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Archaeology and Paleo-Environments of djbel boukahil

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Abstract

The territory of the Ouled Naïl served as a refuge for Holocene communities (around 7000–4000 B.C.). The coexistence between communities that remained hunter-gatherers and those that adopted a nomadic pastoral lifestyle pushed these societies into a process of Neolithization, visible through the cultural contexts of settlements in the foothills and the rock art sites (wild and domestic fauna) in the Ouled Naïl massif. Numerous traces left by these "Neolithic" groups on rock panels indicate optimal climatic conditions and show human adaptation to a diversified environment through multiple cultural actions.

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1. *Introduction*

Djebel Boukahil region, located in the southern slopes of the central Saharan Atlas, remains one of the least documented areas in Algeria concerning the Final Pleistocene and Holocene periods. Available archaeological data are fragmentary and come essentially from peripheral research or sporadic surveys. This scientific gap makes any attempt at a complete reconstruction of ancient human occupation dynamics in these arid environments difficult. However, by cross-referencing the results of work carried out by several researchers, notably Lhote (1984), Roubet (2016), Fontugne & al. (2016), it becomes possible to propose an initial interpretation of the environmental and cultural dynamics of this region, placing them within a broader regional framework.

The interest of this study lies in the integrated approach we have adopted; combining environmental, archaeological, and geomorphological data to better understand the prehistory of these little-explored areas. This approach allows for a better understanding of the migratory routes that human groups might have taken during the Pleistocene-Holocene transition, a period marked by major climatic changes. It is now accepted that the end of the Pleistocene, particularly the Younger Dryas, experienced a return to colder and wetter climatic conditions that would have favored the reoccupation of certain zones on the southern Atlas slopes. The first human settlements in these areas seem to have occurred as soon as environmental conditions became favorable again, as indicated by certain dates obtained from peripheral sites in the Ouled Naïl region (Northeast and South).

Despite this, it is still premature to precisely identify the movement axes or the geographical origin of the human groups that occupied these territories. A North-South extension, however, remains plausible (Amara & Roubet, 2014). Paleoenvironmental data from various research (Roubet & Amara, 2016) suggest an ancient anthropization of the territory, initiated as early as the Final Pleistocene and intensified at the beginning of the Holocene by groups of mobile hunter-gatherers, probably seeking refuge areas.

2. *Methodology*

This research is based on a systematic survey campaign carried out in Djebel Boukahil area. This region, although difficult to access due to its rugged topography and extreme climatic conditions, proved rich in archaeological evidence. Thanks to geomatics tools (GIS, Arch GIS), we were able to identify several types of sites: surface deposits, rock art stations, and sites near oueds (wadis) or in open areas. These remains generally appear on the surface, often exposed by wind erosion, storms, or floods.

However, the analysis of surface sites poses many difficulties, notably the absence of a precise stratigraphic context. In several cases, the lithic objects found appear to have been reworked by natural agents. Nevertheless, certain elements, such as the ram's head with a sphere from Ras el Ahmar, associated with lithic pieces, could originate from levels still in place. Old

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work carried out by Grébénart in the 1960s and 70s uncovered sites with preserved stratigraphy correlated with dated sedimentary data. At El Idrissia, for example, a surface site rich in scattered lithic material attests to sustained occupation, represented by a wide range of tools: geometric armatures, backed bladelets, scrapers, retouched blades, as well as fragments of ostrich eggshells, Neolithic pottery, and bone remains.

In order to better understand the spatial and cultural organization of the sites, different collection methods were applied: qualitative recording without location, collection with or without grid system, targeted excavation near rock art stations. Two major sites, Aïn Naga and Safiet Bou Rhenan, were subjected to in-depth analyses. The techno-typological results reveal great cultural coherence, with facies attributable to the Iberomaurusian, the Capsian, the Neolithic of Capsian tradition, and the Recent Neolithic. Radiocarbon dates obtained confirm the plurality of occupation phases.

Finally, the sedimentary observation of hydromorphic sands suggests that humid conditions persisted until the mid-Holocene (Green Sahara period). This environmental stability probably contributed to the observed density of occupation. Despite limited resources, our survey has made it possible to establish an initial map of the archaeological potential of the region. Human activity during the Holocene is clearly attested by the diversity of sites: dwellings, funerary monuments, rock art stations.

This work is part of an interdisciplinary research dynamic, at the crossroads of paleoenvironmental studies, prehistoric archaeology, and anthropology. It is integrated into a series of broader research projects on the Prehistory of the Saharan Atlas, initiated notably by Amara (2003) and Roubet & Amara (2016). The results presented here constitute a first step towards a better understanding of ancient human dynamics in the northern Sahara.

3. Distribution of archaeological heritage in the massifs of Djebel Boukahil region

Djebel Boukahil massif presents two main zones where the numerous rock art figures are concentrated. The first zone, containing the main stations on the southern flank, south of Djelfa (region of Messad, Ain Naga, Amoura...), and the second zone, on the eastern flank, west of Bou Saada (Djebel Moubakrera, el-Araïs, Tschar, el-Kahil,...), offers a few stations important for the themes they present (Lefebvre, 1975; Poyto, 1976; Lhote, 1984).

These rock art ensembles are concentrated along a long front stretching from Bou Saada to the north of Laghouat. This distribution corresponds to the topographical conditions offered by the Djebel Boukahil massif. The territories correspond to the southern and eastern piedmonts of the central Atlas. This Atlas rock art province represents the main economic (lithic industry) and cultural (rock art) activities since the beginning of the Holocene. This long chronology reflects a permanent occupation visible through the zones already mentioned. The iconography shows the representation of wild and domestic fauna from a rather ancient age, and symbolic, schematic, and geometric figures from a more recent age.

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The inventory of figures (style and theme) allows us to interpret the circulation of the populations responsible for this rock art and various prehistoric activities. Our approach follows the alignment of the central Saharan Atlas massifs, which in turn follows the concentration of regions occupied by Holocene populations in the south-southeast exposed zones.

The large region south of Djelfa concentrates the greatest number of stations and open-air occupation sites or rock shelters. Our survey has made it possible to map the distribution of this archaeological heritage. This region, less invested by research, offers what seems to us to be the extension of the territory south of Djelfa towards the east.

The studied territory resembles a kind of peninsula. It is bounded to the east by the great depression of the Hodna basin, to the north by the large bodies of water of the Zahrez el-Charqui and el-Gharbi, to the west by Oued Touil and the extension of the western Atlas massifs, and to the south by the large floodplains of numerous oueds that join further south the great fluvial artery of Oued Djedi. The orogenic unit of the Ouled Naïl is higher in the north and lowers towards the south. The geographical units of our study area show, to the north, the Snalba mountains; to the east, Djebel Fernan and Taggout; to the south, the Atlas foothills eroded by an intense hydrographic system. The small mountain chain of Bou Kahil acts as a shield to protect the Ouled Naïl mountains.

4. *Geographical and geological framework of the massifs of Djebel Boukahil region*

Our region (Fig. 1), marked by depressions, mountainous massifs, and a complex hydrographic network, presents a landscape shaped by millions of years of erosion and tectonic activity (Pouget, 1980; Ritter, 1901).

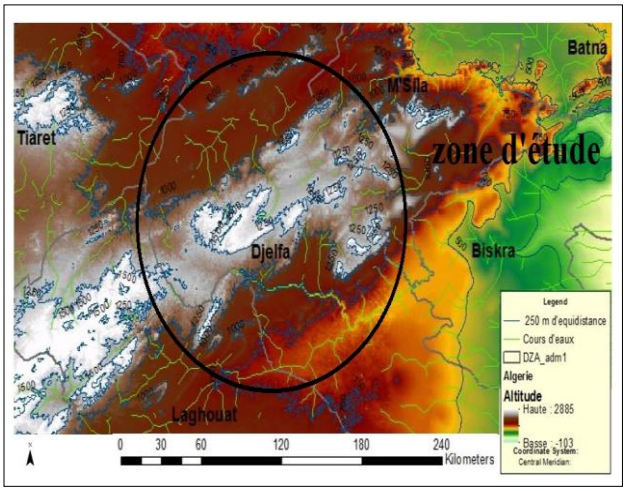


Fig 1. Topographic map of the study area

4.1 Large Depressions and the Hydrographic Network

To the north and northeast, vast depressions, such as Chott el-Hodna, are fed by oueds originating from the Aurès, Belezma, and Ouled Naïl massifs (Pouget, 1980). Two major oueds structure the landscape:

•Oued Touil (west), becoming the Chelif before reaching the Mediterranean.

•Oued Leham (east), flowing into Chott el-Hodna.

These watercourses, now intermittent, historically served as communication axes between the Atlas, Tellian, and Saharan mountain chains.

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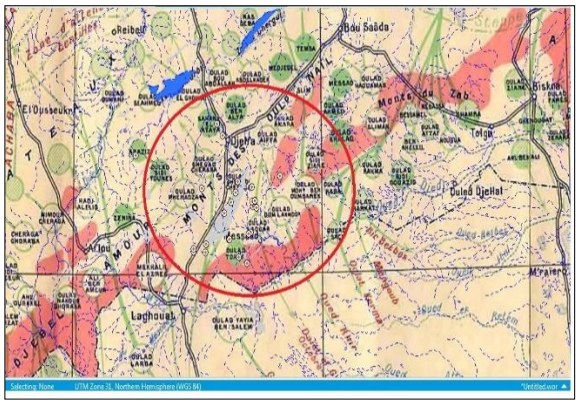


Fig 2. Hydrographic network of the study area

4.2 Geology and Landscape Formation

The mountains, dating mainly from the Cretaceous, result from Tertiary tectonic folding (Pouget, 1980). The dominant rocks (limestones, sandstones, marls) have been eroded into characteristic formations: cuestas, glacis, and entrenched valleys. Ouled Naïl mountains (14,000 km²) present parallel folds oriented southwest/northeast, with peaks like Djebel Mimoun (1,600 m) compartmentalizing the territory (Ritter, 1901).

4.3 Depressions and Human Occupation

The depressions (e.g., Aïn Naga, Messad) form "natural bays" conducive to habitation, as evidenced by prehistoric sites (e.g., the Amoura shelter, studied by Rabhi). The oueds (Mergueb, Djedi) create communication axes there, although their flow is now intermittent.

During the Holocene, climatic changes led to:

•The formation of dune cords (150 km long) (Pouget, 1980).

•Intense erosion, shaping hamadas, gour, and glacis.

•The accumulation of deposits (clays, red sands) during the Quaternary.

5. Climatic framework of Djebel Boukahil massifs

The Ouled Naïl mountains experience a continental arid Mediterranean climate. The climatic influence evolves from north to south. The region experiences hot summers and cold winters. Rainfall intensity decreases from north to south. Temperature undergoes irregular cycles, which disrupt the regime of the hydrographic network.

5.1 Precipitation

Annual precipitation is low, ranging between 300 and 150 mm/year. The peaks can experience seasons of snow and intense rainfall. This precipitation intensity decreases from north to south. This decrease follows the topographical gradient marked by the high mountains of the northern sandstone barrier (Dj. El-Ouachba, Sahari, Senalba, Tesfara, Zemira, Taggout, Mobakrera, ...) and the southern mountains (Dj. Djellal Gharbi, Djellal Chergui, Tafara-Zerga, Guedid, Bou Kahil, Fernan, ...).

Winter winds from the west/northwest and north (Mediterranean current) bring back moisture-laden clouds from the coast and the Tellian Atlas. The mountains acting as an obstacle allow the clouds to release their water over the Ouled Naïl mountains. The large summer depressions coming from the south cause violent storms on the southern flank, thus watering the vast plains that extend to the left bank of Oued Djedi. The region experiences another phenomenon linked to the hot sirocco winds and sand winds from the central Sahara blowing from the southwest/northeast and northwest/southeast.

This climatic activity marks a legacy of the ancient climate during the Holocene. The latter is characterized by long humid phases

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during the Early and Middle Holocene and more present arid phases, eventually giving the climatic aspect we know today with the reduction in precipitation rates.

5.2 Temperature

The temperature of the Ouled Naïl mountains is marked by its continentality. Isotherms range between 13 and 19°C/year. Temperatures increase from north to south. They follow the topographical gradient and the level of precipitation. The thermal amplitude is always high and exceeds 35°C/year. Cold, harsh winters are marked by snow cover on the peaks for a very short period.

5.3 Population

Historically belongs to populations that practiced nomadism and pastoralism. The dominant tribe of the Oued Naïl confederation gave its name to the massifs. The abundance of pastures, the vast plains, and the openness of the territory favored the practice of nomadism and pastoralism. Nomads still continue to move with their herds of goats, sheep (mainly), dromedaries, dogs, and everything that constitutes farm life, but on the move. These large families of the Ouled Naïl confederation still practice transhumance over wide territories ranging from the High Plateaus of Sersou (Tiaret), Titerie, and Constantinois, in the north, to the Saharan limits of Touggourt and M'zab, in the south. Passing through humid terrains, dayas, floodplains, or areas of chaaba or oueds, they sometimes sow cereals in autumn and harvest them upon their return at the beginning of summer.

A few ruined Ksours mark the presence of a sedentary tradition in the Ouled Naïl region. They are located near perennial springs, oueds, or where traces of agricultural practice are attested. These are practices of shrub, market garden, and cereal cultivation. A scientific survey and study could help us understand how these settlements were established in a region where the primary practice is linked to nomadism.

6. Prehistoric sites and their distribution in the Djebel Boukahil mountains

The sites are mainly distributed in two zones: the northeast and east zone, and the south zone. In the north, we recorded some rare stations in the High Plains stretching from El-Idrissia (Dj. Serdoun), Koreiker (Dj. Ouechba), and Kef et-Taga (Dj. Senalba), also extending to the easternmost point of the Ouled Naïl mountains (Djs. Mender, Moubakrera, Maaleg, el-Kahil). Then towards the south, the "great bay" and towards Laghouat concentrate the largest number of stations (Djs. Guedid, Ez-Zerga, Bou Kahil, Tafara-Zerga, Mergueb, Lezreg, Milok).

The geographical situation explains the distribution of sites across the entire Ouled Naïl territory. We understand that topography plays an important role, suggesting a strategy in the circulation of Holocene populations. The wooded, high northern reliefs present a reduced number of sites, but rather are found in the depressions separating the low-altitude ridges, such as the Aïn el-Ibel, Aïn Naga, and Messad basins.

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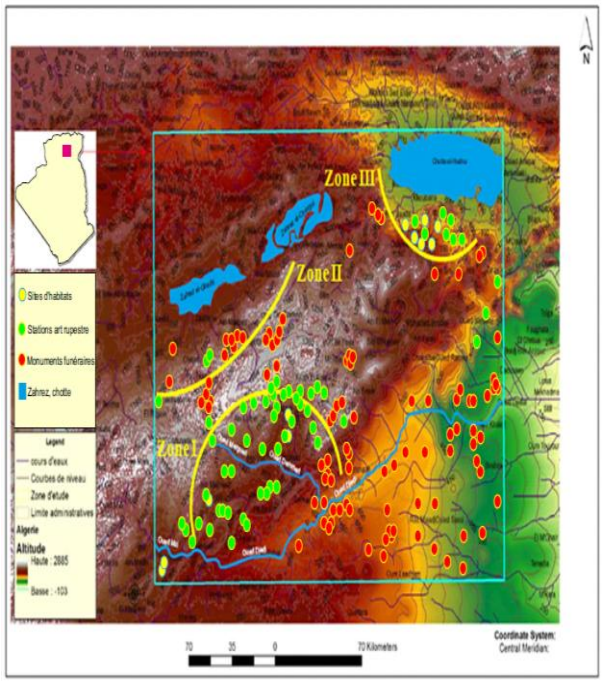
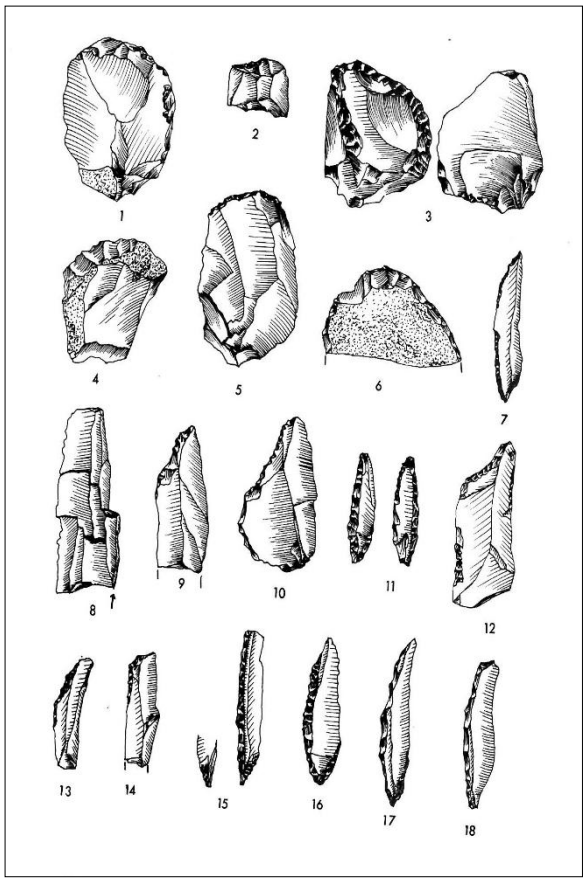


Fig.3 Prehistoric sites and their distribution in the Ouled Naïl mountains]



Idrissia (Zenina) complements the corpus of discoveries.

7. History of research in Djebel Boukahil mountains

7.1 Prehistoric Habitat Sites

Since the first discoveries, the presence of lithic objects from different periods has always been reported in the immediate surroundings or at the foot of various rock art panels. It was not until the 60s and 70s that the first excavations were conducted by Grébénart.



Fig.4 Lithic industry plate - Esseyar Site

7.2 Rock Art Sites

The discovery of the first rock art site in Ksour mountains in 1847 reignited the debate on the antiquity of human societies. This debate was encouraged by the multiplication of other discoveries in North Africa. In the Ouled Naïl mountains, discoveries have multiplied since 1850. El-

Fig.5 Rock art figure – Hajret Elmakhtma site

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7.3 Funerary Monuments

Several field investigations were conducted at the end of the 19th century by French researchers, motivated by historical and strategic reasons, mainly in the High Plateaus, the Saharan Atlas, and the Great Sahara. Unlike these relatively well-documented regions, the Ouled Naïl area has been the subject of very few studies. Although some scientific articles have been devoted to it, they have not provided sufficiently detailed information on the structures studied during archaeological excavations.



Fig.6 Dolmen – Kaf Dachra Site

8. Conclusion

The Djebel Boukahil mountains, characterized by complex geology and a relief shaped by active tectonics, constituted an ideal refuge for Holocene populations. Their northeast/southwest orientation favored a temperate and relatively humid climate, conducive to human settlement. Prehistoric communities favored the southern lowlands (alt. 700-800 m), better irrigated by oueds like the Mergued and the Djedi, rather than the northern heights (alt. 1500 m). These areas, rich in pastures and water, attracted abundant fauna and allowed the development of hunting-gathering and herding activities. The numerous archaeological sites discovered since 1850, such as Hasbaïa and Aïn Naga, testify to the historical importance of this region as a center of ancient human occupation.

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