

Rock Art, Landscape and Prehistoric Settlement at the High Atlas (Morocco)

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This project focuses on the rock art area of Oukaïmeden, at the High Atlas (Morocco), under the scope of the so-called Landscape Archaeology. From an archaeological perspective, landscapes are composed of a number of perceptible and measurable elements, among which there are a number of relationships. In this project we aim to understand the way these elements are connected and the way by which human beings inscribe their own culture on it. To this end we rely on Geographical Information System methodologies. With these methodologies, land cover, mobility between the valleys, pathways, cost surface, visibilities, sunstroke etc. will be analyzed to find out whether there are relevant connections between art and critical resources of the territory, as pasturages, water, routes of access, etc.

Keywords: Landscape archaeology, Rock Art, GIS, Pathways, Cost Surface, Visibility

1. Introduction

Landscape Archaeology aims to study the perception, not only physical but emotional, that human beings have regarding the space they are moving in and the way they inscribe on it their own culture and experiences of being in the World in a phenomenological sense (HEIDEGGER, 2003). Therefore we can say that there are as many landscapes as socioeconomic organizations, and they differ from each other depending on the pattern of economy, social structure, and material and mental (rational) control of their physical surroundings.

This project focuses on the rock art in the area of Oukaïmeden, a high valley 80 km south of Marrakech, located at 2630 m. above sea level (Figure 1).

Historical records from 16th century AD onwards describe the exploitation of the previously mentioned area as summer pasturage exclusively by two tribes proceeding from the villages of the Rerhaya valley to the West and the Ourika valley to the East (MAHDI, 1999; FRANCHI, 2005). The hypothesis we want to test is that the prehistoric rock art of the area is connected with a seasonal but regular occupation of the valley that started

in the Middle Holocene period (Sub boreal), i.e. 6000 BP, when the climatic conditions of seasonality started and differences in climate and vegetative growth justified the periodic movements between the valley and the mountain (see ALIFRIQUI, 2002). In that sense, the rock art could have served as a kind of mental map, conveying information both on sacred and profane matters, as entrances, resources, rights of access and/or prohibitions.

To test our ideas we are developing a field study including GPS positioning of archaeological and rock art sites, digging, 14C, and archeobotanical sampling and landscape modelling by means of GIS.

We offer to discuss some first results on the GIS appliance devoted to modelling the Oukaïmeden rock art landscape.



Figure 1: View of the study area.

2. Background of archaeological knowledge in the High Atlas region

Research on Oukaïmeden rock art started in 1949 and since then works continued on and off until a general Corpus was produced by Malhome in 1959. Nowadays the Centre National de Patrimoine Rupestre (SALIH *et al.*, 1998) is in charge of the research, being responsible for testing pits in the area. At the moment it has only provided one 14C dating result for the rock art area, dated to the beginning of the first millennium B. C. (GRAOUI *et al.*, 2008).

3. Getting Data

To carry out our analysis we needed several kinds of cartography, in order to generate a DEM (Digital Elevation Model), and archaeological data. The first problem we encountered was the absolute lack of cartographic information; there was no cartography of the area studied. So, how to get the topographical information needed? We examined all the possibilities and finally found in the Global DEM the solution to this. By examining and studying all the Global DEM available, we concluded that the most appropriate method for our investigation was the ASTER-GDEM. Which has 1 arc-second (30 m) grid of elevation postings.

To acquire thematic cartography regarding the land cover, we used the Classification of Remotely Sensed Imagery. And we worked with Thematic Mapper images. Our team used GPS to place the location of archaeological sites and rock art stations and developed a database (Figure 2).

4. Analysis

Accessibility

To study the mobility patterns, we first developed a friction surface based on the strong slopes which represent the resistance to travelling from one pixel to its nearest neighbor. In order to create a magnitude of friction surface it was required to assign friction values to slope values through an empirically derived equation. Then we calculated a cost surface using an anisotropic function based on the direction of the movement and the friction surface. Those frictions that vary in strength

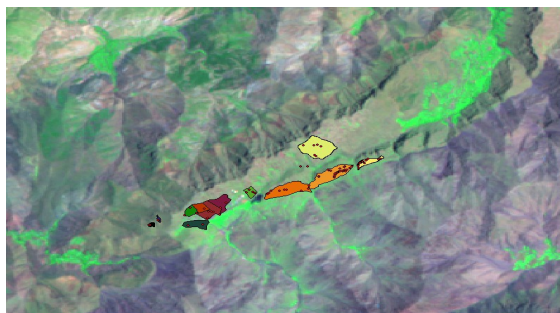


Figure 2: Rock art and archaeological sites.

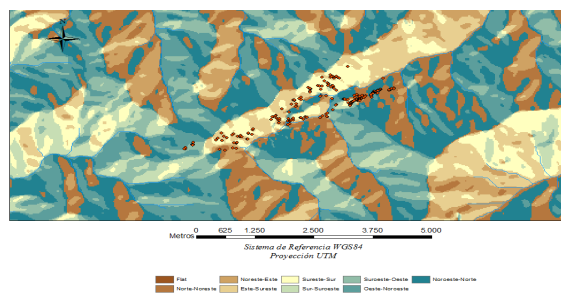


Figure 3: Sunstroke layer.

depending on the direction of movement are known as anisotropic frictions.

Pathway

Once a cost surface has been created using an anisotropic function, a pathway tool determined the least-cost route between any designated cell or group of cells.

Visibilities (Viewshed)

With the help of the DEM from a cell the visual rays are extended in all directions to find the line of sight at the height of the cells to determine if they are (or not) at sight.

5. The archaeological analysis

Rock art areas lie predominantly on the slopes oriented S/SE facing the sun and on the best sheltered and warmest side of the valley. This is also the main geological orientation of the sandstones on which rock art is engraved, although there are some exceptions, such as the quadruped motifs engraved on sandstones standing on both sides of the Tiferguine' stream ford. Also, there are funerary areas (tumuli) opposite to these sandstones, all of them aligned to the East and looking to the North, between the valley bottom and the natural paths where people and animals move around. One important problem we have to cope with is the lack of chronological information. Due to this issue we do not know yet whether rock art was partially or totally contemporary with tumuli. In either case we might have to speak of a complementary relationship between rock art and tumuli extended through time. Sometimes both were complementary and other times one of them (the tumuli), could have substituted art as a symbolic meaning of territorial control. Therefore the location of both of them can be interpreted in a sacred and profane way at the same time. The Southern orientation provides the best shelter in an area subjected to alpine climate conditions. At the same time, the relationship rock art/graves suggests the opposition light/darkness or life/death. . It could be said the same about the predominant Eastern orientation of tumuli, related to death and regeneration in a symbolic/profane organization of the landscape with the paths at the bottom of the valley marking the border between life and death and the cycle of self-regeneration of nature (BRADLEY, 2000).



Figure 4: Transit layer.

Another regularity in the pattern of the landscape can be deduced from the analysis of the present GIS layer. Rock art is distributed following a W/E axis, spreading across the course of the river Irini which plays the role of main movement's distributor. No less important is the fact that small water streams and seasonal *wadis* are distributed perpendicularly to the Irini river in a fishbone pattern, because they create watersheds as natural fringes between areas. Curiously enough they correspond almost exactly with the study areas we had distinguished for practical reasons during our first field campaign in 2008. One hypothesis we are working on is that watersheds coincide with the present fringes between pasturage areas of the different factions of the two tribes currently exploiting the valley and probably, with those of the prehistoric inhabitants, so that natural features of the landscape would have been perceived and used as fringes and landmarks for people living and using their resources in a *long durée* way of organizing the landscape.

A third GIS layer that needs to be analyzed is the accessibility and ease of ambulation between archaeological sites. In order to measure this variable the resistance to movement has been considered, represented by the steep slopes of the territory under study, which make communications to and from Oukaïmeden, very difficult. In order to calculate the latter variable we used the Naishmith's formula (POUCHER, 1960), whereby a person moves an average of 5 km. per hour, although the higher the friction (in this case the slope), the longer the time invested in the displacement, at an average of 30 minutes per 300 meters of vertical drop, i.e. the initial time is doubled if the slope is 12%, triples if is 24%, quadruples if 36% and so on. We could add to this formula the one posed in the late 60's by Higg and Vita-Vinzi, the so called *site catchment area*, designed to calculate the economic area of a human group living in a

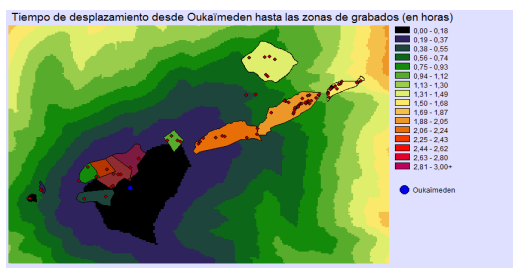


Figure 5: Accessibility and easy of ambulation.

certain archaeological site. The formula was calculated on the basis of ethnographic accounts of the behaviour of mobile and sedentary populations. Higg & Vita-Finzi's formula calculates a maximum catchment area of five km radius or approximately one hour walking from the base for sedentary farmers and two hours walking or *circa* ten km radius for mobile hunter-gatherers and herders (HIGGS and VITA-FINZI, 1972).

Taking into account both formulae we can draw some conclusions from the analysis of the accessibility layers. First of all, rock art areas and archaeological sites are included in the area between one hour and maximum two hours walk from the centre of Oukaïmeden, what is more, the great majority of them fall into the one hour-walk area. Second of all, due to the stress caused by friction, it seems probable that prehistoric people that used the grazing area and were responsible for the rock art did not come from very far away, but probably from the valleys below, that is, we should be talking of *transterminance* instead of *transhumance*. As we said before (*vide supra*), at least from the 16th century A.D. onwards, the pasturages of Oukaïmeden are exploited exclusively by people coming from Rerhaya and Ourika valleys. An ethnoarchaeological enquiry developed by our team among the Berber shepherds based on the summer villages or *azib* showed that herders entering the summer pastures of Oukaïmeden, spend between four hours and a day's march that, given that the entry day to the grazing area is August, 10th, it can be estimated at a maximum of 10 hours. It is true that nowadays herders going from Ourika benefit from the road built in French colonial times. The Moroccan government has recently built a track which connects Oukaïmeden with the small villages or *douars* sparse on the Rerhaya valley, so that the time spent could have been slightly longer before, although, given the steep terrain, differences may not have been very significant.

The next GIS layer to be considered relates to visibilities.

In this case, we are not as interested in where the rock art sites are visible from or the views commanded by a certain point marked by rock art, as in what a person moving through the valley would have seen. In other words, whether there is a visible pattern in the rock art location. This is a question not easy to resolve, for weapons, idols and animals could have been depicted on the same rock surface (figure 7) or, as in some cases, weapons or other depictions are superimposed on animal engravings, so we could guess that the message conveyed could have changed through time.

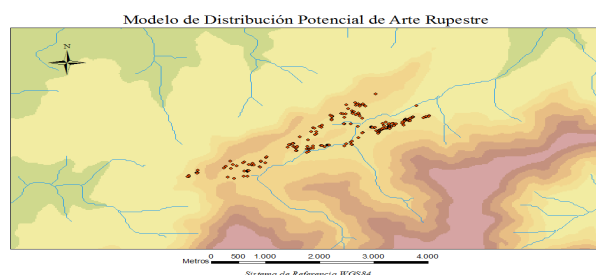


Figure 6: Spatial organization.



Figure 7: Rock art depictions.

Also, types and techniques of representations differ from each other, which means that they probably are not contemporary; this is a problem difficult to solve due to the fact that there is no easy correlation between human occupations and rock art, and 14C samples taken from our 2009 digging campaign, that are still in progress. In spite of it we could say, based on typological evidence, that most parts of carved weapons can be dated at the Early Bronze Age, and broadly speaking around the Second Millennium B.C. We can also say that all, or at least, most parts of animal depictions seem to be older for typological reasons, that is, that they should be dated as the Late Neolithic or Copper Age, based on the lithic industry sampled in the area. More problematic are the human depictions, which aren't typologically homogenous and probably neither they are contemporary. We could speak of *trends* in the way that the pattern of the rock art is distributed. In that sense, weapons seem to be mainly concentrated at the entrances, although not only at the paths. Animals are spread either on fringes as happens in our zone 9, the so called Bull's pass (*Col du Toreau*), or close to the main hydric resources as, for instance, the endorreic area nowadays transformed into a reservoir (our zone 8), the ford over the Tiferguine stream (our zone 10) and other wet areas located at our 10th and 11th areas (Figure 8).

Regarding human depictions, they are probably not all contemporary. Those male and female depictions with explicit sexual features lie always on marginal areas at the fringes of cliffs. Therefore it is tempting to suggest that they could be related to the celebration of rites of passage to adulthood.

In conclusion

First results of GIS application to the archaeological area of Oukaïmeden suggest the existence of some kind of structure in the rock art distribution, probably related to different chronological periods and with apparent changes among them. This internal structure is organized on a main axis along the valley, connected with watersheds and in obvious relation to the geological structure of the area, but it also reflects the human use of the space in Prehistoric and subsequent times. There is still a huge amount of research to be done on the site, but a crucial point to be developed in the future is the global understanding of the economic and social system underlying the gravures, which requires the broadening of the archaeological fieldwork and GIS to the valleys below, where trasterminant shepherds expend the rest of the year.

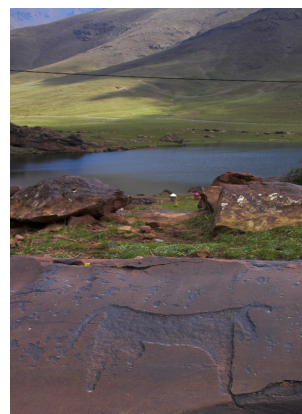


Figure 8: Animal depictions connected with wet areas.

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