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## **The "Desert Patina" programme on adaptation to climate change in the Sahara, initiated by the European Commission**

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### Abstract:

Climate change, resulting in rising temperatures, is one of today's key subjects. This article presents the initiative taken by the Research Department of the European Commission to investigate the adaptations of the prehistoric populations of the Sahara to a similar situation some 5,000 years ago. The aims and objectives of the programme, labelled "Desert Patina", are explained. Work in the field is described, and preliminary results in Morocco detailed.

### Résumé:

Le réchauffement du climat est aujourd'hui un sujet de discussion majeur. Cet article présente l'initiative prise par la Direction de Recherche de la Commission Européenne, afin de comprendre les adaptations des populations préhistoriques du Sahara à une situation semblable il y a quelques 5.000 ans. Les buts et les objectifs du programme, intitulé «Patine du Désert» sont expliqués. Le travail sur le terrain et les résultats préliminaires au Maroc sont décrits.

### Zusammenfassung:

Klimawandel, zusammen mit Temperaturanstieg, ist heutzutage ein beliebtes Thema. Dieser Beitrag beschreibt die Initiative der Forschungsabteilung der Europäischen Kommission, die Anpassungen von vorgeschichtlichen Völkern der Sahara an ähnliche Vorgänge vor rund 5000 zu erkunden. Die Ziele und Vorgaben des Programms "Desert Patina" (Wüstenlack) werden erläutert. Die Feldarbeit wird beschrieben und die ersten Ergebnisse aus Marokko werden dargestellt.

## **Introduction**

Global warming is no longer contested. Whether this is a totally natural process, with millions of years of glacial and interglacial periods well

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documented, or whether mankind is partially or wholly responsible, is still a subject for debate. This is not the concern of the present article. The aim here is to present a Euro-Mediterranean programme initiated by the Research Department of the European Commission: "Desert Patina".

### **Problematic of the "Desert Patina" programme**

With climate change becoming an increasingly acute problem, many countries are investigating methods of alleviating this situation of major risk. One approach is the study of prehistoric populations who experienced a similar situation and who adopted new strategies to survive. To this end, the Research Department of the European Commission initiated a programme, associating eight teams working in Algeria, Egypt, Libya, Morocco and Tunisia and experts from France, Finland and Italy. The programme is coordinated by the European Network PACT <sup>1</sup>.

The programme started on 1<sup>st</sup> September 2004, with a life-span of three years, ending in the autumn of 2007. The first seminar bringing together participating teams took place in Marrakech in 2004, the second in Djelfa (Algeria) in 2005. The third was held in Marrakech, in December 2006.

The Sahara was an obvious choice for carrying out the programme: the effects of the severe climatic variations which have taken place in recent millennia are clearly visible and hundreds of thousands of paintings and engravings, in rock-shelters or in the open, illustrate the way of life of past populations.

Palaeoclimatologists, geomorphologists and dating laboratories have established the main lines of the climatic variations. Much has been written in general terms about the adaptation to climatic variations in the Sahara (see for instance, Le Quellec, 2003). But in the present programme, rock art specialists were asked to look at the images left by these prehistoric inhabitants of the Sahara with new eyes, and to discover *concrete* examples of the measures they took when confronted with increasing aridity from around 3,000 bc. Their strategy should be useful to today's desert inhabitants, facing increasingly harsh conditions. As Hassan has said: "A more profound understanding of how societies dealt with climatic change in the past is one of the means by which we can cope with our changing climate today" (Hassan 2002: viii).

But another important objective of the "Desert Patina" programme concerns the rocks themselves. The aim is to explain, in the light of modern knowledge,

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<sup>1</sup> "Science and Cultural Heritage" of the European Federation of the European Networks of scientific and technical cooperation.

the mechanism of the formation of the blackish layer, known as 'desert varnish' or patina, which covers the rocks of the Sahara, and to re-create it where necessary. This 're-creation' of the rock surfaces becomes necessary in cases of damage or deterioration, since not only do these rocks testify to the climate changes that have taken place in the past, they also provide the only way of knowing how the prehistoric people managed to adapt to these changes.

This aspect of the "Desert Patina" programme also has an economic objective: the encouragement of private enterprises engaged in restoration work to extend their competences to rock art and, at the same time, the protection of the cultural heritage of the Sahara. The importance of this cultural heritage as an attraction for the tourism industry is well known. With tourism becoming the number one industry in the world, ahead even of oil, the development of an ecological tourism in the Saharan countries will encourage young people to stay in the regions where the climate warming contributes to the desertification. The Twareg who drive tourists around in southern Libya want to stay there. They are well aware that without tourism they would have difficulty surviving in their homeland – and without the Twareg, tourists would be in difficulty too.

### **Adaptation to climate change in the past**

Several possibilities were open to prehistoric societies faced with deteriorating conditions. They could modify their way of life, changing from wide-ranging nomadism to a more settled life around permanent water-holes. They could reduce their herds of cattle and raise sheep and goats, less dependent on extensive pasturages. New animals could be hunted and hunting techniques adapted. They could turn to agricultural exploitation, as did the early 1<sup>st</sup> millennium BC Garamantes in the Wadi al-Ajal in Western Libya. This powerful group set up an ingenious underground system (*foggaras*) to transport water for irrigation from a distant source, before simply digging wells.

Not all of these possibilities are visible in the rock art. The increase in the number of figurations of sheep and goat in the later periods can, however, be clearly seen. So is the introduction of that essentially desert animal, the dromedary, towards the end of the 1<sup>st</sup> millennium BC.

### **The role of Morocco in the "Desert Patina" programme**

Morocco has an important role to play in this programme, since it is the participating country in which the majority of experiments have taken place in the field. However, most of the samples submitted to the Finnish laboratory for C14 dating come from Algerian sites. The Moroccan partner in this programme

is the Division of the Cultural Heritage of the Moroccan Ministry of Culture and Communication. Specifically, in the field, the project is directed by the National Rock Art Centre in Marrakech, under its director, Dr. M. El Graoui.

Morocco has over recorded 300 rock art sites, three major ones in the High Atlas, the rest south of this mountain chain, in the pre-Sahara. The great majority contain engravings, on sloping rock faces or on boulders in the open air. Paintings are rare, limited to a few rock-shelters and caves. In order to characterise the different patinas which have formed on the sandstones, the main rock surface chosen by the engravers, the Moroccan team studied particularly the sites of Oukaimeden (High Atlas), Oum La Leg, Adrar n'Metgourine and Tinzouline (Foum Ech Chenna) (the last three south of the High Atlas).

Sandstone samples were taken in 2004 from the site of Oukaimeden for laboratory study and analysis in the Centre de Recherche en Physique Appliquée à l'Archéologie (Bordeaux University, France). The study of the texture and nature of the components of the patinas formed on the surface of the sandstone has enabled their diversity to be understood and the mechanisms of their formation to be grasped.

Patina formation was also carefully studied at Oum La Leg. This site, containing several hundred engravings in Tazina style, has been well studied from the point of view of the contents (mainly wild animals), but the question of the patinas had previously only been briefly treated. In July 2006, careful observation of the greyish-black patina of the engraved lines showed that it had developed on a thin beige/reddish beige layer (2-3 mm) which had moulded the surface of the blocks and the engraved lines themselves, and that many engravings had been re-worked after the formation of this layer. One immediate conclusion was that two stages of engraving had taken place, separated by an intermediate period of unknown length. This has important implications for the dating of these Tazina style images – which is still an unknown factor.

Turning to the second aim of the project, the study of the engravings and paintings «with new eyes», in order to detect ways which prehistoric populations adapted to climate change, the Moroccan team next had a close look at Adrar n'Metgourine, some 20 km north of the previous site. This ridge contains engravings very different in style from the Tazina engravings at Oum La Leg. It is characterised by pecked representations of cattle, many done with great skill, others less so. Wild animals were in a clear minority.

No evidence of adaptation to a deteriorating climate on either of these sites could be noted. However, the nearby ridges of Moumersal, also characterised by pecked cattle of the second, rather less well executed group, contained an

unusually high number of engravings of Barbary sheep. This animal is seldom represented in the rock art, except for a late site in the Draa valley (Tinzouline/Foum Ech Chenna), containing also horses and camels, probably dating to the first millennium BC.

As cattle continued to be engraved, but almost no antelopes (a favourite game animal on Tazina sites), the team has proposed as a working hypothesis – needing further study – that Barbary sheep were hunted by the later cattle-herders as an adaptation to a drier climate, instead of the antelopes which had migrated to wetter pastures. The Barbary sheep has a reputation for liking rocky areas, but it is also known for its resistance to drought, and can be seen on the now largely-dry plateau of the Tassili n'Ajjer in Algeria and in the Messak in Libya.

Further field tests took place early in 2007, with experimentation in situ of patina re-creation (Fig. 1). Instruments to measure daily the temperatures and humidity were also set up in the proximity of the engravings, both in southern Morocco (Fig. 2) and in Oukaimeden.

### **The "Desert Patina" programme: the future**

The final reports of the participating teams and experts will be submitted to the programme coordination in Bordeaux in June 2007. By then, the results of the field tests in Morocco, including C14 dating of hearths from seven trial trenches in Oukaimeden, will be known. The overall assessment will then be presented to the Research Department of the European Commission.

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### **Illustrations:**

Figure 1: Grinding of sandstone for the preparation of the mixture to be used to repair the cracked engraved rock.

Figure 2: Setting up of the temperature captor. Green tube (on ground) for rainfall measurement.

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Fig. 1

Fig. 2



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