Unravelling Patterns in Oukaïmeden Rock Art

Desenredando patrones en el arte rupestre de Oukaïmeden

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Abstract

Statistical analysis was applied to the study of Oukaïmeden rock art as a way to obtain chronological information. By means of correspondence analysis we identified trends in the representation of the various individual motifs in the valley rock art. Subsequently we analyzed recurrent associations and overlappings, which led us to the last scale of analysis: the dating of rock art stations.

Key words: *Correspondence Analysis, dating, rock art.*

Resumen

El análisis estadístico ha sido aplicado al estudio del arte rupestre de Oukaïmeden como vía para la obtención de información cronológica. Mediante el análisis de correspondencias hemos identificado tendencias en la representación de varios motivos individuales en el arte rupestre del valle. Procedimos después al análisis de asociaciones recurrentes y superposiciones, lo que nos llevó al último nivel de análisis: la datación de las estaciones de arte rupestre.

Palabras clave: *Análisis de correspondencias, datación, arte rupestre.*

Introduction

No doubt, one of the most complex challenges the ARPA project has dealt with was the spatial and chronological understanding of rock art engravings, as a preliminary step to its interpretation within Oukaïmeden history. Although the Atlas' rock art studies have a long tradition (Glory 1953; Malhomme 1953a and 1953c, 1959,1961; Jodin, 1966b; Simoneau 1968 and 1968-1972; Baier 1971, Chenorkian 1988; Rodrigue 1991, 1998, 1999, 2001;Souville 1986, 1991; Searight,1992 & 2004 ; SbihiAlaouiandSearight 1997; Salih *et al*. 1998 ; Züchner, 1998; El Ezziani 2004a & b; El Graoui*et al*. 2008) and is an active research topic with some recent synthesis (Searight 2004), some main problems still arise, especially regarding the chronological framework of the different anthropomorphic, zoomorphic and symbolic carvings. Most approaches to rock art representations have been strictly descriptive, focused on stylistic classifications throughout the different areas of the High Atlas and without any approach to its physical location in the landscape. Although discussion about chronology has been a recurrent topic in the research, a satisfactory proposal has yet to be presented, and most of the contributions point to the definition of groups of associated carvings or to the discussion about some chronologically evident facts, such as the occurrence of camels or Libyan-Berber inscriptions. However, the chronological ordering of prehistoric engravings is worse known, to the extent that even two different chronologies (long and short) have been proposed (Searight2001: 186-187). Therefore, the previous approaches did not provide an entirely satisfactory base for our study.

Given the current state of the art, a different approach to the study of Oukaïmeden rock art was required. Without neglecting the description and analysis of techniques, motifs and styles of the more than a thousand carvings documented, a significant effort was devoted to the search for a deeper level of significance within them, whether spatial, chronological or both. The purpose was to detect the chronological evolution of rock art within the valley, and to evaluate -if possible- changing patterns on its location on the landscape over time. The main goal was to avoid an improved but simple description of the carvings by integrating them in the study of the physical and human history of the valley through time.To do so, an original methodology had to be developed. That methodology should be capable of detecting,organizing and associating criteria within a large amount of data. Considering that traditional methodologies based on the stylistic search for parallels had reached their peak as inter-pretative tools, an alternative, more objective technique was searched to unravel Oukaïmeden rock art.

The chosen technique was a statistical test known as correspondence analysis, a type of multivariate analysis which started to be applied by French archaeologists in the mid-1970s to typological studies and assemblage comparisons (Baxter 1994: 134-135). However, these first applications had no perceptible impact outside France, at least until Scandinavian scholars spread the method to a wider, Anglo-Saxon audience. Since the 1990s, the method has been increasingly accepted and applied to a growing range of archaeological subjects, and now it is one of the most accepted analyses throughout the world. It has proved its value at analyzing and organizing huge samples of data, providing interpretative frameworks which go beyond the seriation of material culture, to give a deeper insight into the internal dynamics which lie beneath item distribution.

In short, correspondence analysis is one among several statistical methods used to find organizing structures within the archaeological data. These structures are usually clusters and seriations, the first being groups of units -e.g. tombs, sites, items-that share similar features due to their chronological or geographical closeness. As more information is added to the sample, variations are expected to appear and a refined analysis is required to evaluate the degree of similarity. The gradual transformation of material features within the sample should finally become a series where units are arranged according to their degree of similarity. That ordering is named seriation and constitutes a core part of the archaeological science since its beginning in the 19[th]century. As soon as technology made it available, different computing methods were established to help with the detection of cluster and seriation within archaeological data. Some of these algorithm-based analyses are Multidimensional Scaling, Principal Component Analysis and Principal Coordinate Analysis, with correspondence analysis as a later addition.

Like other methods, correspondence analysis searches for similarities among the different units and represents them according to their greater or lesser relationship, thus detecting -when possible-seriations within the sample. However, it has some advantages regarding the other techniques, as it also reveals the internal structure of the data when no seriation is present, thus being appropriate for cluster analysis. Moreover, this method reveals the relative distance among units, with similar units and their associated variables represented together and the most different cases displayed with a considerable distance between them. The display in a

two axis diagram not only provides an easily understandable graphic, but avoids a common problem of other seriation techniques,that represent the units and variables in a linear series. These methodologies place the different elements analyzed in consecutive rows that define a seriation, thus forcing the data to provide a structure whether it exists or not. Correspondence analysis, on the contrary, prevents preconceived ideas about existing structures as it does not create seriations and clusters if they do not exist. Therefore, interpretation of the results is the archaeologist's task (Jensen and Nielsen 1997).

As said before, correspondence analysis is displayed on a coordinates system. This representation is the result of how the method works, where variables -usually a good amount of them- are standardized and represented in a multidimensional cloud of points. In this multidimensional space the axes are chosen to display the largest variation in the cloud, which corresponds to the first and second axes and which are usually the initial coordinates system obtained. Other combinations of axes can be chosen (first and third, for example), but they will represent a lesser degree of variation. As stated above, the interpretation of the diagram corresponds to the archaeologists, but the presence of a parabola-shaped figure is a clear indication of a seriation. The more perfect the seriation, the more symmetric the parabola is. The characteristics of this parabola - symmetry, distance between incidences, etc. - can help to interpret the material transformations of the whole series. An

accumulation of units and variables implies a slow change in the studied features, while distances within variables and cases mean rapid changes between them. Cases defined by a small set of variables usually appear separated from the main body of the parabola, and usually correspond to ill defined cases which can be removed from the analysis, which sometimes improves the seriation (fig. 1).

Once a seriation or clustering is detected, it is the archaeologist's task to determine its meaning: it usually has chronological implications but can also represent social, wealth or gender variations, for example. That flexibility and its potential to find new organizational structures within the data has made correspondence analysis one of the most attractive statistical tools for archaeologists, who usually have to work with large amount of qualitative data. Surprisingly, correspondence analysis has not been favoured in rock art studies, what is striking considering the recurrent problems in organizing and analyzing rock art throughout the world. Only in Australia (McDonald 2008; Franklin 2007; 2011) and the Pacific area (Wilson 2004) has correspondence analysis been systematically applied to understand regional rock art traditions with good results.However, as far as we know this statistical technique has never been used in African rock art before, although other similar multivariate analyses have been successfully applied in the High Atlas (El Ezziani 2004a, 2004b, 2006)and will be extensively discussed in this chapter.
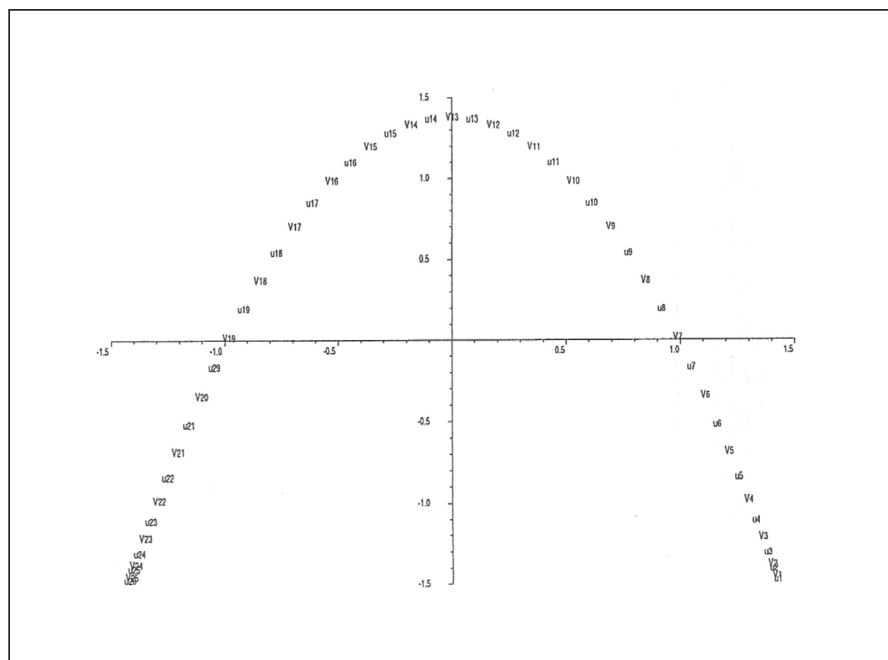

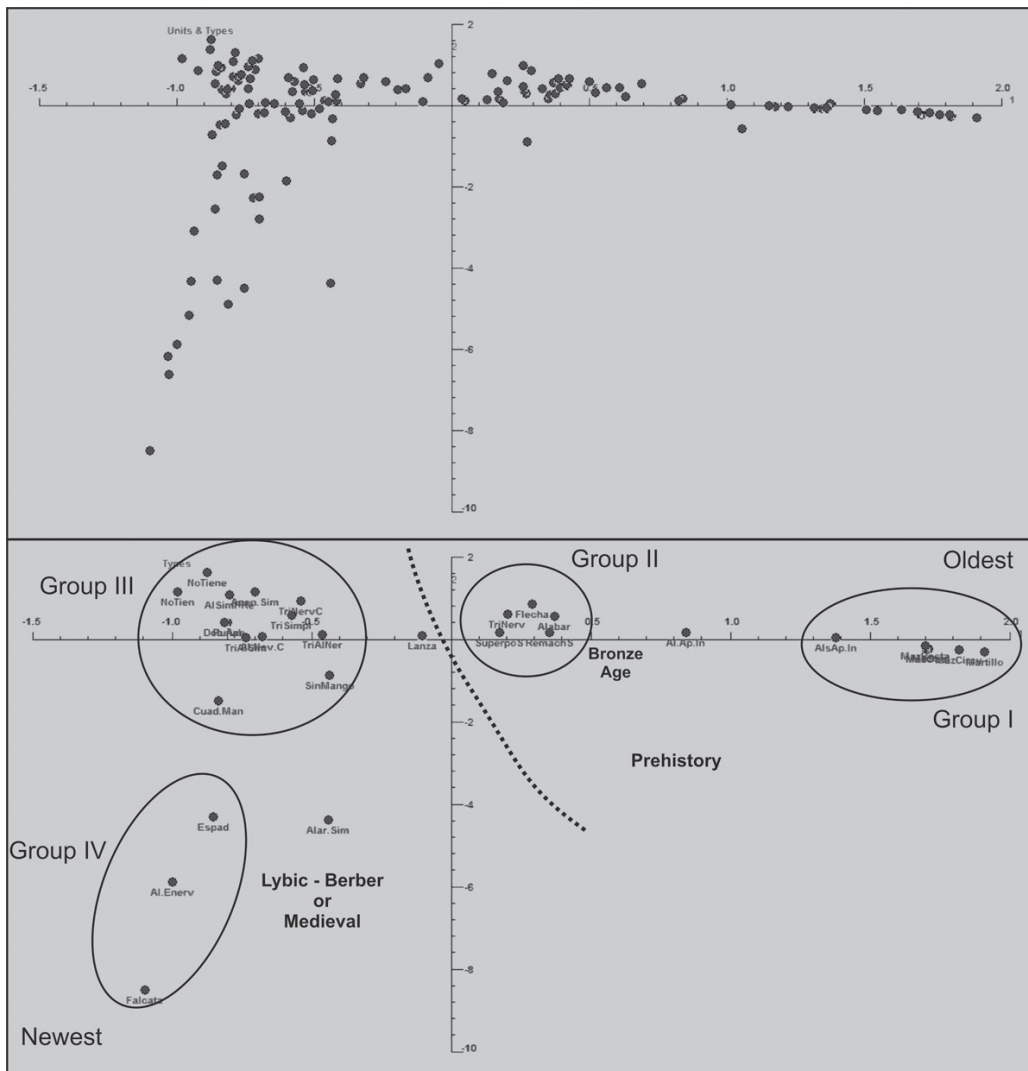**Fig. 1**. Correspondence Analysis showing a perfect seriation. After Jensen and Nielsen 1997.

Fig. 2. Distribution and interpretation of the weapons correspondence analysis. Top: raw distribution of cases. Below: Identified groups. Only variables have been represented in order to make the graphic understandable

Lastly, it is also necessary to understand the limitations of correspondence analysis. As with every statistical approach, it shows tendencies rather than absolute results, and the strength of these tendencies are directly related to the characteristics of the sample. The larger and better defined the sample is, the more likely it is to show the hidden structures lying beneath the data, if they really exist. In our case, the analyses relied on the rock art database designed by our team colleague, Dr. Collado, which thoroughly described more than a thousand engravings organized in eight main types -zoomorphs, anthropomorphs, weapons, and so on- each of them described by additional subtypes. From a different point of view, the distances among units or variables do not have a correlation with chronologies, and

thus some references are needed to understand the meaning of the chronological evolution displayed on the diagram. These problems have evidently affected our analysis, as explained below. Some statistically good results have been of little use due to the scarcity of represented units, while others have been stylistically relevant but lacked chronological precision. Even considering all these problems, correspondence analysis has proved to be a key element for the interpretation of the rock art of Oukaïmeden within its historical context, and can help to establish new ways to organize and understand High Atlas rock art. The statistical program used was WinBASP (Bonn Archaeological Software Package), a free statistical package developed cooperatively and that can be downloading at www.uni-koeln.de/~al001/.
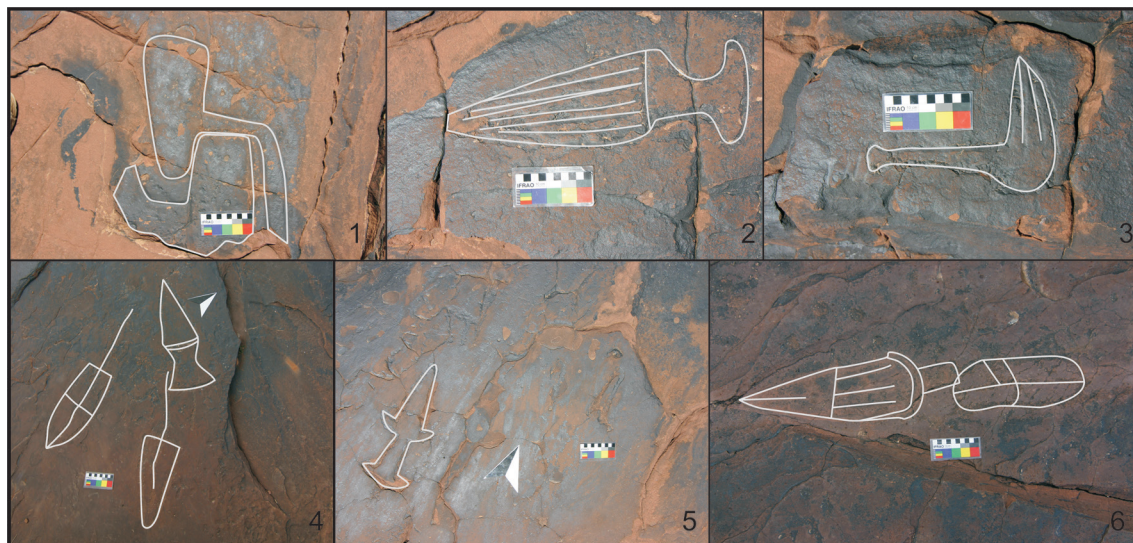
Fig. 3. Oukaïmeden's weapons. 1.Pre Bronze Age, maces (Group I). 2-3. Bronze Age dagger and halberd (Group II). 4. Libyan-Berber spear/arrows and dagger (Group IIIA).5. Libyan-Berber dagger (Group IIIB). Late Libyan-Berber dagger (Group IV). Figures have been digitally traced to improve the visibility of the engravings.

An armed world: weapons in Oukaïmeden rock art

As stated before, the quality of correspondence analysis relies on the size of the sample and the number of variables used to describe any of the selected units. In our case, the kinds of engravings that best fulfilled these requirements were weapons, which represented 34% of the total depictions and whose description involved a larger number of variables. The database developed by Dr. Collado distinguished several categories, such as halberd, dagger, sword, spearhead, arrowhead, club, mace, hammer and axe. Each category had several defining features, i.e., with or without hilt, straight or concave-ending hilt, blade with or without grooves, handle with or without rivets, round-ended handle, triangular or ellipsoid spear or arrowhead, etc. The database produced a total of 294 engravings and 29 variables, a sample which was considered large enough to achieve a successful result. Additionally, the selection of weapons as a starting point for the analysis had an organizing advantage, because some of the depictions are similar from an iconographic point of view to those considered in Europe to be dated to the Bronze Age (Chernokian 1988, Souville 1986, 1991, Searight 2004). That parallel was taken as a chronological link in a fancied temporal chain, to which other clusters or groups could be attached. Our decision was supported by the fact, that as seen in chapter 2.1, we have archaeological proofs of the human presence in the valley during the Bronze Age.

The results of the correspondence analysis were fairly good, as the diagram showed a parabolic curve which marked the existence of a seriation within the data, with three main groups and a prolongation of one of the legs of the parabola (fig.2). The analysis of these three groups proved, that they were associated to three main kinds of weapons -maces, halberds and daggers- and different variables related to the shapes of their hilts and blades. As halberds were assumed to be Bronze Age types and obviously daggers and swords could not be considered the oldest depictions of the series, a chronological interpretation of the whole diagram took shape around the Bronze Age depictions. Thus maces (group 1) would correspond to a pre-Bronze Age, while the two clusters defined by daggers, swords and other weapons (Groups III and IV) would belong to post-Bronze Age periods. Group III was chronologically placed in the so-called Libyan-Berber period, a chronologic *catchall* from the First Millennium B.C. to the Muslim invasion in the 7th century AD, and the minority group established as Group IV was dated in the middle Ages.

The chronological interpretation of the diagram was supported by the overlappings documented throughout the valley, where the newest weapons systematically appeared on the top. Of course, what the correspondence analysis showed was simply a statistical trend, so the groups detected expressed the moment when a given variable was more characteristic.However, some examples of this variable can be found before or after the main concentration occurs. This situation can be seen when comparing
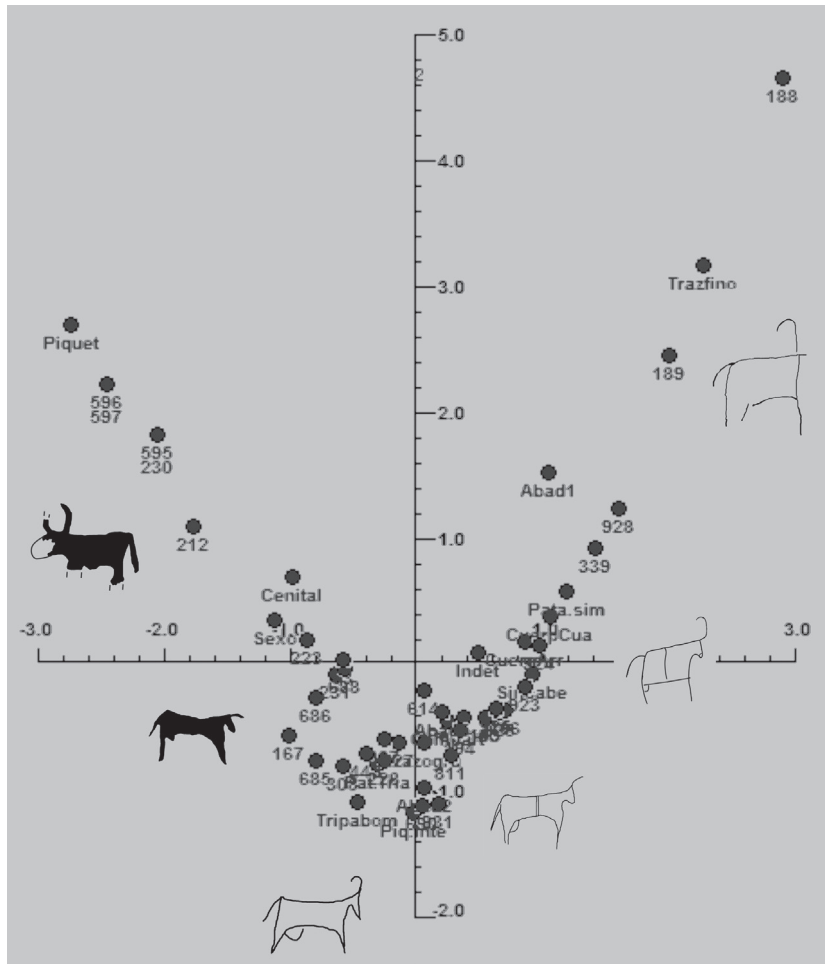
Fig. 4. Correspondence Analysis of Bovines.

the diagrams that represent the whole distribution of incidences (units and variables) with the isolated variables. The second diagram shows the distribution of the four clusters described above, while the second one shows a far more continuous curve. This situation is logical, as engravings progressively modify their formal characteristics over time.

These preliminary results led us to far more detailed analysis of the distribution, which included the exhaustive study of all the engravings and their associations within the panels and stations. Some inaccuracies were detected, due to the presence of variables that encompassed different stylistic representations. This is the case of the round-ended handles, which were a distinctive feature of the Libyan-Berber period but also appeared in the previous Bronze Age. In these cases, a less abundant feature such as the shape of the blade- usually differentiated the weapons of both periods. Again, further analysis of Group III led us to define two

subgroups (IIIA and IIIB) with subtle differences that could be relevant to refine a period as extensive as the Libyan-Berber one. Eventually, the analysis showed that the amount of prehistoric engravings was far smaller than the protohistoric or medieval ones, maybe pointing to a different dynamic after the Bronze Age.

Thus, the diagram could be interpreted as follows (fig. 3): the first weapon depictions to appear in the valley were the maces with different shapes -oval, circular, rectangular- whose handles did not have appendixes.However,the first representations of halberds started to appear almost immediately, and both kinds of depictions occasionally appear together. The Bronze Age set of weapons is very well defined: halberds with appendixes on the end of the handles, daggers with round-edged hilts, rivets and blades -both daggers and halberds- with several grooves. This iconographic set seems to have endured for some time, as the variables which de-
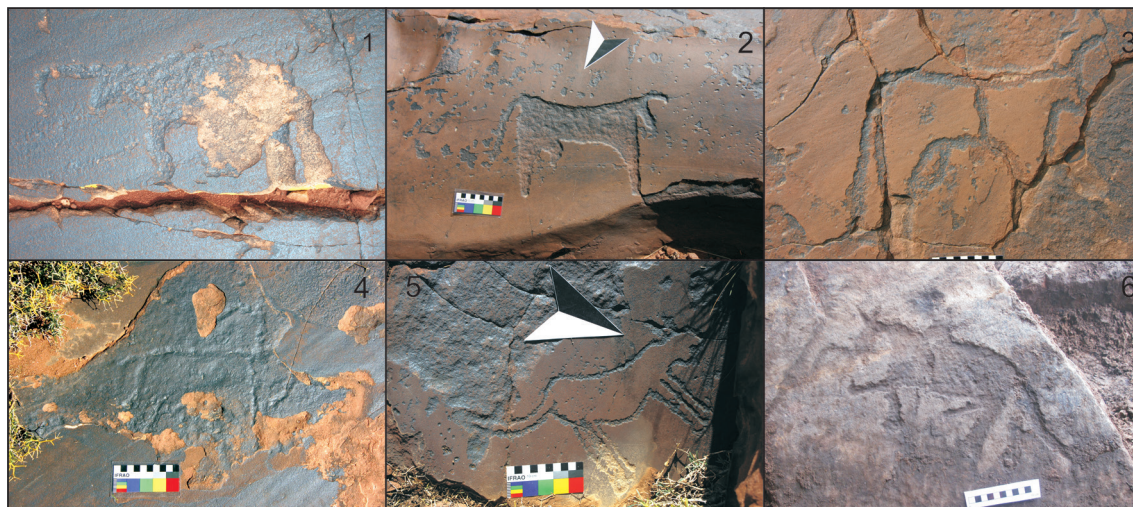
Fig. 5. Types of Oukaïmeden zoomorphs: 1.-4. Prehistoric. 5. Libyan-Berber. 6. Middle Age.

fine it are very coherent and tightly clustered -which implies slow changes, as mentioned above. At the end of this period other depictions started to appear -spear points- and a new amount of variables related to the Libyan-Berber period substitute the previous Bronze Age engravings. These new weapons are mainly daggers with round-ended hilts, although some evolution can be seen throughout the series. At the beginning, the most representative kind of daggers have round-ended hilts -following the Bronze Age traditions but with a worse defined handle- with just one midrib instead of the grooves on the blade, that characterized the previous period. As the seriation progresses, the round-ended hilts still appear, but the midrib disappears, and sometimes a grip and ricassos are visible. The only other weapon documented at this period is the spear, which is only represented in a very specific context, where an anthropomorphic figure is attacked with these weapons. The last moments of the seriation correspond to a small sample of weapons that could represent swords with square hilts. Unlike the previous periods, these depictions are not standardized, and thus their interpretation as a chronological period is far more difficult.

Analyzed as a whole, the correspondence analysis planned on weapons has been highly satisfactory. Not only has it proved the existence of a stylistic seriation within the engravings, but it has allowed us to establish a preliminary overview of the engravings with several possible chronological phases. Furthermore, it has opened a path for structuring most of the rock art of the Oukaïmeden, as the relationships between weapons and other symbols can link less known engravings to the already

organized depictions. Moreover, the spatial analysis of the four different groups has also provided valuable clues to hypothesize about the territorial patterns in the Prehistoric and Protohistoric periods, as we will propose below. Therefore, the statistical test has been up for the challenge, benefiting from a well sized sample, a good data analysis and an accurate set of variables.

Bovines and other zoomorphs

The promising results of the first correspondence analysis encouraged us to repeat the test with the bovines, the most frequent animal depiction, which have to be considered as domesticated in view that a high mountain valley as Oukaïmeden is not their natural environment. As they are also very demanding in their feeding, they would have been the main beneficiaries of the fresh summer pastures. Again, the basis for our study was Dr. Collado's art database, with some stylistic variables added after the careful drawing of most engravings. The chosen variables included engraving techniques -marginal or invasive abrading, pecking or a combination of both- perspectives -wrong or right- and stylistic conventions -concave or convex belly depiction, portrayed sex or not, schematic head- and so on. However, there were two key differences between the previous test based on weapons and the one carried out on bovines. Firstly, the bovine engravings were much more scarce, only 36 depictions defined by 17 variables. They were usually depicted in isolation, except for two cases, one where a dagger of Group III overlaps a bovine (rock-art station 34 in
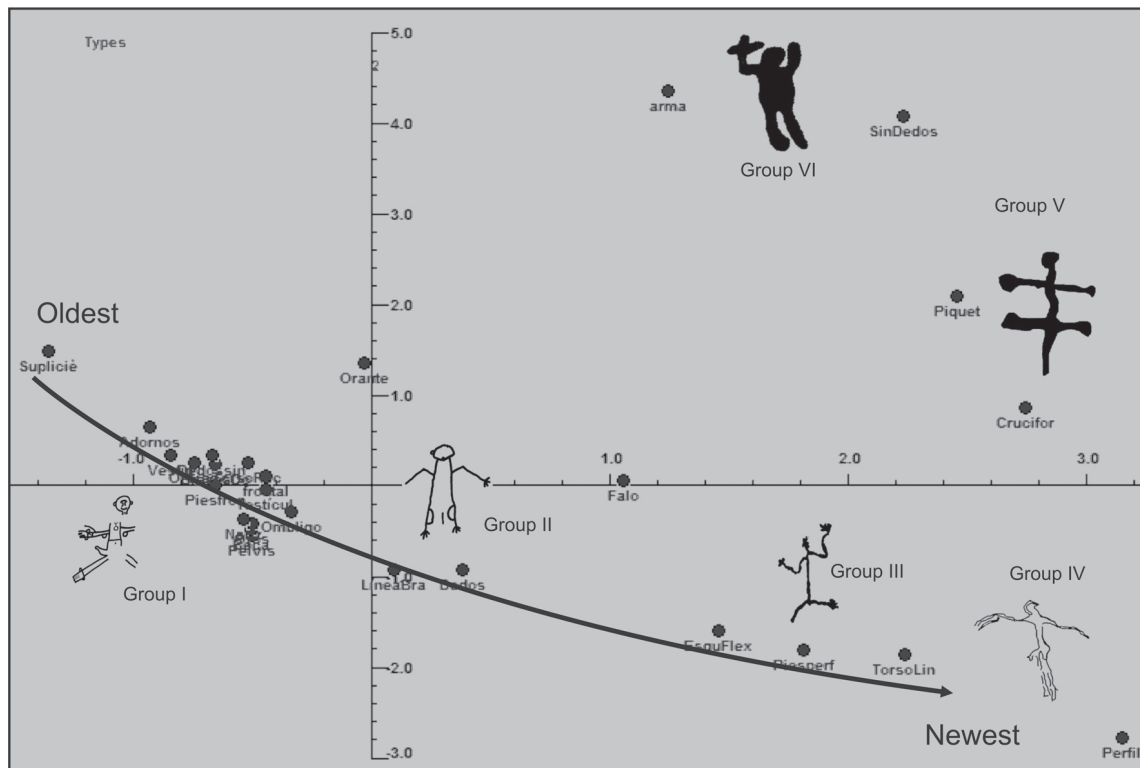
Fig. 6. Correspondence Analysis of Anthropomorphs: Group VII has not been included to maintain a proper scale. Only variables have been depicted to make the display comprehensible.

OK5 area), and a second which overlaps an antropomorph drawn in profile and is in turn overlapped by a schematic square-bodied bovine (OK2 "Dam" area station 1).This small sample obviously should have an impact on the reliability of the test, especially considering the high number of variables in cases which would make it difficult to detect accurately defined clusters. Secondly, the bovines did not provide a chronological benchmark from where an absolute dating could be achieved, although the case where a bovine is overlapped by a dagger of Group III can lead us to guess that most of them belong to an older, prehistoric date. Anyway, the best result that could be expected was a relative ordering of the different bovine styles, while their chronological framework should be evaluated afterwards. Finally, the analysis of the bovine depictions was planned as a first step for the study of all animal engravings throughout the Oukaïmeden Valley. Most of these animals share bovine stylistic conventions, but they are so poorly represented that no statistical test could be done on them. Thus, the correspondence analysis carried out on bovines could open a path for the interpretation of the whole sample of zoomorphic engravings in Oukaïmeden.

Considering the small size of the sample, the results were astonishingly good, based on the representation of an almost symmetric parabola that clearly points to the existence of a seriation underlying the data (fig. 4). In this case, one of the sides of the parabola is characterized by a group of engravings with invasive pecking, wrong perspectives and a strongly highlighted sex, while sche-

Fig. 7. Anthropomorphs of Oukaïmeden according to the Correspondence Analysis. Groups I-VI.

matic bovines with squared bodies, small or absent heads and without sex are represented on the other side. Between the legs of the parabola, a progressive evolution through a more schematic depiction of animals is perceived, as occurs with the legs of animals, which evolve from triangular legs to simple lines. Regarding the relative ordering of the seriation, the identification of the oldest side of the parabola was achieved through the analysis of the overlappings between animal representations. An overlapping having the more schematic depictions always on top has been documented in at least one case. Thus, the more schematic a bovine looks, the more recent should it be considered. Another clue is delivered by the overlapping of a partly pecked bovine depiction with sex remarked and wrong perspective over an anthropomorph of archaic features (OK2 "Dam area station 1).On the contrary, fully pecked representations with wrong perspectives should be considered among the oldest animal engravings throughout the valley.

Although these data are relevant and provide a general overview of the relative antiquity of the bovine styles and the correspondence analysis can be considered statistically perfect, the fact is that the small size of the sample has prevented an efficient use of the information. The distribution of engravings showed a continuous ordering with no real clusters detected within it. In an attempt to overcome this problem, a new correspondence analysis was prepared, this time including the whole sample of animals; a total of 73 units and 20 variables were included. The results did not vary significantly from the first test, although a new group associated to carnivores and schematic horses, all of them represented with four legs, was identified. Thus, although the evidence of a seriation is undeniable, the results were less operational than those achieved with the weapons (fig. 5).

As stated above, the animal sample did not provide many chronological clues. However, besides the two cases discussed above, there is a third one that can help us date the animal carvings. This occurs at station 23 of OK3, where a mace which could belong to a Late Neolithic/Copper Age according to the statistical analysis, is depicted on the same panel as an elephant of square body; an evolved type from a stylistic point of view. Although we cannot prove that they were strictly coevals, they were carved by using the same technique and have an identical wear patina. In any event, the fact is relevant because the elephants depicted in the Elephants' Shelter share some stylistic characteristics with the one from the OK3 area. Given that, as already seen (See above), a charcoal sample provides a terminus *postquem* of 2840-2340 calBC for the

Fig. 8. Elephants' Frieze photograph (above) and its rubbing (below) after Rodrigue 1991.

Elephant's Shelter depictions, we could date both the maces and the almost schematic, square bodied animals at the Copper Age or Copper to Bronze Age.The Copper to Bronze Age chronology assigned to animal depictions is also reinforced by the case of the bovine in station 34 of OK5, which is overlapped by a Type III dagger with good counterparts in Libyan-Berber Art, i.e. the Iron Age. These cases provide a chronological frame of Late Neolithic/Copper Age to Bronze Ages for the zoomorphic depictions in Oukaïmeden, with just two exceptions. The first one is the horseman carved on the block collapsed at the Elephants' Shelter*,* that should be put in relation with a Middle Age level of dwelling in the shelter (see above Chapter 2.1). The second cases are some engravings of slender, four-legged horses and canids, very typical of the classic Libyan-Berber style (Searight 2013:fig.4; Bravin 2009: 97 and ff.; Salih and Heckendorf 2002: figs. 3, 5, 6 13, 16; Malhomme 1961:104:1160 and 1167, 106: nos.1181and 168 among others). Due to the small size of the sample, we failed to go beyond the assignation of a plausible chronology for animal depictions and were unable to distinguish different stylistic stages, but only a general evolution, which can be useful for comparison with other neighbouring areas, nonetheless, such as the *Yagour* plateau.

Anthropomorphic depictions

A third correspondence analysis was planned on anthropomorphic depictions, although the sample presented similar problems to those of the previous one. In fact, the engravings identified as anthropomorphic were only 59 and included few but very different styles, from simple cross-like schematic

Fig. 9. Group VII depiction (left) and contemporary ostrich (right).

figures to very detailed male depictions surrounded by a complex panoply of weapons and symbols. However, the symbolic and iconographic relevance of these figures made us think it was worth the effort, especially considering the anthropomorphic depictions are often connected with some of the most important rock art panels of the valley.

Moreover, the study has benefited from two previous works on the High Atlas anthropomorphs (Searight 1993, El Ezziani 2002, 2004a, 2004b), the latest based on the use of statistical techniques similar to the Correspondence Analysis. Both of them have been helpful to define the set of variables included in the analysis, but the work of El Ezziani was especially useful to determine the general, chronological framework of this type of figures. As in both proposals, most of the variables correspond to the existence or absence of human features -ears, nose, fingers- or adornments; stylistic conventions as stick-style or rectangular bodies, etc. The final sample was composed of 59 units and 30 variables.

The results of this new correspondence analysis have been far less significant than the previous ones, as no parabola was detected in the diagram. Instead, an elongated cluster was documented, surrounded by smaller groups of cases and variables. The detailed analysis of the different variables showed that the long cluster could imply some short of seriation, but its direction and meaning remained inconclusive. The detailed analysis of the depictions suggested an evolution either from schematic to natural figures or the other way around (fig. 6). The absence of chronological criteria within the sample implied that the seriation could be read from both sides, thus leaving the interpretation open and subsequently useless.

The clue to find a chronological meaning for the Correspondence Analysis came from El Ezziani's former works (2002, 2004a, 2004b), which encompass the whole anthropomorphic depictions in the High Atlas (around 160). Based on a different statistical technique (the Multiple Factor Analysis), he detected six different groups (I-VI), and proposed a chronological evolution from the most complex and elaborated anthropomorphs to the schematic, stick-style figures. A definitive argument came from the association between anthropomorphs and other engravings, some of which had a clear chronological ascription. Thus, several of the more detailed anthropomorphs were associated to halberds (El Ezziani 2004b: 540), a weapon which, as already said, is dated to the Bronze Age, while a more schematic figure from the *Yagour* plateau has a Libyan-Berber inscription written within it (El Ezziani 2004b: 542). According to these strong evidences, the long, curved cluster of the Correspondence analysis should be read from left to right, being the more elaborate the oldest depictions. The other cases displayed throughout the diagram were easily identified as very scarce and statistically non-representative, as happens with the cruciforms. Lastly, a group of depictions -the ones traditionally interpreted as violin Idols- also appeared isolated.

After a close analysis of every depiction, seven clusters were defined: Group I comprised some complex engravings with arms and legs represented by two lines, very detailed facial features, and what is usually interpreted as clothes and sometimes jewellery. This first group would also include the figures known as *suppliciè* (sacrificed or tortured) in French tradition, which depict a human being -most probably a man- killed by spears or arrows. Given the warlike engravings to which these depictions are related, these figures could also be interpreted as combat scenes where a warrior or hero was killed in a context of conflict, of which we know as much within the Oukaïmeden shepherds as in other pastoral societies (Thapar 1981; Mahdi 1999; Ati 2009; Bouhand Mammo 2008; See also Chapter 6.1). This group should be identified with El Ezziani's Group III (2004a: 520-523) (fig. 7.1).

From this initial stage the figures tend to an increasing schematism, first with the body still rectangular but legs and arms depicted by a single line (Group II) (fig.7.2) and finally stick-style figures where toes and fingers are the only remnants of the initial, naturalistic figures (Group III) (fig.7.3). These two groups would respectively correspond to El Ezziani's Groups V and VI, respectively (2004a: 526-528). The end of the curve (Group IV) would be characterized by very schematic and linear figures in profile, without fingers or toes depicted, much in the way of El Ezziani's Group II (2004a: 517-520. The only exception would be an anthropomorph associated to a bovine with horns in skewed

Fig. 10. Libyan-Berber scutiforms.

perspective, although this case would be an exceptional example in Oukaïmeden rock art.

The other three groups consisted of a small amount of engravings and appeared isolated due to their poor numerical representativeness, with an unclear chronology and an absence of links to Groups I to IV. Group V was defined by just two cruciforms whose isolated representation made them impossible to interpret (fig. 7.5). Neither of them is associated to other art motifs that could give us a clue about their chronology, and El Ezziani doesn't include them in his study.Nevertheless, although rare, there are some cruciforms in Libyan-Berber art that could perhaps be associated with these cruciform antropomorphs (Salih and Heckenderorf 2002: fig.14).

On the contrary, anthropomorphic Group VI is important despite its uniqueness in Oukaïmeden as they come from the Elephants' Frieze, (Rodrigue 1987 and 1991), where a procession of four elephants, a feline and a rhinoceros or perhaps a warthog are depicted marching to the right. The two humans are shown between the first and second elephant, the one to left partially overlapped by a Libyan-Berber inscription (fig. 7.6). Although the engraving technique (invasive abrading) is considered old in the rock art of Oukaïmeden and the Libyan-Berber inscription provides an *ante quem* date for them, of the 6th century B.C. or even later, for the scene, (Chaker and Hachi 2000:96: El Khayari 2009:130 and ff), its chronology is still undefined and most of researchers (El Ezziani 2004a: 519; Searight 1993: 70) consider it to be Libyan-Berber, too. According to El Ezziani's analysis, these fig-

ures should be also included in its Group II (2004a: 506) (fig. 8).

The last cluster detected by correspondence analysis is Group VII, which included ten depictions belonging to the so-called violin Idols in French tradition. This kind of figures has a triangular or rectangular body with two oval or semicircular protuberances on both sides of the body that are considered to correspond to the arms. The legs are defined by parallel lines, but they do not have toes, although a kind of claw has been documented in some cases. The body has a large, semicircular shape between the legs from which some straight lines are pecked. Although there are some general features that could relate them to the Libyan-Berber engravings of Groups I and II, there are also significant differences: rounded arms and a bird-like face, absence of fingers, toes or clothes, etc. which could point to a different chronology. These engravings are all concentrated in the OK5 area and frequently appear isolated, but there are two cases where they are connected to weapons. That is, for instance, the case of station 19 of OK5, where a violin Idol is
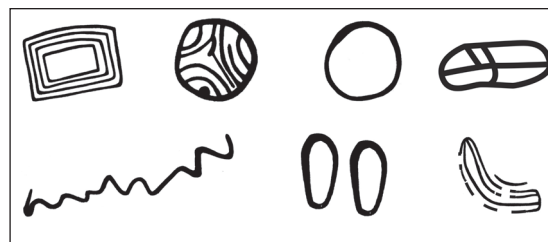

Fig. 11. Libyan-Berber symbols. After Malhomme 1959 and 1961.

connected to a triangular depiction, a possible Type III dagger, that is carved on its right side. In OK5 station 20, another violin Idol is overlapped by two maces, the oldest group of weapons, considered to be dated to the Copper Age to Bronze Age. The third case, station 42 is very interesting, given that another violin Idol appears on the same surface as a triangular dagger and a fan-like symbol, (interpreted by Collado as possible necklace depictions), both of them well known in other rock art panels of the valley connected with Libyan-Berber art, although both symbols have an undoubtedly different wear patina.

Regarding their interpretation, no consensus has been achieved among the ARPA's team. Some members (H.C.) consider them to represent female anthropomorphs. Contrary, the present authors read them as birds, perhaps an ostrich, depicted in overhead view (fig. 9). Most of the iconographic features match, in our view, this interpretation: the bird-like face, the two rounded arms -which could better be seen as wings- or the absence of toes that would be understandable since ostriches have no toes but claws, which sometimes are represented. The semi-circular shape and the lines pecked between both legs could be interpreted as a tail with feathers. The overhead view is one of the features that characterize the oldest zoomorphic representations in Oukaïmeden. This fact could suggest a prehistoric chronology for these depictions, coherent with the maces overlapped to them in one case. Although in two cases Group III daggers of Libyan-Berber date are depicted on the same panel, in at least one of them the wear patina looks outstandingly different.

Significantly, El Ezziani's statistical analysis isolates this set of figures from the very beginning of his study (2004a:502), reinforcing the idea of their specificity. Chronologically, the aforementioned author relates them to the older of the two groups in which he divides the anthropomorphs' chronology (2004b: 558). Regarding its interpretation, El Ezziani rejects the interpretation of these figures as violin Idols, an interpretation that has been strongly contested, due to its aprioristic and historicist approach (Searight 2004: 51), and proposes an alternative explanation as archetypes of femininity (El Ezziani 2004b: 516).

The third correspondence analysis did not provide results as good as the two previous ones, but combined with the previous work of El Ezziani it has served to establish a coherent framework for this type of engravings. For example, the Corre-
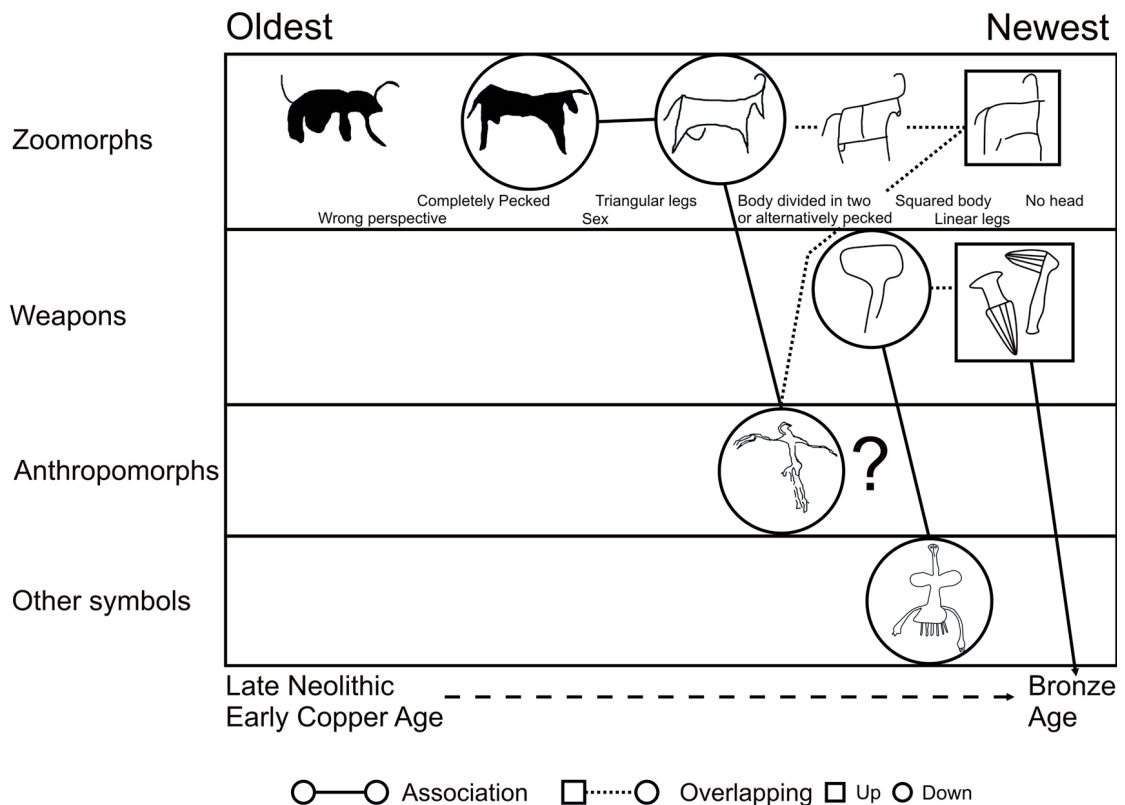

Fig. 12. Proposal of typology for Prehistoric depictions at Oukaïmeden.

Fig. 13. Examples of overlappings in Oukaïmeden. The grey colour indicates the engraving which lies above.

spondence Analysis has confirmed the progressive evolution of figures towards an increasing schematism, only pointed by El Ezziani, while on the other side his work has helped to interpret several isolated clusters (as group VI), which are more coherently understood within a wider sample. Although the chronology of the engravings will be thoroughly discussed in another paragraph, everything points to that anthropomorphic depictions began at a later phase, when pressure over resources became stronger and claims on rights on resources gave way to intergroup conflicts. The presence of some halberds associated to the oldest depictions could point to a Late Bronze Age chronology for the appearance of these engravings, although their exact chronology has still to be properly stated. Actual Bronze Age halberds were probably rare and exotic in Northern Africa. In fact, only a miniature halberd is known up to now to have been discovered inside a cist tomb at *Mers*, near Tangier in Northern Morocco, together with two bronze or copper awls (Souville 1986; Ponsich 1970). Due to its small size, it is difficult to guess whether it mimics a west Iberian "*Carrapatas*" type halberd or not (Schumaher 2002). It is plausible, that some few models of "Atlantic" halberds could have arrived into Northern Morocco, but it does not look probable that they reached as far as the Atlas area, where there are not recorded. However, the scarcer they were, the more valued as power emblem would they be seen

From individual depiction to rock-art stations

Despite their limitations, the three correspondence analyses described above provided some key chronological clues with regard to a broader organization of Oukaïmeden rock art. The second level of analysis focused on the study of the relation between the first two organized sets of depictions with other kind of engravings, which were more difficult to date, mostly geometric depictions whose meaning and chronology are often dubious. The reiterative occurrences of these symbols with the ones studied through statistics not only let us assign some chronology to the former, but also to establish organized sets of symbols for each historical period. Once these sets of symbols were defined, an approximate -if broad- chronology for each rock art panel and station could be stated. Thus, a spatial analysis could be undertaken throughout the different periods of Oukaïmeden occupation. Of course, some of the symbols -those that did not have a physical relation with the ones dated- could not be chronologically ascribed to any period.

One of the groups that could be easily dated was the circular or rectangular motifs, either simple or complex – with a carved pattern inside – usually called scutiforms, since they recall shields (fig. 10). The circular ones are far more numerous and frequently appear depicted in groups, as in several stations (5, 10, 11 & 14) of OK2 "Village" area, or station 10 in OK4 area, sometimes combined with other *signs*. This is the case of rock-art station 15 in OK2, "Village" area, where shield-like round motifs combine with a foot print and a dagger belonging to Group III (Libyan-Berber date). The same happens in station 2, panel 2 of OK2 "Dam" area, where a round scutiform is depicted together with three Group III daggers and a snake-like motive. In several other stations, foot prints and scutiforms come together in the same panel, sometimes in as-

sociation with Group III weapons, as in station 12, panel 2 in OK4 area or in station 55 of OK5 area. Moreover, footprints are usually linked to weapons and anthropomorphs of Groups I and II; consequently, we assume that round scutiform depictions and foot-prints are to be dated to the Libyan-Berber period. Of no lesser interest is the scutiform in station 4 of OK2 "Dam" area, since that motive is connected to a four legged animal. Four legged depictions are characteristics of a late Libyan-Berber period and are very rare in Oukaïmeden.

The scutiforms of square size and complex pattern are less numerous and seem to be associated to anthropomorphs of Group I (El Ezziani 2004a: 540).Therefore they could belong to the early Libyan-Berber Period too. The best known case is the so-called *Homme de Pinguet* (Malhomme 1959:45 fig111a) of station 4 in OK2 "village" area, but there are many others, such as the *man of Israoul* (Malhome 1959:146, fig 430) and the one from *Aguerd n'Tircht*. This rock-art station contains an anthropomorph with a Type III dagger, a square scutiform and spearheads some of them overlapped to a naturalistic depiction of a bovine. They all appear together with four-legged animal depictions of undoubtedly Libyan-Berber chronology (Mahomme 1959:157-158, nº458). Several other similar cases are collected by Searight (1993).

The same method was used to assign chronology to snake-like forms, the so-called slingshots and the fan-like signs that, when in association always appear connected to round scutiforms or Group III weapons (See fig. 11). Similar associations also exist in other High Atlas rock art areas, such as *Tizi*

N'Tirlist (Malhomme 1961:168), with a snake-like sign and a slingshot, together with round scutiforms and riders on four-legged horses. Also in the so-called *Bou Oudrouc*'s Man, where an anthropomorph of Libyan-Berber age is depicted together with Group III daggers and a fan-like sign (Malhomme 1961:151). Snake-like depictions have also been found as far away as the Canary Islands, linked to circular motifs and Libyan-Berber writing (Farrujía 2009: 37). Eventually, other underrepresented weapons, such as axes with a thin, lateral blade also appear related to Libyan-Berber engravings, as in station 5 of OK7, where one of them overlaps a Type III dagger, or in station 45 of OK5, where they appear related to Type IIIB daggers.

Other symbols are far more difficult to ascribe to any of the periods considered. Especially relevant are a group of geometric, round-shaped depictions -oval or irregular- whose interior is divided by lines creating a sort of net. However, in most cases this kind of representation seems to appear in relation with Libyan-Berber symbols not only in Oukaïmeden (Malhomme 1959: 30) but in other places, such as *Yagour* (Malhomme 1961: 93-98) and even the Canary Islands (Farrujía 2009: 38).

Eventually, some kinds of symbols could not be ascribed to any specific chronology. This is the case of the simplest depictions, such as simple lines or cup marks, which could have been made in different periods.

The analysis of the relationships between the engravings with a known chronology and those whose chronology was unclear has substantially enlarged the corpus of symbols ascribed to a specific period.

Fig. 14. Libyan-Berber I (left) and II (right) examples. Chronologically, the first group would connect with the previous Bronze Age period.

Of course, that ascription can only be considered in general terms, as precise chronologies could only be achieved through the relationship of rock art with accurately dated archaeological stratigraphic sequences, what has been proved almost impossible to get in Oukaïmeden. Even considering this problem, the statistical analyses and the subsequent search for relations within panels and stations has provided an alternative path to the study of the evolution of themes and the spatial distribution of engravings over time. Imperfect as it is, it is now the only path available to unravel the evolution of Oukaïmeden rock art over time.

Summing up: Main associations in Oukaïmeden rock art

So far, the aforementioned methodologies and results had but one objective: to establish a chronology for Oukaïmeden rock art engravings. Even considering the problems already described, statistics combined with analysis of motifs associations has provided a way to organizing rock art and overcome the simple inventories carried on until now. It has also established a proposal of chronology that can be used to systematize other rock art areas in the Atlas, such as *Yagour*. This proposal should not

be considered a classical typology of rock art with accurate chronologies, but as a series of associations between rock art symbols with a similar, wide chronology. The chronology provided -if imperfect and incomplete- constitutes the first step to broadly define historical periods, to compare stylistic evolutions and to finally accomplish the unravelling of Atlas rock art.

A) The prehistoric depictions

There are two main groups of rock art engravings whose chronology must be considered undoubtedly prehistoric (fig. 12). The first one is weapons of Groups I and II according to the first correspondence analysis undertaken. These weapons consisted of maces and halberds, but after a careful analysis of the representations a third group was added, characterized by daggers with several grooves on the blade and a double rounded hilt. As we have explained before, the far more numerous Iron Age daggers -which also have double rounded hilts but just midrib- affected the statistical analysis somewhat by hiding these Bronze Age daggers, which in fact are better defined by their multiple grooves on the blade, a feature that also appears in most of the halberds, as can be seen in station 7 of OK2 "Village" area. Here an anthropomorph's hand appears together with grooved bladed dagger and halberd
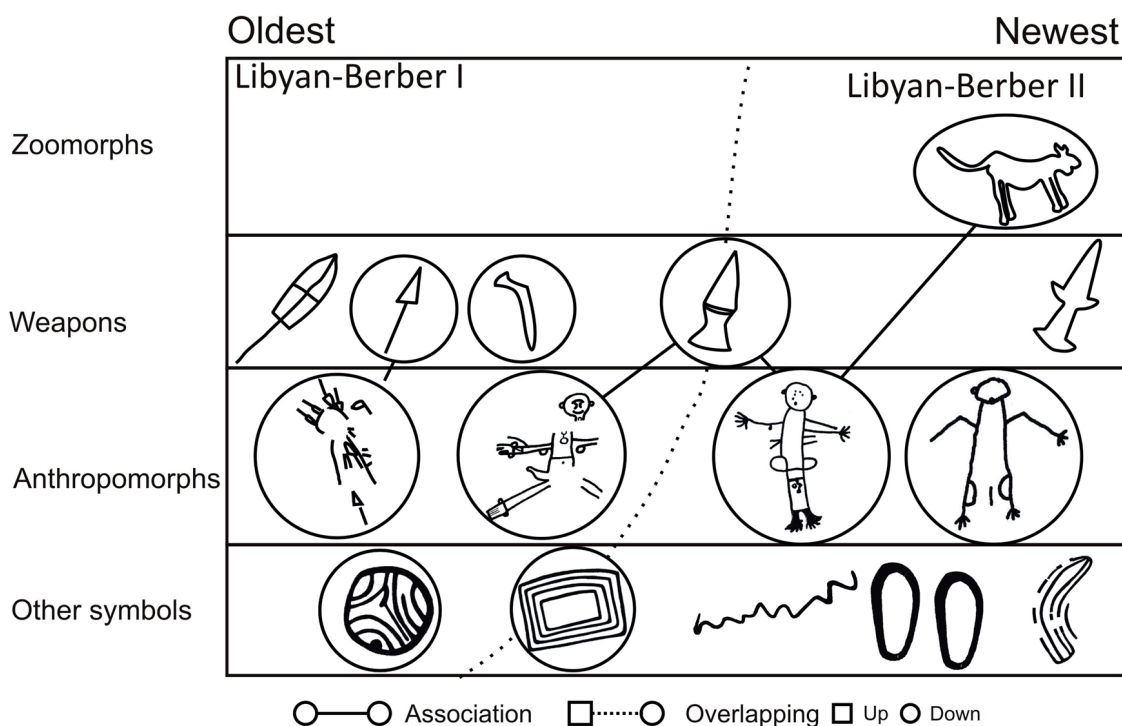

Fig. 15. Proposal of typology for Libyan-Berber depictions in Oukaïmeden.

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and a Nine Men´s Morris or *Awale* motive. The second main group is that of animals, with the exception of a very small sample of engravings that are dated to the Libyan-Berber period and that are very well characterized by the representation of four legs. Along with these, another group of depictions should be considered to be of prehistoric date. This is the group of so called "violin idols" discussed above, for which an alternative interpretation as ostriches has been already proposed

Other than animals and Bronze Age weapons, not many depictions can be considered prehistoric. The main debate is focused on the presence of anthropomorphic depictions in the Bronze Age. Leaving aside the figures undoubtedly considered Protohistoric (Groups I to III) and the so-called violin Idols, which would not be anthropomorphs in the present authors opinion, only two depictions might correspond to this period, although only one of them can be considered prehistoric for sure. One of them is located in rock-art station 1 of OK2 "Dam" area, where an anthropomorphic figure is represented along with a bovid represented with horns in skewed perspective. Both figures are overlapped by two schematic square bovines, which belong to the newest type in the prehistoric zoomorphs series. Therefore, its adscription to the Prehistoric period is undeniable. The second case corresponds again to OK2 "Dam" area, where on panel 1 of rock-art station 7, a human depiction in profile, apparently wielding an elongated object and with an erect penis was carved in front of a bovine with horns in wrong perspective. In this case its ascription to a prehistoric chronology is more dubious, since the Correspondence Analysis places it at the end of the seriation, thus being one of the newest depictions in the whole sample. El Ezziani placed this image in Group II, too (El Ezziani 2004a: 539). Other authors (Searight 1993: 70) consider it to be prehistoric, an interpretation shared by some members of the ARPA team (H.C See Chapter Art). The present writers could not reach any conclusion, because, although even if these anthropomorphs might have been ascribed to a prehistoric period, they were anyway very infrequent and scarcely representatives statistically.

There are other problems regarding the interpretation of the set of engravings described above. The first is their absolute and relative chronology. Although all these motifs are previous to the Libyan-Berber art, and therefore they were made between the Late Neolithic and the end of the Bronze Age, a more accurate chronology is difficult to achieve. Weapons are the best identified from a chronological point of view, with halberds and daggers belonging to the Bronze Age and maces being slightly

older, probably dated between the Late Neolithic to Copper Age. The chronological distance between these two groups of weapons seems to have been small, a fact shown by the statistical analysis which left an empty space between both kinds of weapons -an indication of fast changes within the seriation (Jensen and Nielsen 1997: 44-48). That feeling has been archaeologically confirmed, since in some cases (rock-art station 3 of OK2 "Repeater" area, or rock-art station 3, panel 2 in OK8 area), maces coexist either with halberds or with typical Bronze Age grooved blade daggers,therefore we cannot exclude that maces could have reached the Bronze Age. In turn, Bronze Age halberds and daggers are sometimes overlapped by Libyan-Berber Group III daggers, such as in OK6 area, station 26, panel 2 or in OK3 area, station 44 (fig. 13).

The major problem appears when we try to link weapons and the other depictions. Some of the main evidence for dating zoomorphs is the relationship between a mace and a squared elephant, which corresponds to the newest zoomorphic type according to the statistical analysis. Since they were depicted using the same technique and offer a similar patina, both engravings seem to be of the same age, so a link could be established between the oldest weapons and the most evolved animal depictions. Although the connection is weak due to the lack of information, all the relationships presented above are quite coherent and could be summed up as follows:

B) The Libyan-Berber depictions

Most of the depictions documented at Oukaïmeden are classified as Libyan-Berber, a long period which runs from approximately mid7th century B.C. to the Muslim conquest in the seventh century A.D. The rock art that corresponds to this period is very well known, but it still lacks chronological accuracy, thus it is quite difficult to organize the sample of rock art engravings into a coherent corpus. In fact, most Moroccan rock art engravings of other Atlas and Anti-Atlas areas dated to the Libyan-Berber period are quite different from those recorded at Oukaïmeden, mainly consisting in very schematic scenes of riders, where warriors fight each other. In Oukaïmeden, on the other hand, Libyan-Berber engravings seem to be represented by very detailed depictions of anthropomorphs without horses -although some isolated, schematic horses occur=, weapons and shields. Another main distinction is the context in which the engravings are represented. They almost never depict scenes, although some complex figures known as the *Supliciès* could be interpreted as such.
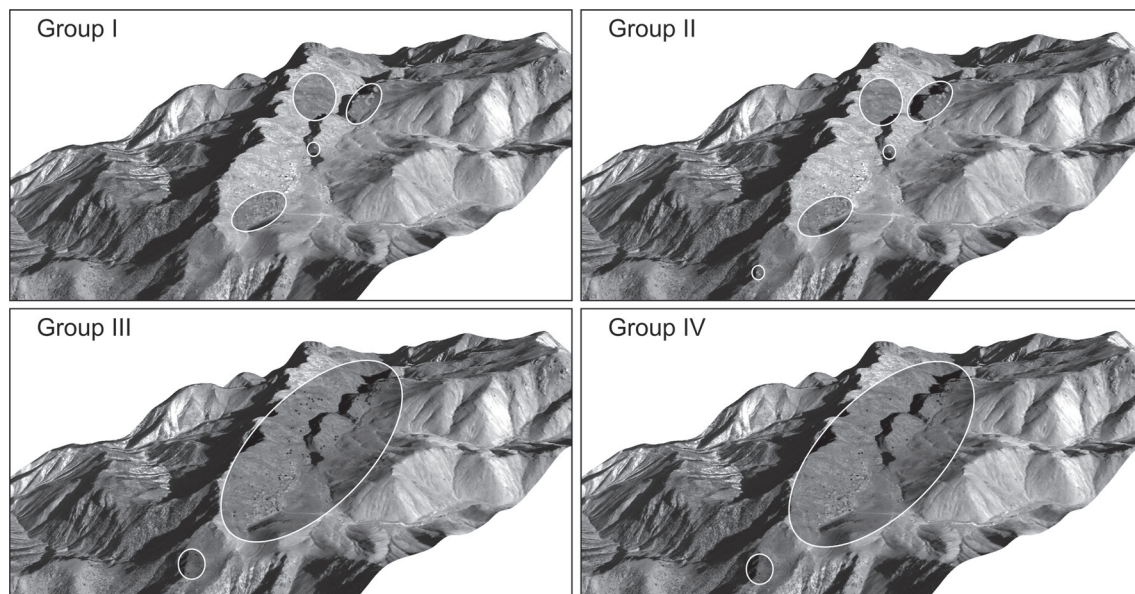
Fig. 16. Distribution of rock art depictions in Oukaïmeden. Top row: Prehistoric Period (Pre-Bronze and Bronze Ages). Lower row: Libyan-Berber I and II Periods.

Libyan-Berber engravings can be broadly classified in four large groups. The first is of course weapons, which consists mainly of daggers and swords, most with double-rounded or squared hilts. Double–rounded hilts were also documented in the Bronze Age, and the difference between both models depends mainly on the blade, which is multiple-grooved in the older examples (identical in daggers and halberds) and has only midrib or they event lack it, in the Iron Age daggers. The panoply is completed with slings, axes, spears and arrows, although daggers are by far the most abundant weapon. Contrary to Bronze Age daggers, which show a remarkable uniformity, Libyan-Berber daggers evince an evolution through time and wider variability, not only in the blade or the hilt shapes, but sometimes in the presence of hilts or ricassos (fig. 14).

The second main group is made up of anthropomorphs' Group I to III. Although there is a continuous evolution from the more elaborated to the simplest models, two groups could be broadly defined depending on their -relative- complexity. Group I would correspond to the most complex engravings, with two lines to represent arms and legs, detailed facial features and in some cases personal adornments, such as earrings and bracelets. Most of them are represented with what has been described as clothes – i.e. diagonal lines represented both inside and outside the body. Additionally, in some of them, the artist seems to have tried to represent movement, sometimes through the depiction of bent legs and

arms, or with arrows pointing to the head -the case of the so-called *supliciès* (See fig.14 left). Group II would include less elaborated figures, already in frontal position and with a squared body but with some schematic elements, such as arms and legs represented with just one line, partial or no facial features and a more hieratic representation (See fig. 14 right). Anthropomorphs at final stage of the evolution (Group III) are stick-style figures normally without any other symbols around.

Libyan-Berber anthropomorphs and weapons are usually joined by a wide range of symbols. In fact, most of the undefined representations in Oukaïmeden seem to belong to that period. As we have said, the set of symbols that can be ascribed to the Libyan-Berber period includes the round and rectangular shapes -with inner decoration or not-, footprints, snake-like forms, "fans" and probably curved, irregular shapes with inner partitions. The sample of Libyan-Berber depictions is completed with a small group of zoomorphic depictions that correspond to two very well-defined conventions. The first one represents animals in the most schematic way -just four vertical lines for the legs and a horizontal one to define the body-, much in the way of the schematic horses that characterize Libyan-Berber rock art in other areas of Morocco. In this case they appear isolated and without riders, so it is impossible to determine the kind of animal depicted. A very interesting case is the one recorded in OK2 "Dam" area, where a four legged zoomorph was carved in contact with a scutiform. The second

group of animals are felines, which are represented in a more naturalistic style with a curved body, a round head with ears, four legs with the paws marked and tail. Both types have parallels in *Yagour* (Malhomme 1961: 106, 109, 112, 138).Although different, both styles have some common features and are depicted with four legs, a convention unknown in the previous period. Schematic horses are dated in the Libyan-Berber period, and in the case of the less known felines,from a chronological point of view they can be put in relation with a depiction in *Yagour* representing a Group II anthropomorph fighting with two of them (El Ezziani 2004a: 542).

The combination of the Correspondence analysis, associations of engravings and comparisons with other sites in the High Atlas have allowed detecting some evidences of an evolution in the Libyan-Berber engravings, which could be chronologically useful.This is the case of weapons (Groups IIIA and IIIB) and anthropomorphs (Groups I and II) and other signs linked to them (fig. 15).What we have called Libyan-Berber I period is represented by Group I anthropomorphs and daggers with double-rounded hilt, most of which have a midrib on the blade -instead of several grooves that characterize Bronze Age daggers- or no midrib at all. Spears or arrows are also represented at this moment, with an oval shape crossed inside. Shields are also included,especially the rectangular ones, while other symbols such as foot prints, fans or snake-like figures are absent(See fig. 15).

In a second stage (Libyan-Berber II), the most characteristic figures are anthropomorphs' Group II. Daggers are still the most frequently represented weapon, but they present greater variability, including the presence of hilts and ricassos (See fig. 15). Double rounded hilts are still common, but hilts and grips are far better defined, in comparison with the almost triangular shapes of previous periods. Other kinds of simple, squared hilts also appear. Most blades do not have midrib.Along with daggers, other weapons are represented, such as axes and slings. The amount and variability of signs seems to increase over time, such as rounded shields, fans, foot prints and most of the irregular, rounded shapes correspond to this period.

This briefly exposed evolution is coherent with the El Ezziani's anthropomorphs study, although it incorporates the rest of Libyan-Berber symbols into the analysis. However, the chronology proposed by El Ezziani (2004a: 561) marks a date for the appearance of anthropomorphs which in our opinion is too old. El Ezziani suggests the second half of the second millennium BC, based on the association of halberds and anthropomorphs. However, although the adscription of halberds to the Bronze Age is be-

yond doubt, the links between the engravings and the physical objects are terribly vague and, already argued, the mechanisms through which the knowledge and symbolic appropriation of these pieces took place are unknown. The only archaeological item, that could be identified as a halberd was found in Tangier, more than 500 kilometres to the north (see above). Therefore, trying to compare the Iberian types of halberds to the High Atlas engravings seems, in our view, lacking of serious base.

In fact, the relation between halberds and anthropomorphs is significantly scarce, with only 5 cases in 40 Group III depictions (12, 5%). Moreover, this halberds show notably differences with those that appear isolated: they are much worse defined and more schematic, sometimes being just a triangle and a line to represent the handle. In our opinion, this lack of definition would imply a progressive temporal distance with prestige objects whose general meaning is kept but whose concrete details have been forgotten. Therefore, the halberds linked to anthropomorphs would represent the memory of an old prestigious symbol, most probably without direct links to a weapon which was, in the best of assumptions, exceptional in North Africa. That would also explained the scarce amount of halberds linked to anthropomorphs, three cases in Oukaïmeden (OK2 "Village" area, station 7 and Rodrigue1999: O/VII/153, page. 199 and O/VII/280 page 210), and another few cases in the neighbour *Yagour* plateau (Rodrigue 1999: Y/II70, page 234; Y7IV/8 page 240), as they would play a minor role in the symbolic panoply that surrounded the appearance of human figure.

Finally, El Ezziani's proposal does not consider the long term process between the arrival of an exotic and its survival within the symbolic code of a group. The scarcer and more exotic they were, the longer its survival as an emblem. Therefore they could have gone on depicting them, when in Europe these weapons were already out of use. These arguments led us thinking that, although halberd depictions could have appeared during the Bronze Age, anthropomorphs followed suit probably later, at the Bronze Age/Libyan-Berber transition or at the beginning of this second period, a time when, as proved by the *Supliciées* motifs, an increased warfare would have driven to an stronger self-consciousness and sense of group identity against others groups in conflict because of critical resources.

Another point for debate is the link between the High Atlas Libyan-Berber depictions and those that characterize the Libyan-Berber period in the Anti-Atlas and the Saharan desert. Although scarce, the presence of Libyan-Berber rider scenes in the High Atlas has been documented in sites as *Jbel*

Rat, but they were unknown in Oukaïmeden. The discovering of several depictions that could be included in this group, along with some anthropomorphs,as those of the Elephants' Frieze must be considered marginal in Oukaïmeden and therefore they have not been included in our proposal (See fig. 15). However, their chronological position is relevant, as it can provide the clues for the whole evolution of Libyan-Berber rock art in the High Atlas, and thus they will be discussed in the final remarks of this chapter.

Beyond the diagrams. The spatial implications of correspondence analysis

Correspondence analyses are not just a statistical technique to detect organizing criteria within vast quantities of data; neither does this information remain isolated in a mathematical level of analysis. Leaving aside the specific aspect of analysis -in our case, the stylistic evolution of the different types of engravings- the data can be analyzed from other points of view with the improved insight provided by correspondence analysis. One of these points of view is spatial analysis -that is, how the clusters or seriations detected in the correspondence analysis are distributed throughout the territory. In a project such as this, where the analysis of landscape is paramount, the search for ordering patterns in the different chronological periods was a main aim to achieve. Although they are far simpler and imperfect than GIS analytical techniques, the transposition of the statistical results to the topographical map has provided some clues, that added a better insight of the topo-chronology of Oukaïmeden rock art that is, the way in which the spatial distribution of engravings evolved through time. Not surprisingly, the best results were achieved with weapon depictions, which were the most abundant sample of engravings and also had proved a better seriation. When the four groups defined in the correspondence analysis were displayed over the Oukaïmeden map, they showed similar spatial criteria, depending on their chronology. Thus, Groups I and II, which were defined as prehistoric, show a similar territorial distribution pattern, with two main areas located on both sides of the valley, and a small amount of depictions in the middle (fig. 16 above). Groups III and IV, on the other hand, showed a more systematic distribution that covered the whole valley (fig. 16 below). In these periods, new areas connected to small streams were chosen for depicting weapons, in what could be interpreted as symbolic appropriation of these marginal wet areas, scarcely exploited before. These areas are associated with grazing ar-

eas smaller than the ones related to the main river, a situation that could point to a new scheme where the pressure over resources was higher than previously. As most of the weapons depicted in Oukaïmeden belong to Groups III and IV, it seems that the more intensive distribution of rock art along the valley could be linked to a higher stresson resources and higher tension among human groups.

Moreover, the differences in the chronological distribution of rock art opened a way to integrate other kind of symbols into our analysis. According to this hypothesis, all depictions placed in the marginal areas should hypothetically correspond to Libyan-Berber or Medieval periods. Although the construction of hotels and *chalets* in that area has seriously affected the engravings preservation, and thus the results can be biased, some indications seem to reinforce that hypothesis, as most of the engravings documented at this area are rounded and rectangular shields, etc and therefore correspond to the Libyan-Berber Period. Thus, the spatial expression of the correspondence analysis has had a retrospective effect providing new clues for a full understanding of the rock art spatial patterns in Oukaïmeden.

As with their correspondence analyses, the spatial distribution of zoomorphs and anthropomorphs has reflected sample deficiencies. However, although the spatial distribution of these types did not provide further information, its position somewhat reinforces the previous analysis made on weapons. Thus, the hypothesis of two different patterns going on in Prehistory,and in later periods seems to be reinforced. Again, statistics show the tendency and detect the hidden structure within the data -this time, in its spatial aspect. However, as in the case of the two axes displays, it is the archaeologist's work to find out the economic, social or ideological explanations to these distributions and their changes over time. To do so, a far more complex analytical tool -the GIS- is required, to join the data previously obtained and give them a geographical meaning.

Conclusion:unravelling rock art patterns in Oukaïmeden

The analysis and ordering of Oukaïmeden rock art was essential to detect the main trends, chronological, spatial or stylistic, that structured and gave a symbolic and cultural meaning to rock art throughout the human occupation of the valley. To do so, an alternative methodology based in statistics has been applied in combination with the classic techniques of rock art analysis based on the stylistic or techni-

cal features of the depictions. The combination of multivariate techniques, traditional approaches and a comprehensive search for associations and parallels has achieved a significant success in detecting some of the organizing criteria in Oukaïmeden rock art. These criteria have provided a chronological and spatial meaning for most of the carvings, establishing a proposal of typology -though generic- for the prehistoric and protohistoric depictions of Oukaïmeden.

The main conclusions of this analysis can be summarized as follows:

-Most zoomorphs seem to be the oldest depictions in the series, appearing prior to the Bronze Age. The only exception would be a small group of animals depicted with four legs, mainly schematic horses or felines, but there are others (the elephant of station 7 in OK2, "Dam" area, some Libyan-Berber horsemen in Y*agour,* (Rodrigue 1999:Y/XI366 page 356) or the four legged animal in OK2 "Village", station 7 (see Fig. 15 and Rodrigue 1999: O/III/29, page 158) which belong to a later, protohistoric period. Within the prehistoric engravings, zoomorphic depictions evince a stylistic evolution towards schematism. Except for elephants and the rhino o warthog in the Elephants' Frieze, all herbivores depicted are domesticated and with the exception of equines, all are bovines, whose high value as mobile wealth, could explained the venture of exploiting and controlling high mountain summer resources. Of course, as still occurs to this day, bovines were not the only herds that fed on these altitudinal pasturages; there were probably sheep and goats, and in higher numbers. Nevertheless, as still today in many Mediterranean countries, the social, symbolic and economic value of bovines was paramount (Sherratt 1981 and 1996). A wild origin has been proposed for a donkey depiction of a most probable modern chronology (Rodrigue 1999 and Collado's Chapter 5.1 in this volume), without any proof to support this point.

Although our team's colleague Collado (see Chapter Art this volume), identifies several types of herbivores according to their physical features as goats and deer, the present writers think that all these herbivores are in fact bovines, based on stylistic, faunistic and archaeological data. To begin with, the presence of deer depictions in Moroccan rock art still has to be proved. Although in one case one animal depiction (OK5 area, station 34) has been interpreted as a deer, such interpretation is doubtful and other authors classify it as a bovid (Searight 2001: 300). Although remains of Barbary Deer have been found in archaeological contexts (Searight 2001: 272), depictions of deer are not taken into consideration in the latest synthesis of Mo-

roccan rock art (Searight 2001: 63-67) Moreover, the so-called deer or goat depictions in Oukaïmeden show a long tail, while goat and deer tails are short.

But the main argument for this interpretation is not only stylistic, but is also coherent with the model developed for explaining the story of the human use of the valley: i.e. short seasonal movements, between ecologically complementary areas located at different heights, what we call in Spanish *transterminance*, of prehistoric and protohistoric shepherds from sites located at mid or low altitude. By practicing short seasonal movements between lowlands and highlands, these prehistoric pastoralists had profited of the strong contrast in climate and vegetative growth between these, as it is still practiced today in Spain.

In any case, the identification of this small group of cases is a minor debate, as they are all considered Prehistoric, and nevertheless cattle represent the vast majority of herbivores depicted in Oukaïmeden. Therefore, their final ascription doesn't affect either the chronological interpretation of Oukaïmeden rock art or its social and economic implications.

Bronze Age representations are mainly weapons. Such a fact could point to an increasing conflict caused by a greater need to control critical resources such as highland grasses, a process that apparently grew to open warfare in the Libyan-Berber period and the middle Ages. Halberds and daggers are emblematic weapons embodying the symbol of warriors as leaders and probably the claiming of rights over pastures. This is especially true if, as shown by pollen and anthracological analysis, degradation evolved rapidly from the very beginning of human presence in the valley.

Protohistoric depictions tend to increase quantitatively and in variety. Although weapons are the most significant depictions, human and symbolic representations are quite common and have a relevant place within the sample. At the end of this period, the variety of types grows substantially, including footprints, new weapons such as slings or lateral axes and the first scenes where prominent figures -warriors, heroic ancestors- seem to be killed in battle. Thus, the meaning of the whole set of protohistoric depictions seems to have been similar to that of the Bronze Age, while during the Libyan-Berber Period, the number and variety of depictions increased exponentially, probably as a response to greater stress on resources. Anthropological literature on transhumant and *transterminant* shepherds, such as the Mahdi (1999) on the Berber shepherds and our own small inquiry among the Oukaïmeden *transterminant* shepherds support this view (Thapar 1981; Casimir 1992; Madhdi 1999; Kreutman

2004; Bouh and Mammo 2008:111;Ati 2009:31 and ff; Kreuer 2011: 63 and ff.). Although there are human depictions before the Libyan period, they are very rare and when related with other art categories, they always appear connected with animals. Thus, it seems that the emergence of human representations was a late phenomenon and according to the warlike symbology, to which they are connected, linked to an increased level of violence throughout the valley.

Significantly, the schematic horses that characterize Libyan-Berber rock art in most areas of Morocco and the Western Sahara are almost absent in Oukaïmeden. Although their position within the panels is not conclusive and thus their diachrony or synchrony with the two periods detected in Oukaïmeden is unclear. However, analyzed in a broader context there are several evidences that point to a later chronology for this style. The most comprehensive study of High Atlas anthropomorphs carried on by El Ezziani considers these figures to be slightly coetaneous to the last stages of frontal anthropomorphs (El Ezziani 2004a: 562), considering them local interpretations of the more numerous Libyan-Berber engravings that characterize the rest of areas of Morocco. Considering how both, weapons and anthropomorph depictions are rooted in Bronze Age symbolism, while four-legged animals are completely different engravings, it would be plausible to consider that these schematic horses appeared at the end of the Oukaïmeden Libyan-Berber period.

Rock art stations that can be assigned to a prehistoric date look to be located in a restricted area of the middle of the valley, on both sides of the *Irini* River and its tributaries, the *Tifergine* and *N'Talaisane* Streams, around which the best pastures are laid. From Libyan-Berber times onwards, other areas of marginal resources were exploited, which could be interpreted as a sign of greater pressure on resources.

Of course, these events need to be considered in a broader sense. Both Archaeology and Statistics have methodological gaps when analyzing complex processes, especially when dealing with a subject as complex as the recording and interpretation of rock art. A variety of methodological and interpretative problems have been described throughout this chapter. Thus, these statements must be understood as general trends to be contrasted with neighbouring areas, rather than a closed schema. In fact, the combination of methodologies applied at Oukaïmeden has been unable to solve certain chronological or interpretative issues. Some of these cases, such as the Elephant's Frieze, have already been discussed in detail and evidence the challenges faced by a comprehensive, global approach such as the one presented here.

As usually happens with both archaeological and statistical approaches, a better understanding of the analyzed parameters can be achieved through an increase in the observed sample. In our case, the comparison between the results presented here and the data provided by other rock art areas in this region, such as the *Yagour* plateau can help to clarify some of the problems found at Oukaïmeden. During the study of Oukaïmeden rock art depictions further information was sought in *Yagour* engravings and no incoherencies were detected between both sets of depictions. However, in addition to the search for parallels and associations, an integrated correspondence analysis could be made with the engravings of these two areas and some minor zones to get a much better, refined statistical analysis.

Assuming all the gaps in the described methodology and its results, it opens a new path to both the analysis of High Atlas rock art and a promising research thread to be further explored. Moreover, the academic discussion on correspondence analysis results and their interpretation will hopefully lead to a renewed approach to the chronological and stylistic study of this art. However, relevant as it is, the whole study described above only gets its full meaning when analyzed from a global point of view that includes the complementary paleoecological, archaeological, geographical, ethnographic and geographical information gathered about the Oukaïmeden Valley. It is only within this much broader context where the research presented here can be fully useful.