheets to trace on the rock surface. These results allow us to tackle another goal: presenting these unique sites to the public. The quality of the data that can be currently produced using 3D imaging, combined with systems able to create immersive virtual tours, is offers new exciting opportunities to bring inaccessible rock art locations to anyone in the world.

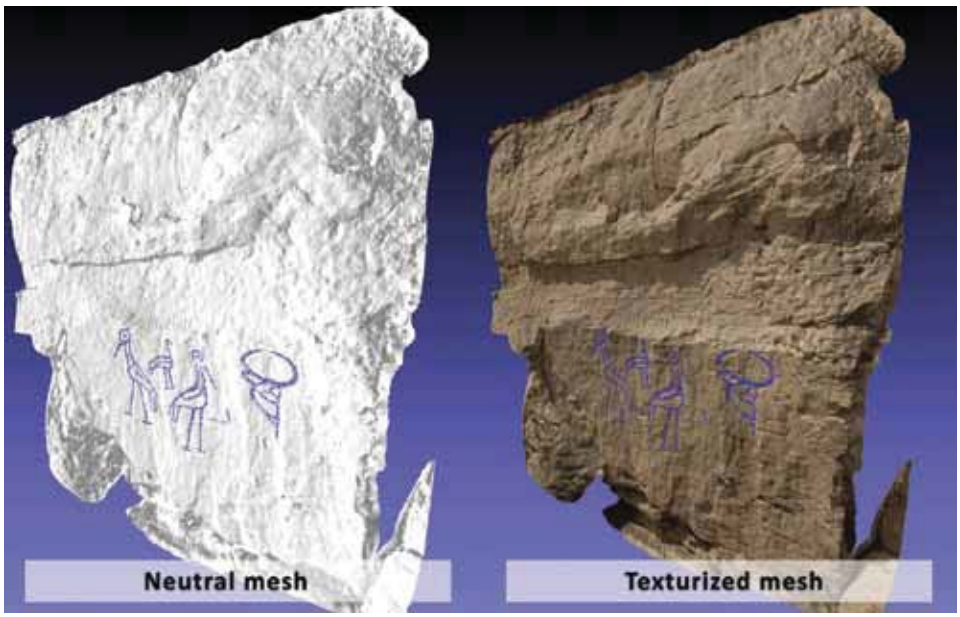


Fig. 1 - Perspective view of the dynasty 0 monumental inscription at El-Khawy (Edfu - Egypt) showing the glyphs, previously traced digitally, repositioned on the 3D surface (with neutral color on the left and photo-realistic texture on the right)

Fig. 2 - Screen shot from the Virtual Tour of one of our rock art site in Upper Egypt. The 3D platform allows virtual and immersive visits and the interaction with contents.

Changing faces: applying different recording systems to megalithic art

The last decades have seen a significant breakthrough with regards to the recording of rock art. From the usual rubbing/plastic sheets and day-light recording there has been a move to the systematic use of artificial light and lately assorted protocols involving photogrammetry. The latter has the double advantage of avoiding direct contact with the art and obtaining a clearer picture of the actual representations. In our contribution we deal with several decorated megaliths from Galicia (NW Spain) that were recorded years ago by rubbing on paper with or without the use of artificial light and are now revisited by using photogrammetry. We undertake an appraisal of the results offered by these different means of recording.

Alia VÁZQUEZ-MARTÍNEZ,
University of Santiago de Compostela, GEPN-AAT
Ramón FÁBREGAS-VALCARCE,
GEPN-AAT, University of Santiago de Compostela
Carlos RODRÍGUEZ-RELLÁN,
GEPN-AAT, University of Santiago de Compostela
Contact email:
alia.vazquez.mtnez@gmail.com;
ramon.fabregas@usc.es;
carlos.rellan@usc.es

Keywords: 3D modelling, megalithic art, traditional techniques, Galicia

Fig. 1 - Penelas, Rodeiro, Pontevedra, Spain. (photo Ramón Fábregas)