La revue d'études archéologiques **ISSN:1111-7699**
Vol:23 /Num: 01/ 2025 / pp 788-806 **EISSN:2600-6499**

The Paleolithic Cultures of the Es Sebba site (Brezina, Algeria): Preliminary Results

Djamal Yataghane [1♦], Abdelkader Derradji [2]

[1] University of Algiers 2 - djyat1@gmail.com
[2] University of Algiers 2 - derradji_kader@hotmail.com.

Received: 02/08/2025 **Accepted: 01/12/2025** **Published:31/12/2025**

Abstract:

The Brezina region, located between the Saharan Atlas and the northern Sahara, constitutes an excellent field for studying the Paleolithic period in the Atlas region. This paper presents the preliminary observations from the lithic industries collected during our fieldwork at the Es Sebba site (1 and 2), in 2018, conducted as part of the CNRPAH project on the Algerian South-Western Sahara region and its surroundings. These findings showed, at first sight, the presence of three Paleolithic industry assemblage: the first, a Lower Paleolithic industry contains handaxes and large flakes, the second as a Middle Paleolithic industry dominated by Levallois, and discoid techniques, and finally, the third, that of the Upper Paleolithic industry characterised by small flakes and blade production. The discovery of these Paleolithic phases in both stratigraphic context, and surface context, as well as the variety of knapping techniques, demonstrates that this region is important for understanding the evolution of prehistoric technical traditions.

The study also highlights the role of the hydrological dynamics of the Seggueur Wadi in the preservation and distribution of lithic assemblages in the fluvial terraces.

Keywords: Algeria, Saharan Atlas, Brezina, Paleolithic, lithic industry.

♦ *Corresponding author*

1. Introduction

The Brezina region is located at the boundary between the Saharan Atlas and the northern Sahara, it serves as a prime land for studying Paleolithic settlement dynamics in the region. This area, which is crossed by the Seggueur Wadi and rich in siliceous raw materials, has yielded lithic industries attributed to the Paleolithic period, some of which share characteristics with the Aterian. However, it remains little known due to the lack of studies and old and fragmentary documentation.

The Seggueur Wadi's dynamic hydrological activity has played a dual role: burying and preserving lithic materials, while simultaneously contributing to their dispersal or erosion.

The current paper offers a modest contribution to enhance our understanding of local cultures. It builds upon the fundamental work of both Estroge and Aumassip, whose studies, though they remain the only available ones, which remains essential references.

Our fieldwork at Es Sebba 1 and 2 sites, in 2018 as part of the CNRPAH project on the Algerian South-Western Sahara region and its surroundings, documented three distinct lithic assemblages: the first attributable to the Lower Paleolithic (handaxe, large flakes), the second to the Middle Paleolithic (Levallois, discoid) and the third to a probably Upper Paleolithic (blade production).

2. Brezina Location

The Brezina area is located 87 km south of El Bayadh, covering an area of over 15,000 km². It is bounded to the north by the high plains of El Bayadh, to the south by the desert zone (Ghardaïa to the south and Tadjrouna to the southeast), and to the west by El Abiodh Sidi Cheikh and El Bnoud (Fig. 1). Both areas (plain and desert) are separated by the "Saharan Cretaceous escarpment of Ed Diss[1]" and characterised by contrasts, due to its location in a semi-arid climatic landscape and crossed by the most important hydrological system in the region, composed by two large wadis, El Maleh and El Ghoul, together they form the Seggueur Wadi at the level of Diss.

Brezina is located in a transition zone, connecting the Saharan environment to the Atlas environment, via the Seggueur Wadi, which extends southward. The presence of this important hydrographic network, which drains the southern part of the Saharan Atlas, contributed to the formation of fluvial terrace along its banks, containing Paleolithic industries. These industries, primarily lithic, provide an important record for the study of this period and the understanding of local cultural evolution.

[1] Flamand, G. B. M., Recherches Géologiques et Géographique Dans Le Haut-Pays de l'Oranie et Le Sahara, Lyon, 1911, p.680.

3. Research Background

The first archaeological discoveries in the region date back to the discovery of the rock art of Tiout by Jaquot and Koch in 1847. Then, the expeditions of the 19th and 20th centuries, notably those of Foureau (1877-1878) and Christian (1906), as well as the work of Dalmas (1908) and Vaufrey (1934), and the research of Roubet, Lhote, Cominardi and Hachid, have exclusively documented Neolithic cultures and industries, and rock art.

While most investigations focused on Neolithic remains and rock art, the work of Estorges in the 1960s reported significant Paleolithic Mousterian industries that are important for understanding North African Middle Paleolithic cultures[2]. Although these findings were poorly disseminated and primarily recorded in an internal USTHB publication commemorating Estorges, they remain fundamental for understanding local cultural developments in the Brezina region (Prehistoric cultures[3] and Mousterian[4]).

Although these works provide the only available data on the Paleolithic occupations within a relative chronostratigraphic context (Fig. 2), the scarcity of publications and the impossibility of re-studying Aumassip's collections does not give us the opportunity to discuss or even confirm the previous results.

[2] Camps, G., « La Préhistoire en Algérie et les activités scientifiques du C.R.A.P.E. durant l'année 1967 », in Lybica, no. XV, 1967, pp.373–410.

[3] Aumassip, G., « Industries Préhistoriques Du Bassin de l'Oued Seggueur (Algérie), in A La Mémoire de Pierre Estorges, Maître Assistant à l'Institut de Géographie d'Alger (1962-1978) », USTHB-LGAT, 2009, pp.153–224.

[4] Aumassip, G., and Estorges, P., « La Question Moustérienne Dans Le Nord de l'Afrique, in A La Mémoire de Pierre Estorges, Maître Assistant à l'Institut de Géographie d'Alger (1962-1978), 2009, pp. 239–250.

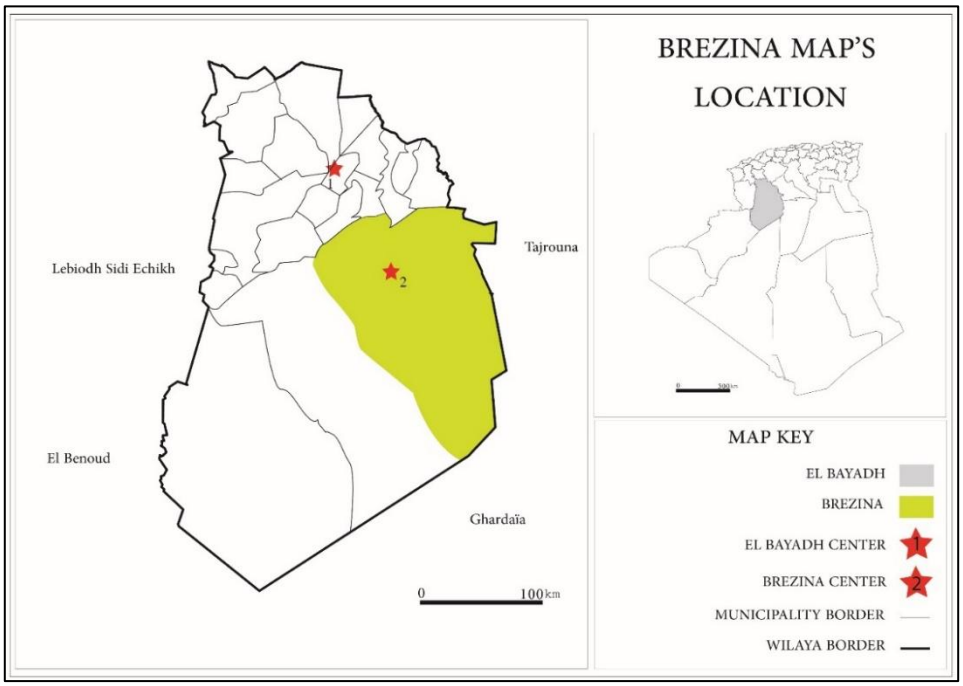


Fig 1. Location map of the Brezina region. Yataghane Dj.

culture	Context	Chrono-stratigraphic attribution
An Aterian with the presence of tanged pieces and discoid nuclei.	**In surface**	**attributed to the (Soltanian)?**
A Mousterian denticulate industry dominated by discoid nuclei.	**From unwell consolidated breccia at the summit of T3**	**Attributed to the (Presoltanian)?**
Lower Palaeolithic industry (Acheulean) characterised by large elements.	**On the surface of an ancient Glacis (IV)**	**Referred to the (Tensiftien)?**

Fig 2. Summary table of Lower and Middle Paleolithic cultures in the Brezina region according to Aumassip 2001.

4. Geological and Hydrographic Setting

The Brezina region, situated south of the South Atlas Fault, serves as a geological and geomorphological boundary, between the Atlas Mountain ranges and the Sahara Desert (Fig. 3) and characterised by a limestone range crossed by the Seggueur Wadi. This area gorges that highlight extensive erosion.

The region presents a stratigraphic sequence of formations, ranging from the Jurassic to the Quaternary. The Jurassic ones are composed of limestones and marls. The

Cretaceous formations include Cenomanian marls rich in marine fossils and massive Turonian limestones containing flint deposits[5].

The Tertiary period is represented by varied formations including conglomerates, sandstones, gypsiferous sands, and chalcedonic deposits characteristic of the Gours[6]. The latter were one of the sources of raw materials for prehistoric populations.

The Quaternary deposits are less documented due to Estorge's premature death, which prevented the full publication of his work, show significant formations such as glacis, alluvial terraces, dayas (silty depressions), and dune systems[7]. These deposits illustrate the principal climatic variations that have influenced the region.

The Seggueur wadi has a typically Saharan hydrographic regime, characterised by episodic and intense floods. The confluence of several wadis, including El Rhoul and Mouillah, contributes to shaping a dynamic marked by alternating periods of erosion and sedimentary deposits.

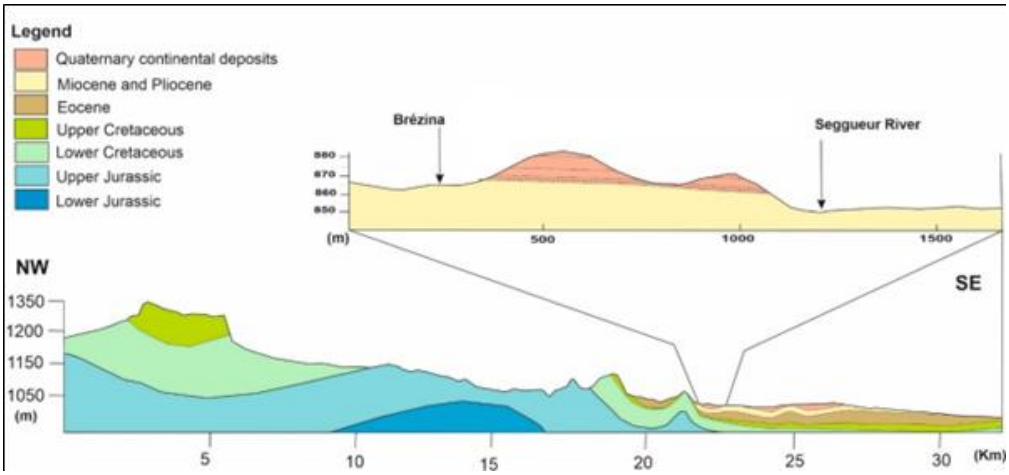


Fig 3. Geological section of the Brezina region. Derived from the 1/200000Brezina geological map. Chibane S.[8], 2023.

[5] Cornet, A., L'Atlas Saharien Sud-Oranais, Monographies régionales, 19 -ème Congrès Géologique International, 1 ère série, no. 12, 1952, p.52.

[6] Flamand, G. B. M., Recherches Géologiques et Géographique Dans Le Haut-Pays de l'Oranie et Le Sahara, Lyon, 1911, p.682.

[7] Estorge, P., Le quaternaire de la région de Laghouat, Travaux de recherche du C.N.E.R.A.T. Edition restreinte, no. I, 1983, p. 3-29.

[8] Chibane S. et al., «The Quaternary Continental Sequence of the Brezina Oasis (West Algeria): Fluvial Deposits as an Archive of Early Human Activity», XXI INQUA Congress 2023, INQUA Roma 2023, Session 71, Quaternary of North Africa: chrono stratigraphy and paleoclimatic variations., Roma, 18 July 2023.

This combination of geological, geomorphological and hydrological factors makes Brezina as a privileged site to study human-environment interactions during the prehistoric period and to provide a stratigraphic framework reference and also to understand the geological evolution of the Saharan margin.

5. Impact of the hydrological system on archaeological site preservation

Fluvial terraces develop along river banks, formed by alternating climate cycles and tectonic movements[9]. Their formations reflect the interaction between these both processes: hydrographic incision and climatic deposition (e.g., Milankovitch-scale cycles)[10].

These formations often contain well-preserved archaeological remains in a context where the sedimentary layers are relatively stable[11]. However, their preservation potential may be compromised by erosional processes or tectonic disturbances[12].

The terraces of the Brezina region are directly linked to the hydrographic system of the Oued Seggueuer. The sedimentation is continental, and presents facies, mainly alluvial (conglomerate horizons, sandstone and gravel). The absence of an absolute date has made the Quaternary of the region subdivided according to the stages recorded in: Lower, Middle and Upper Quaternary units[13]. However, the sequences described by Aumassip[14] require a more in-depth study. Geological process analysis in the El Bayadh area reveals persistent diapiric activity during the Late Quaternary[15].

---

[9] Bridgland D., Westaway R., and Cordier S., « Les causes de l'étagement des terrasses alluviales à travers le monde », in *Quaternaire*, Vol. 20, no. 1, 2009, pp. 5–23.

[10] Bridgland D. R. and Westaway R., «Climatically Controlled River Terrace Staircases: A Worldwide Quaternary Phenomenon., Geomorphology, no. 98, 2007, pp. 285–315.

[11]Mishra S. et al., « Fluvial Deposits as an Archive of Early Human Activity», Quaternary Science Reviews 26, no. 22–24, 2007, pp. 2996–3016.

[12] LELAND J. et al., «Incision and Differential Bedrock Uplift along the Indus River near Nanga Parbat, Pakistan Himalaya, from 10Be and 26Al Exposure Age Dating of Bedrock Straths», Earth and Planetary Science Letters, no. 154, 1998, pp. 93–107.

[13] Estorge, P., Le quaternaire de la région de Laghouat, Travaux de recherche du C.N.E.R.A.T. Edition restreinte, no. I, 1983, p. 3-29.

[14] Aumassip, G., « Industries Préhistoriques Du Bassin de l'Oued Seggueur (Algérie), in A La Mémoire de Pierre Estorges, Maître Assistant à l'Institut de Géographie d'Alger (1962-1978) », USTHB-LGAT, 2009, pp.153–224.

[15] Nedjari A. et al., « Les diapirs de l'Atlas Saharien Central (nord de l'Algérie), une activité permanente au quaternaire », Bulletin du Service Géologique de l'Algérie 33, no. 1–2, Algérie, 2024, pp. 57–71.

These alluvial formations are subject to climatic and geological constraints that impact their preservation states, but, represent among the best-preserved sedimentary sequences in the region, providing a stratigraphic framework for investigating cultural records.

6. Context, Materials and Methods

Fieldwork (2018) focused on the right bank of the Seggueur Wadi near the Brezina oasis, targeting two main sectors: Es Sebba 1 and Es Sebba 2 (Fig. 4).

The fieldwork at the Es Sebba site combined both vehicle and pedestrian surveys, following two approaches: a systematic survey, primarily based on the analysis of Google Earth imagery, and a non-systematic survey, which followed routes suggested by a local guide and our field observations.

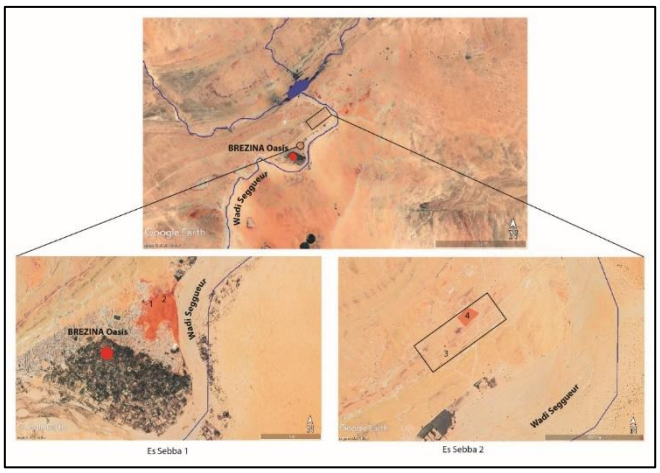
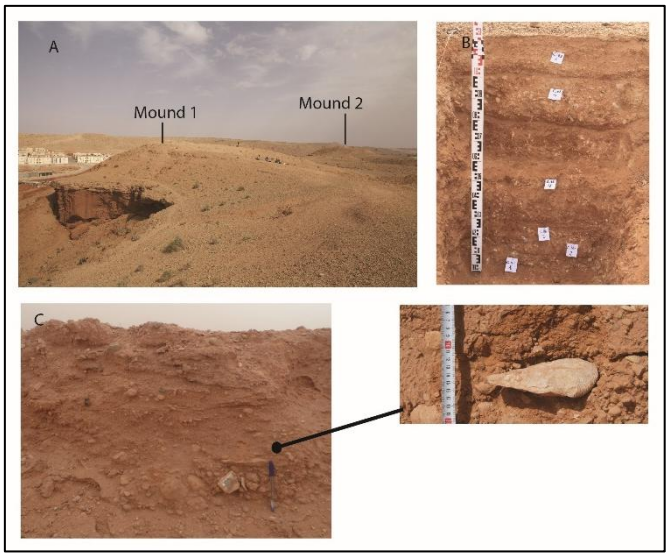


Fig 4. Map showing the two study areas. Es Sebba 1: 1-mound 1, 2-mound 2. Es Sebba 2: 3-test pit area, 4-surface collection area. Image from Google Earth 2025.

The selection of sampling areas was based on sites located during pedestrian surveys and our field observation, targeting areas with a high concentration of surface lithics and where artifacts were visible in section. The areas indicated by the guide were either too far or of lesser archaeological interest. After identifying points of archaeological potential, we carried out test pits, as at Es Sebba 1 and in the Es Sebba 2 area, along with a systematic collection of lithic material. The latter was conducted on a plain with a gentle slope (Pic 3. B), overlain by an eroded sandy level (Pic 3. A).
The fieldwork combined survey, surface collection, test pits, and the recording of stratigraphy after cleaning the sections. These initial observations, which will need to be supplemented by a detailed geoarchaeological and geomorphological study, as well as by dating, have nevertheless allowed for preliminary stratigraphic description of the site.

At Es Sebba 1, investigations began with test pits and stratigraphic sections on two mounds composed of alternating sandy and pebbly layers, sealed by a calcareous crust

and overlying a conglomeratic level, which rests on a red Tertiary clay layer. This geomorphological formation, constituting a "Gara" (Pic 1-A) that towers more than 40 meters above the wadi, yielded Lower Paleolithic artifacts. The test pit (Pic 1-B) (2 m × 3 m) excavated on Mound 1 revealed ten (10) lithic artifacts, including a handaxe made of local limestone (Pic 1-C), found in primary position at the top of a sandy layer overlain by a gravelly layer.

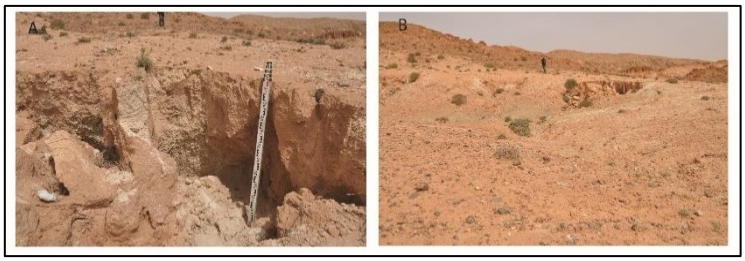


Pic 1. Es Sebba 1. A-Mounds of the "Gara" (northward view), B-Test pit of the Es Sebba 1 area. C-Photograph showing the handaxe discovered in situ within a sandy level at Es Sebba 1 site. Moussaoui Y. et Yataghane Dj.



Pic 2. Es Sebba 2. A-Test pit of Es Sebba 2 area (northward view), B-In situ lithic industry in th Es Sebba 2 test pit. C- Test pit of Es Sebba 2 area showing thick sandy formation. Moussaoui Y. et Yataghane Dj.

Investigations at Es Sebba 2, located 3 km east of the "Gara" along the wadi margin, revealed an abundant lithic industry consist of levallois flakes, blades, and points. A test pit (1.50 m × 3 m) excavated in a very fine, friable sandy formation yielded 380 artifacts attributable to the Upper Paleolithic (blade cores, retouched flakes) (Pic 2). Concurrently, systematic surface collections (15*15m) on higher-lying glacis surfaces recovered over 407 artifacts, including Levallois cores and Mousterian points (Pic 3).



Pic 3. Es Sebba 2. A- The eroded sandy level overlying the surface collection area B- Systematic surface collection at Es Sebba2. Yataghane Dj.

This paper presents a preliminary overview of the collected assemblages. Our analysis is primarily based on the definitions established by Bordes, Tixier, Boëda, and Rahmani.

For this initial assessment, industries containing handaxes and large flakes were classified as Acheulean. Those demonstrating Levallois and discoid reduction strategies were attributed to the Middle Paleolithic. Finally, small-sized industries with blades were assigned to the Upper Paleolithic. It is important to emphasize that these preliminary attributions are based not exclusively on typological and technological criteria, but also on the stratigraphic position and geomorphological context of these industries, elements which have contributed to this approach.

The composite section, established from the two studied areas (Fig 5), reveals formation over 12 meters thick we have divided into six units (A-F) separated by calcareous crusts and pebbly layers.

The base of the formation at the "Gara" of Es Sebba 1 -where the main sequence (11m) is defined- is characterised by a conglomerate (Unit A) that shows an unconformity with the underling red clay-matrix Tertiary formations (Fig 5). The quaternary formations, in turn, initially appear to show cyclicity, with an alternation of fine-grained sediment layers and gravel layers.

The formation at the "Gara" is capped by a 30 cm calcareous crust (middle part of Unit E), which appears to correspond to the "Tensiftian" crust documented by Estorge in

the Saharan Atlas region[16]. The upper portion of Unit E and F, described at the Es Sebba 2 area, correspond to recent periods.

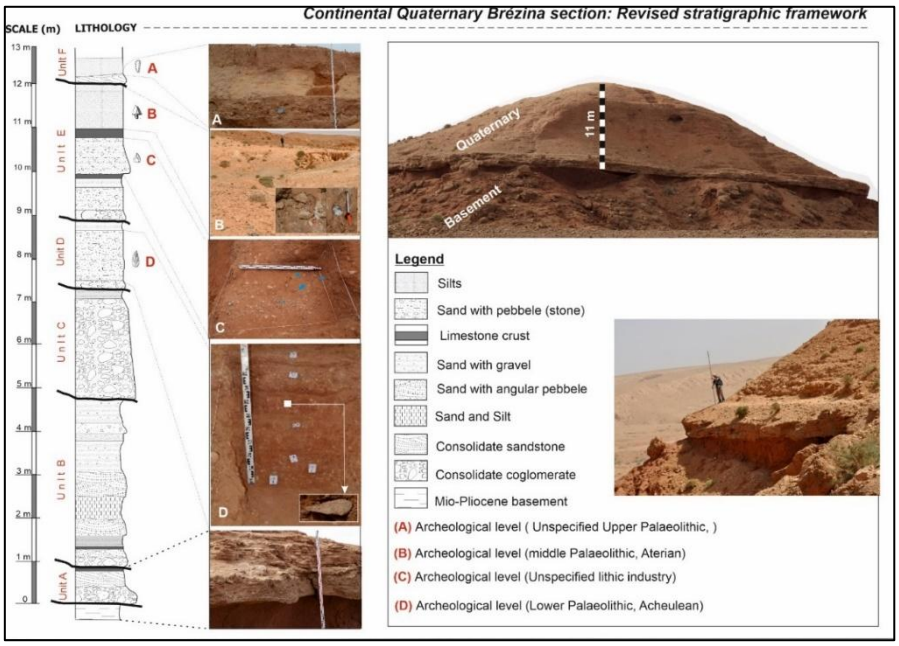


Fig 5. The composite stratigraphic section of Es Sebba site. Chibane S[17].

7. Lithic Industrial Assemblages

The lithic Assemblages, consist of 797 artifacts, were collected from the Es Sebba site. They are distributed between two test pits (Es Sebba 1 and Es Sebba 2) and a surface sample at Es Sebba 2 (Fig. 6). The Es Sebba 1 test pit yielded 10 pieces, and the Es Sebba 2 test pit gave 380 pieces. The surface sampling provided 407 artifacts.

Among the industries collected at the site, unretouched debitage products dominate with 396 pieces: (5) from Es Sebba 1, (184) from Es Sebba 2, and (207) from surface sampling. The cores are represented by (91) units, including (1) from Es Sebba 1, (40) from Es Sebba 2, and (54) from surface sampling. Retouched debited products, representing a total of 76 pieces, are absent from Es Sebba 1 but well represented at Es Sebba 2 test pit (26) and at surface sampling (50).

Other categories are less abundant such as the unmodified fragments totaling (222): (3) at Es Sebba 1, (127) at Es Sebba 2 and (92) from the surface collection. The retouched fragments are represented by only 7 pieces, all from the Es Sebba 2 test pit (3) and the

[16] Estorge, P., Le quaternaire de la région de Laghouat, Travaux de recherche du C.N.E.R.A.T. Edition restreinte, no. I, 1983, p. 16.
[17] Chibane S. et al., «The Quaternary Continental Sequence of the Brezina Oasis (West Algeria): Fluvial Deposits as an Archive of Early Human Activity», XXI INQUA Congress 2023, INQUA Roma 2023, Session 71, Quaternary of North Africa: chrono stratigraphy and paleoclimatic variations., Roma, 18 July 2023.

surface collection (4). Finally, only one handaxe was discovered in the Es Sebba 1 test pit.

Type of Artifact	Test Pit Es Sebba 1	Test Pit Es Sebba 2	Surface Collection Es Sebba 2	Total
Cores	1	40	54	91
Retouched debitage products	0	26	50	76
Unretouched debitage products	5	184	207	396
Retouched fragments	0	3	4	7
Unmodified fragments	3	127	92	222
Handaxe	1	0	0	1
Total	10	380	407	797

Fig 6. Statistical overview of lithic industrial assemblages from the Es Sebba site.

7.1. The lithic assemblage from Test Pit Es Sebba 1

7.1.1. The handaxe:

This partially cortical handaxe is knapped from a flat pebble. The flake scars suggest minimal shaping, with five distinct series (Fig. 7.2): large initial removals (series 1-4) and small final retouches (series 5).

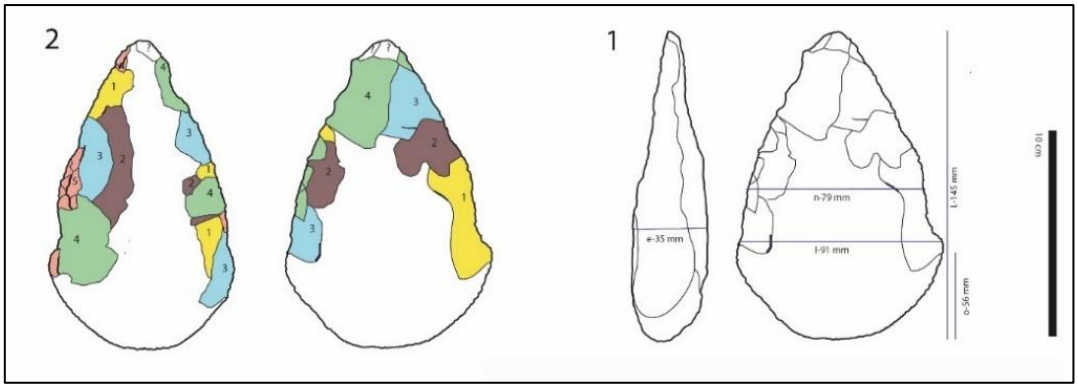


Fig 7. Handaxe from Es Sebba1: 1-Measurements, 2-Diagram of the identified removal series. Yataghane Dj.

It also shows a lateral and facial symmetry, with regular edges except for a slight distal notch. The handaxe is knapped from fine limestone raw material without apparent flaws and in an excellent state of preservation.

7.1.2. The core:

The core was discovered in the sandy level of mound 1 (test pit Es Sebba 1) (Fig. 8.2). It was knapped on an opaque grayish block chalcedonic flint, and measures 58 mm (L) × 46 mm (W) × 38 mm (H) (Fig. 8.1). The core presents two smooth and adjacent striking planes and three negative flakes attesting a moderate reduction, most probably aimed to flake production.

7.1.3. The Debitage Products

The study focuses on eight (8) pieces (Fig. 8), including five (5) flakes and three (3) fragments, with no observed retouch. The flakes fall into two main morphological categories: relatively long flakes (2 pieces, small (23*12*5) and medium-sized (33*28*7)) and wide flakes, including one particularly large flake (140*110*43) (Fig. 8.1). The fragments are represented by only three (3) pieces.

The raw materials used are limestone (4), chalcedonic flint (3) and flint (1). The cortex is absent on the majority of pieces (6), present on two (2) and partial on three (3). As for the platforms, they are mainly smooth (3 pieces), in addition, the bulbs of these products are either diffuse or flat (4 pieces).

We also observed removal scars, mainly crossed and unidirectional (2 cases each), with overlapping (4) or left-oriented (2) debitage axis.

This assemblage appears to belong to the Lower Paleolithic, as evidenced by the presence of the cortical-based handaxe and the large flakes.

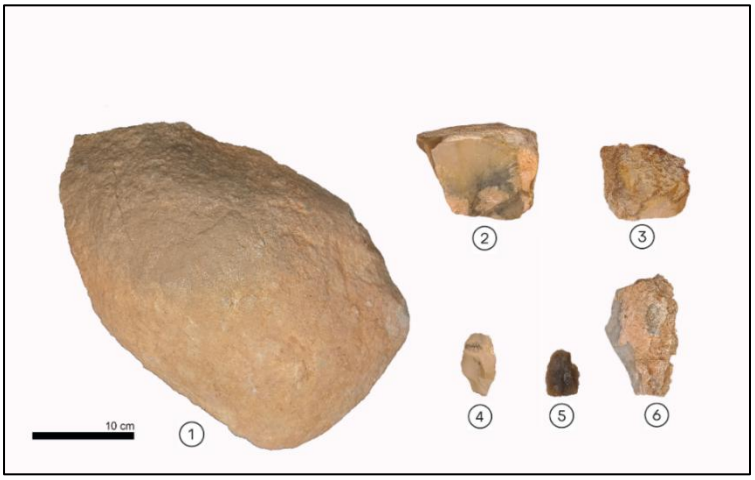


Fig 8. Some representative flakes from the lithic industry assemblage of the Es Sebba 1 area: 1-Large cortical limestone flake; 2-Chalcedonic flint core; 3-Limestone flake fragment; 4-Chalcedonic flint flake; 5-Flint flake fragment; 6-Elongated flake on chalcedonic flint. Yataghane Dj.

7.2. The lithic industrial assemblage from test pit Es Sebba 2

7.2.1. The cores

We analyzed forty chalcedonic flint cores in this assemblage. They can be classified into (Fig. 9): unhierarchized cores (12), organized flake cores (11), organized exploited

flake cores (9) and blade cores (8) (Fig. 10). The average dimensions of these cores vary according to the type: unhierarchized core (50.9 × 37.8 × 24.6 mm), organized flake cores (58.3 × 43.2 × 30.4 mm), organized exploited flake cores (48.6 × 36.6 × 23.3 mm) and blade cores (50.9 × 37.2 × 24.0 mm). As for the striking surfaces, they are mostly smooth (24) and simple (34).

Most of the cores (31) present between 1 and 3 removals, while the longest sequences (4 to 10 removals) mainly concern the organized and exploited cores (9).

Type of Core	Count	Percentage (%)
unhierarchized core	12	30.0
organized flake core	11	27.5
Exploited flake core	9	22.5
Organized blade core (frontal debitage surface)	5	12.5
Organized blade core (exploited core)	1	2.5
Organized blade core (semi-rotating)	2	5.0
Total	40	100

Fig 9. Table showing the types of cores collected from the Es Sebba test pit.

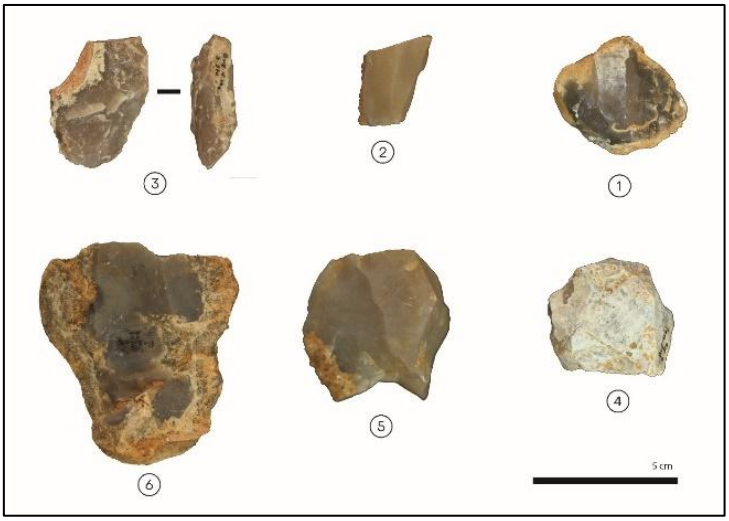


Fig 10. Cores from the Es Sebba 2 test pit: 1 to 3 and 6: Blade cores; 4 and 5: Organized flake cores. Yataghane Dj.

7.2.2. The debitage products

The debitage products (340) from the Es Sebba 2 test pit show a predominance of flakes and flake fragments (fig. 11). The blade products observed reveal a production aimed to standardized blanks. The raw material used is mainly local chalcedonic flint (331 pieces), found in the immediate vicinity of the site. The cortex is absent on blanks, showing advanced knapping reduction.

Wide flakes dominate, but appear on reduced supports (small (L 20-40 mm) and very small (L <20 mm)). As for the platforms, smooth forms predominate (>35%), while

superimposed debitage axis are the majority. Retouched pieces are few in number (29), and are mainly in scalar forms and in direct position.

The toolkit mainly consists of notched and retouched pieces, with some sidescarpers and denticulate (Fig. 11). Thus, this technical assemblage is marked by a production oriented mainly towards flake blanks, as previously noted, combined with a standardized blade component, preferentially exploiting local chalcedonic flint.

We also observed a predominance of unhierarchized core and organized flake cores, with dimensions and technical characteristics varying according to type. However, the presence of blade production, the reduced size of debitage products, and the absence of Levallois reduction suggest potential affinities with the Upper Paleolithic traditions documented in the Saharan Atlas region, such as those at El Ançor[18] and "D.D.C" site[19]. Nevertheless, typological comparisons remain difficult due to the small number and the absence of characteristic tools identified in this assemblage.

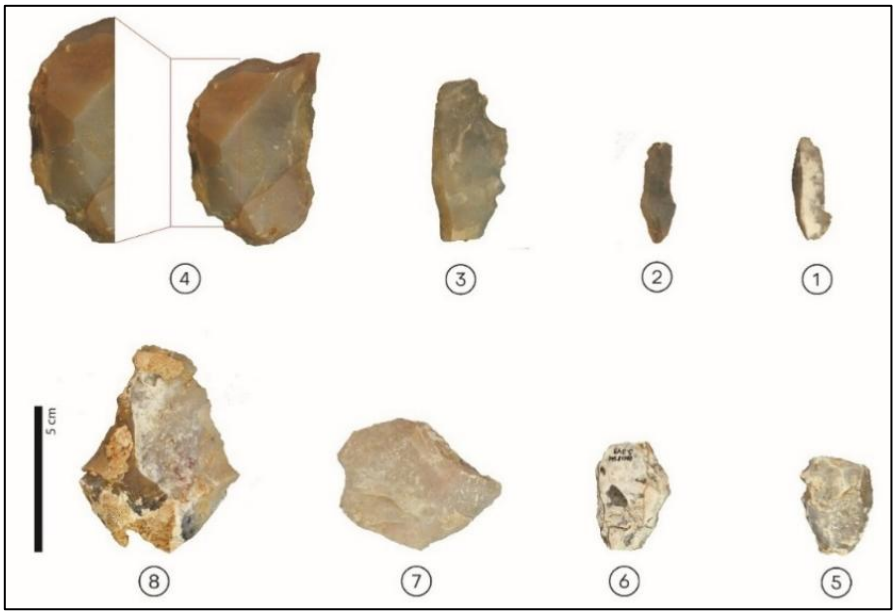


Fig 11. Debitage products from the Es Sebba 2 test pit. 1 and 2: Blade products. 3: Denticulate. 4: Convex sidescarpers. 5 and 6: Laminar flake. 7: Retouched piece. 8: Semi-cortical flake. Yataghane Dj.

[18] Heddouche A.E.A., «Le Gisement Épipaliolithique d'El-Onçor Prés de Bou Saâda. (Algérie) », in Lybica, no. XXV, 1977, pp. 73–84.
[19] Amrouche, M., « Le gisement préhistorique "D. D. C", région de Bou-Saada (Algérie) », in Lybica, no. XXVIII–XXIX,1981-1980, pp.57–67.

7.3. The lithic industrial assemblage from surface collection Es Sebba 2

7.3.1. The cores

The study of 54 cores from the Es Sebba 2 collection reveals relatively homogeneous dimensions, with lengths generally between 45 and 75 mm, with the exception of two pieces: a Levallois core with preferential flakes (102 mm) and a core with organized flakes (206 mm). However, the non-Levallois cores are generally thicker (> 50 mm) than Levallois and discoid cores (< 40 mm).

The assemblage is dominated by organized flakes cores, followed by Levallois cores comprise 12 pieces with preferential flakes, often prepared on chalcedonic flint raw material (Fig. 12).

An exceptional piece corresponds to a Levallois core with two debitage surfaces, each bearing a preferential Levallois flake scar (type A2[20]) (Fig 13.), unique in the region. The assemblage is completed by blade and discoid cores.

The debitage patterns observed on the core surfaces show a predominance of unidirectional organization, particularly for single-removal cores and blade cores. In contrast, the Levallois cores mainly show convergent removals.

Intensive exploitation is evidenced on most cores that have produced more than six (6) flakes. The discoid (4) and blade (9) cores reveal variable preparations and exploitations.

Type	Count	Percentage
Discoid	4	7.41
Preferential flake Levallois core	12	22.22
Recurrent centripetal Levallois core	1	1.85
Bipolar Levallois core	2	3.70
Unipolar Levallois core	1	1.85
Organized flake core	18	33.33
Single removal core	7	16.66
Blade core	9	16.67
Total	54	100

Fig 12. Table presenting the types of cores collected from surface gathering at Es Sebba 2.

[20] Boëda, E., Le Concept Levallois : variabilité des méthodes, CNRS Edition, Paris, 1994, p.130.

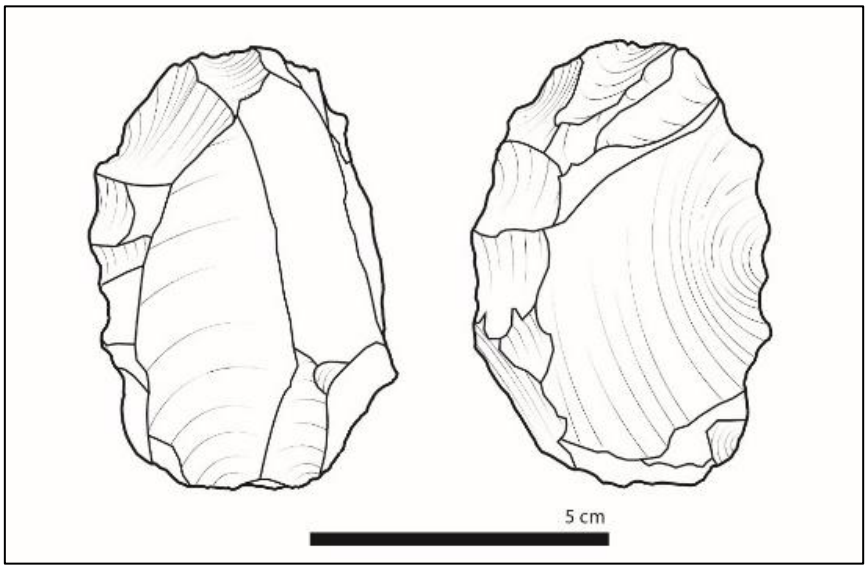


Fig 13. Preferential flake Levallois core with two exploitation surfaces (Es Sebba), type A2. Yataghane Dj.

7.3.2. Debitage Products

The study concerns a set of debitage, collected on the surface at Es Sebba 2, composed of 353 pieces, dominated by flakes (144) and fragments (87), with cortical flakes (31) and two Kombewa flakes.

The raw material used in the development of this industry is mainly chalcedonic flint, which constitutes (347 pieces). Knapping accidents are present, showing complete fractures, although most of the pieces remain intact. The debitage axis is mostly superimposed (196 pieces).

The blanks consist of small and medium-sized modules, with a predominance of large and very large flakes. The platforms are predominantly smooth, and the dorsal scars are mainly unidirectional (154) or crossed (63). The retouched tools (54) show a predominance of scalar and direct retouch, often partial.

Typologically, the lithic assemblage comprises 60 tools, dominated by retouched pieces (18) and notched pieces (11), mainly made from chalcedonic flint. Specialized tools include convex sidescarpers (4), denticulates (4) including two micro-denticulates (2), burins (2), endscrapers (2), as well as composite tools (double/multiple tools). Levallois production is attested by debordant flakes, simple and retouched flakes, and a Levallois blade. Among the rare but technologically significant pieces are a Mousterian point, a pseudo-Levallois point, a concave sidescarpers, a straight sidescarpers, and a transverse sidescarpers, all made on chalcedonic flint.

This assemblage combines a production dominated by wide flakes with a minor but technically evolved Levallois component, systematically exploiting local chalcedonic flint.

The typology presents both Middle Paleolithic features (Levallois methods, Mousterian point, notched flakes) and advanced features (burins, blade production) (Fig. 14) which, in the North African context, could tentatively suggest an Aterian attribution. However, this hypothesis requires further investigations, including analysis of debitage matrices and absolute dating, to be confirmed, especially since no tanged tools were observed in this collection.

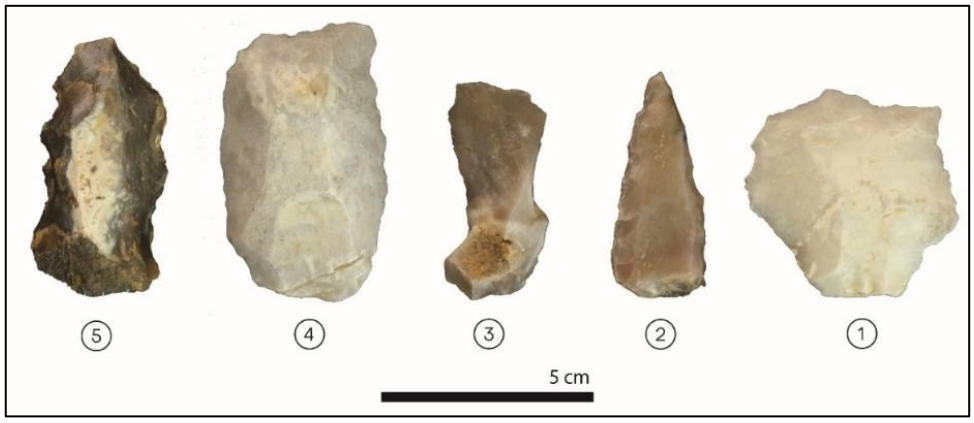


Fig 14. Debitage products collected from surface collection at Es Sebba 2. 1 - Levallois flake 2-Mousterian point. 3 – Burin. 4 - Convex sidescarpers on laminar flake. 5 - Denticulate piece. Yataghane Dj.

8. Conclusion

The preliminary study of the industries at the Es Sebba site (Es Sebba 1 and 2) provides preliminary insights into the knapping techniques and cultures of this understudied region. The stratigraphic context and in situ discoveries highlight significant potential for preserving Paleolithic occupation.

The discovery of these few points within restricted geographical limits, presented here, offers new data for the region, thus complementing the sites already mentioned by Aumassip (2009).

The three assemblages identified at Es Sebba – potentially attributable to the Lower Paleolithic with handaxe and large flakes collected in situ, a Middle Paleolithic with Levallois and discoid techniques and diverse tool types on the surface, and an Upper Paleolithic suggested by the production of small flakes and blades - provide evidence of persistent human occupation in this area located between the Saharan Atlas and the northern Sahara.

The industries show an exclusive exploitation of local siliceous materials in the recent periods (Middle and Upper Paleolithic), and a predominant use of calcareous material

in early periods (Lower Paleolithic). The existence of diverse knapping techniques (handaxe, Levallois reduction, blade production) in distinct stratigraphic contexts suggests a prolonged occupation by prehistoric groups characterised by a diverse technological tradition. However, the rarity of Acheulean artifacts raises the question of whether the presence of this culture is limited or conditioned by a taphonomic bias. The industries collected in situ from the Es Sebba 1, including the large flake and the handaxe, provide new perspectives for the study of the poorly documented Paleolithic in the region.

The lithic industries recovered from the surface at Es Sebba 2, attributable to the Middle Paleolithic, present a particular specificity, including the absence of tanged tools. Furthermore, the assemblage from the Es Sebba 2 test pit, while exhibiting a production of blade and small flakes that supports its preliminary attribution to the Upper Paleolithic, nonetheless lacks characteristic tool types for this period. Therefore, additional studies are needed to confirm its precise cultural attribution.

The absence of absolute dating and precise stratigraphic contexts for some assemblages, limit chrono-cultural interpretations. Hence the need for further analysis to refine the sequence and clarify regional influences.

The future research should integrate geoarchaeological methods to identified hydrological impacts during the site formation process and to better understand dynamics and preservation conditions in the Sahara-Atlas transition zones.

These preliminary results demonstrate that further research are recommended to understand the technical, cultural, and environmental evolution in the Brezina area, which is proving to be a key zone for studying these cultures in the Saharan-Atlas region.

Bibliography list :

Amrouche, M., « Le gisement préhistorique "D. D. C", région de Bou-Saada (Algérie) », in Lybica, no. XXVIII–XXIX,1981-1980, pp.57–67.

Aumassip, G., « Industries Préhistoriques Du Bassin de l'Oued Seggueur (Algérie), in A La Mémoire de Pierre Estorges, Maître Assistant à l'Institut de Géographie d'Alger (1962-1978) », USTHB-LGAT, 2009, pp.153–224.

Aumassip, G., L'Algérie des premiers hommes, IBIS Press, Edition de la maison des sciences de l'Homme, Paris, 2001, p.224.

Aumassip, G., and Estorges, P., « La Question Moustérienne Dans Le Nord de l'Afrique, in A La Mémoire de Pierre Estorges, Maître Assistant à l'Institut de Géographie d'Alger (1962-1978), 2009, p. 239–50.

Boëda, E., Le Concept Levallois : variabilité des méthodes, CNRS Edition, Paris, 1994, p.280.

Bridgland D. R. and Westaway R., «Climatically Controlled River Terrace Staircases: A Worldwide Quaternary Phenomenon., Geomorphology, no. 98, 2007, pp. 285–315.

Bridgland D.R., Westaway R., and Cordier S., « Les causes de l'étagement des terrasses alluviales à travers le monde », in *Quaternaire*, Vol. 20, no. 1, 2009, pp. 5–23, https://doi.org/10.4000/quaternaire.4994.

Camps, G., « La Préhistoire en Algérie et les activités scientifiques du C.R.A.P.E. durant l'année 1967 », in Lybica, no. XV, 1967, pp.373–410.

Chibane S., Yataghane Dj., Benchernine R., Derradji A., Iddir S., «The Quaternary Continental Sequence of the Brezina Oasis (West Algeria): Fluvial Deposits as an Archive of Early Human Activity», XXI INQUA Congress 2023, INQUA Roma 2023, Session 71, Quaternary of North Africa: chrono stratigraphy and paleoclimatic variations., Roma, 18 July 2023.

Cornet, A., L'Atlas Saharien Sud-Oranais, Monographies régionales, 19 -ème Congrès Géologique International, 1 ère série, no. 12, 1952, p.52.

Estorge, P., Le quaternaire de la région de Laghouat, Travaux de recherche du C.N.E.R.A.T. Edition restreinte, no. I, 1983, p.33.

Flamand, G. B. M., Recherches Géologiques et Géographique Dans Le Haut-Pays de l'Oranie et Le Sahara, Lyon, 1911, p.1001.

Heddouche A.E.A., «Le Gisement Épipaliolithique d'El-Onçor Prés de Bou Saâda. (Algérie) », in Lybica, no. XXV, 1977, pp. 73–84.

Leland J. et al., «Incision and Differential Bedrock Uplift along the Indus River near Nanga Parbat, Pakistan Himalaya, from 10Be and 26Al Exposure Age Dating of Bedrock Straths», Earth and Planetary Science Letters, no. 154, 1998, pp. 93–107.

Mishra S. et al., « Fluvial Deposits as an Archive of Early Human Activity», Quaternary Science Reviews 26, no. 22–24, 2007, pp. 2996–3016, https://doi.org/10.1016/j.quascirev.2007.06.035.

Nedjari A. et al., « Les diapirs de l'Atlas Saharien Central (nord de l'Algérie), une activité permanente au quaternaire », Bulletin du Service Géologique de l'Algérie 33, no. 1–2, Algérie, 2024, pp. 57–71.