

# Rachgoun 2: Geomorphological and Lithostratigraphic Framework

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**Abstract:** Summary: Half a century after the work of the prehistorian G. Camps on the "Iberomaurusian" site of Rachgoun, located on the northwest coast of Algeria, nothing has come to confirm, supplement or revisit the conclusions of this author, which still remain in force. In 2017, interest in this deposit was revived, with a view to relaunching prehistoric research in the Algerian north-west (Oran). In this contribution, we have approached the subject, from a geosystemic point of view, under the angle of geomorphology and Quaternary geology, to offer us guarantees of access to appropriate readings of Rachgoun's kjokkenmodding. Two morpho-sedimentary groups were identified (q1 4c and qD) and their connection with the classification frameworks in force, carried out. They are the expression of a Sicilian-Tyrrhenian geography, which ended with the development of a rhythmic phenomenon "sandstone-red silt dunes", witness to variations in sea level, in relation to the glacio- eustatism and neotectonics. Thus, the current landscape of the Rachgoun region is the expression of a recent geography, established in the Tyrrhenian, in a new morpho-sedimentary cycle, which will lead to a new configuration of the relief. In this chronostratigraphic framework, the prehistoric site of Rachgoun, previously qualified as Iberomaurusian (epipaleolithic), occupies the first part of the Holocene (early Rharbien), dated from C14 to 9430 and 9490 years BP. A chronological position which commands a new archaeological reading.

**Keywords:** Rachgoun, Iberomaurusian Kjokkenmodding, Lithostratigraphy, Geomorphology

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## 1. Introduction

The eponymous prehistoric site of Rachgoun, studied and published by G. Camps in 1966, is located in the coastal town of Rachgoun, in the department (Wilaya) of Aïn Temouchent, in the north-west of Algeria (Figure 1).

In the scientific context of the 1960s, this site was a particular subject in the study of the epipaleolithic cultures of the Maghreb. It was a real "brain teaser", to have delivered a protomediterranean human subject (H4) in the middle of a Mechtoid group. It still remains classified in the category of coastal Iberomaurusian sites [1]. The idea of revisiting it stems from a desire to open up the perspective, moving from the paradigm of "the "escargotière"" [2] to that of "kjokkenmodding" [3-6] by broadening the spectrum to field of the Neolithic and neolithization in the circummediterranean geocultural area, using other tools and in the light of recent data from prehistory, anthropology,

chronology and scientific advances in these fields.

Seeing the subject through the prism of kjokkenmodding does not necessarily mean agreeing with the etymology of this word and its historical meanings; it is rather a methodological approach which favors the use of marine resources, as a fundamental element of geography, by making greater use of the archeo-malacological and shellfish perspective. By investing more in the archeo-malacological and shellfish perspective. In the case of Rachgoun, it is around *Mytilus Galloprovincialis* (dominant species), then limpets and other benthic marine molluscs, that the behavioral scenarios of populations that have lived in an estuary biotope are constructed.

This approach, more "geosystemic", is dictated by the conjunction and the coincidence of a number of characteristics, which we can consider as specific to the coastal zone of Rachgoun. It will be a question of explaining the articulations and making legible the significant elements.

An approach which makes prehistoric man, at a first level of observation, a simple agent of the trophic chain, in a coastal context. This man used and exploited, in a sustainable way, specific marine resources, which are the proof of a need, a choice and a selection, participating in the balance or the imbalance of the biocenosis and the biotopes of an estuary environment. In this contribution, which completes a previous one, entitled "The prehistoric site of Rachgoun: palaeoenvironmental approach" (Betrouni, in press), the interest is focused on the geomorphological and lithostratigraphic aspects, in order to draw elements that allow some anchoring chronostratigraphic and paleoclimatic.

The absence of marine and continental terraces and other visible morphostratigraphic markers and the rarity, even the

absence of archaeological and paleobiological remains, have forced us to prioritize this approach. The coastal dune sandstone system (qD formation) constitutes, in this regard, a key document which, through its documentary corpus (morphology, structure, facies, color), opens up perspectives of chronology and therefore possibilities of correlations and comparisons at required scales.

From a methodological point of view, we first recalled the research carried out by G. Camps on the eponymous site of Rachgoun as well as the historical context in which it was carried out. We then opened up the perspective on the geomorphological and lithostratigraphic aspects, for a global and integral study of the Rachgoun deposit, as we delimited it in the geographical history of the Lower Tafna Valley.



Figure 1. 50,000 th map of Algeria, sheet n° 2008. Beni Saf. Lambert coordinates 122.00 x 230.150 Location of the Rachgoun site (Red triangle).

## 2. The Eponymous Deposit of Rachgoun

The eponymous site of Rachgoun is located 800 m from the seaside resort of Rachgoun, a small town, 7 km from Béni Saf, the capital of the town. The Rachgoun deposit consisted of a trench, « *tranchée* » of "115 m" in length, discovered in 1953 during construction of a secondary coastal road [7]. The cartographic data, as well as the little information provided by Camps, suggests that before the construction of the road, the trench merges with the edge of a natural embankment "talus" which dominated a small ravine oriented S.E. - N.W.

In 1984, construction of a two-lane road destroyed all that remained of the eponymous site of Rachgoun, by retreating from the "trench". It would be interesting to compare the photos of figures n° 1 and 2, taken in 1964 by G. Camps [8] Which gives an overview of the site, with current photos, to assess the volume of land removed and consider the extent of damage to the archaeological site.

This comparison exercise also makes it possible to establish the connections between the eponymous deposit

which has disappeared and the new deposit which we have called Rachgoun 2 and which corresponds to the current trench, largely set back from the embankment "talus". This new trench, oriented SW-NW, parallel to the road, is developed over a length of 200 m in length.

The context of the discovery of the deposit as well as the investigation and research missions, carried out between 1953 and 1966, were gathered by G. Camps in an article of about twenty pages, supported by photos, drawings and some statistical data and published in the journal *Libyca* of 1966, under the title "*The Rachgoun deposit (Oranie)*" [9]. Camps recalls the conditions of the discovery or rather of the outcropping of the deposit by road works. He cited the parties and scientists concerned by the deposit, in particular G. Vuillemot, then director of the archaeological district of Oran, who had noted the extent of the damage caused to human bones, to prehistoric industries and to structures of human occupations by road works.

In his report on the state of the deposit, associated with the material collected, which he transmitted to Professor L. Balout, director of the Bardo Museum in Algiers, Vuillemot

mentioned: "kjoekkenmodding" rich in human bones and marine mollusk shells and some rare tools. He had also collected skull fragments, some tools and samples of marine molluscs [10].

In March 1954, a year after the discovery, G. Camps, accompanied by his wife, Henriette-Camps-Fabrer, visited the site to assess the importance of the deposit. They collected many human bones from the rubble, some of which were in very good condition. They also noticed other human bones in place along the open trench. *"We were then able to collect in the cuttings from the road, below the site, numerous human bones, some still in fairly good condition, and above all to recognize the presence of other bones clearly visible on the section"*.

Between 1954 and 1962, in the midst of the Algerian war, the research effort was practically interrupted. It was not until 1964, two years after Algeria's independence, that prehistoric research was again redeployed to the C.R.A.P.E. research center [11], under the direction of G. Camps. Rachgoun deposit reappears on the scientific scene. Camps returned to Rachgoun, for the first time, in January 1964 with M. Richaud [12] then, a second time, in January 1966 with R. Gougeinheim, to revisit the deposit.

The same year, other researchers, missionaries of C.R.A.P.E visited the site of Rachgoun, M. and A. Gast, C. Maître and L. Ramendo. It should also be noted that before 1963, M. Couvert, researcher from the C.R.A.P.E., discovered a skull "*cranial cavity*" which he gave to G. Camps [13]. In 1954, during his first visit to the site, Camps did not hesitate to attribute this site to the Iberomaurusian, because of its coastal position, its lithic and anthropological context. It was only ten years later, in 1964, following the discovery of a female skeleton of Protomediterranean type (H4), in the deep levels of the deposit, that the question of cultural belonging is raised.

Subject "H4" is a *"Nearly complete cranium of a subject buried at the base of the deposit"*. The anthropologist Marie Claude Chamla had attributed this skull to a Protomediterranean anthropological type. The rest of the other subjects presented characters of the Mechta el-Arbi type, sometimes even very pronounced [14]. A paradoxical cohabitation of two distinct humanities. A real "brain teaser" for the prehistorians of the 1960s, familiar with the equation: Man of Mechta = Iberomaurusian and Protomediterranean = Capsian.

How to explain this "anomaly"? Camps reaffirmed the attribution of the deposit to the Iberomaurusian. Supported by the anthropological examinations of M. C. Chamla, he concluded that the men of Rachgoun belonged to an Iberomaurusian group of which the type of Mechta-Afalou constitutes the fundamental element. As for subject H4, he recognized his Protomediterranean character, considering, however, that his presence was exceptional, which could indicate that he is *"The witness of the relations maintained with these different populations"*.

He concluded, finally, by declaring that the Iberomaurusian men of Rachgoun *"Settled on the sands of*

*ancient dunes, a short distance from the shore which they traveled daily in search of molluscs and other seafood"* and that they *"found there a site that was loved by men of their race: they settled there for a very long time. They buried their dead there..."* [15]. The cohabitation of the two anthropological types and their association with a few other cultural indices, lamellar tools, practice of avulsion of the upper incisors, use of ochre in burial rites [16] had strongly oriented the direction of the investigations, to arrive at the "iberomaurusian" solution, which reassured more than it demonstrated.

On the anthropological side, it would be useful to recall M. C. Chamla's point of view, on subject H4, which she had studied well: *"In summary, Rachgoun's wife was a subject of high stature, mesocephalic, of a fairly fine Mediterranean type. All of the characteristics that it exhibits very clearly differ from the very particular morphology of the men of Mechta and Afalou, characterized in particular by extreme robustness and a striking cranial-facial disharmony"*. This first description, apparently well defined, has been somewhat nuanced, by the same author, in a form of hesitation barely suggested: *"However, it is not without interest to underline that there are some characteristics common to both types, in particular: a very high cranial capacity, a mesocephalic cephalic index, facial orthognathism, a high symphyseal region with a well-marked chin, a dentition characterized by the avulsion of the two upper median incisors"*. These are nuances which currently seem essential and even fundamental.

From an archaeological point of view, we note that the corpus of materials collected between 1954 and 1965 came from collections made in the rubble and from outcrop, in section and not on the surface of the archaeological layer. The restrictive context of collection in the rubbles and in the trenches, imposed the use of a stratigraphic terminology which, inevitably, could not cover the spatial dimension (horizontality and continuity of sedimentary and archaeological levels), leading to confusion in reading information and translating it in measurable data (presence, absence, multiplication).

Camps had used the term «*deposit*», sometimes to characterize the archaeological outcrop as a whole, *"The Rachgoun deposit occupies the western slope of a very large hill"* [17], sometimes to designate the shell accumulation, *"The Rachgoun deposit has all the characteristics of a kjoekkenmodding, even of escargotière whose constituent elements of animal origin are tests of marine molluscs and very few helixes and other land snails"*[7]. He uses this term further on page 167 to specify that it's *"Completely covered by a layer of beige earth..."*. In reality the «*beige layer*» is part of the deposit, it does not cover it. It overcomes the «*archaeological layer*», sometimes even through a zonal crust; the «*zonal crust*».

He uses the expression «*archaeological layer*», only once, meaning that it's *"Is... not a simple heap of shells"* and that *"hearth stones are very numerous whereas the sands and the ashes are in variable proportion both in the thickness of*

the deposit and according to the places, along of the cup". The term "Archaeological deposit" was also used: « *The insensible passage of the red-orange sandy layers from the subsoil to the beige earth at the top, at the ends of the deposit, contrasts with the constitution of a real more or less continuous soil crust, in the upper part of the archaeological deposit* » [18].

We understand the difficulty of reading and stratigraphically representing deposits of the kjokkenmodding / escargotière type, whose constituents seem to be arranged in a random and disordered manner. In 1955, L. Balout, about the capsian rammadyas, admitted that « *...the rammadya is not made of regularly superimposed layers, but of piles of rubbish nested at random, one on top of the other, rearranged throughout human occupation, packed, spread out, dug, to bury the dead* »; he added "no doubt we excavate the Ramaddyat in artificial stratigraphy, by stripping 10 cm by 10 cm or 20 by 20 cm." [19].

Forty years later, in 1997, Camps admits that: the sites are only examined through trenches: « *Les sites n'étant examinés que par le biais de tranchées* ». In 2015, an interesting statement was issued by Ginette Aumassip in a point of view on a recent excavation of the Capsian of Hergla, in Tunisia: « *a search in coordinates - a first for an escargotière* ». [20] ". It is regrettable that Camps did not produce a stratigraphic section or a site plan of the deposit, for greater readability and consistency of its observations.

He only used a few photos while his textual description of the sedimentary and archaeological arrangements is remarkably clear and relevant.

We have, in fact, found all the stratigraphic units that he had identified, the "Beige earth", our layer (A), the « *soil crust* », our crust (Cr), "Archaeological layer / deposit", our formation (K), the « *red-orange sandy layers of the subsoil* », our layer (R3). Only the layer (G3), under the layer (R3), was not observed by the author, he had probably confused it

This terminology which was supposed to guarantee the clarity of observation and analysis, could not serve the subject, due to a lack of consistency in the hierarchy of spatio-temporal scales. We can understand the difficulty of access to a system whose constituents seem to be *arranged « without any specific rule »*, in a geometric configuration which associates a classic stratification device and a disordered arrangement, but this did not authorize the use the same tools which, for over a century, have governed the study of "escargotière". In Rachgoun, in addition to the kjokkenmodding context, we are in a coastal geodynamic, which has had direct or indirect effects on the conformation of the Rachgoun deposit, giving it its own characteristics.

As regards the typological examination of the industries harvested between 1954 and 1965 - which lack stratigraphic support - we referred to the conclusions which Camps reached. While admitting the insufficiency of the tools collected to establish a statistic, he considered, however, that: « *"The presence of lamellae with flattened edge is enough to situate this industry in the Epipaleolithic or the Neolithic" and of these two possibilities, the second must be excluded*

*because no element of the tooling presents the slightest Neolithic character, even the smaller. point... could not be confused with an arrowhead, invasive retouching, polishing, rectangles are unknown, as well as ceramics. No remains of domestic animals have been found.*" He finally concludes that "The site of Rachgoun therefore seems pre-Neolithic" and "that it is not adventurous to specify even that it presents, in its industry, the usual characters of the Iberomaurusian" [21].

Conclusions that emerge from a classic typological approach, which differentiates a large tool on grainy rock: "4 stonewheel, 3 nucleiform planers, 4 pebble tools, 1 millstone debited, 14, large nucleus, 135 unretouched flakes, 16 flakes with continuous retouching, 5 denticulates, 5 notches, 1 double scraper, scraper" from a small tools, mainly microlithic on flint and other siliceous rocks: "2 scrapers, 2 sharp lamellae with straight flanged edge, 2 lamellae with flattened edge, 3 lamellae with curved edge and truncated base, 1 obtuse lamella, 1 lamella with arched head, 1 punch on lamella with blunt edge, 1 small blade on edge partial blast, a small flake with blunt edge, 11 pieces with notches and denticulates, 1 point, 16 lamellae and flakes with continuous retouching, 34 nucleus, 100 flakes and lamellae unretouched" [22].

To demonstrate the "frustrated" character of Rachgoun's Iberomaurusian and exclude it from any process of innovation, suggesting the Neolithic, Camps had used a methodological approach by elimination and negative determination: "no invasive retouching" in the lithic industry, no trace of polishing, no trace of geometric microliths (rectangles), no trace of ceramics, no trace of adornment, no sign of domestication, no fish remains", suggesting the practice of fishing.

To consolidate this approach, which excludes any connection with a Neolithic influence, Camps uses the metaphor of runners, the « *coureurs de grèves* », presenting these coastal populations, under the caricature of "strand-loppers" [23], such as those birds (sandpipers) which follow the line of the tides to collect mud and sand. The idea adopted by the author was that these populations - not acquired by neolithic innovations - were dependent on maritime resources, available within the limits of the foreshore: the coastal area between high and low tide, which is the height of a standing man's legs. Not having the skills to fish, these populations would only have had access to the molluscs that lived in the foreshore: mussels, limpets, a few predatory gastropods, barnacles... Camps had made a point of emphasizing that apart from these molluscs: "No fish remains were collected, while sea urchin spicules are not lacking."

On this specific chapter, we clearly understand the passage that Camps wanted to cross, from the paradigm of the escargotière to that of kjokkenmodding, knowing however that the idea of "strand-loppers" participates in a European Mesolithic historicity which opposes the last Paleolithic hunters to the "miserable" Mesolithic. A European historiography which did not concern a Maghreb which lived another epipaleolithic history.



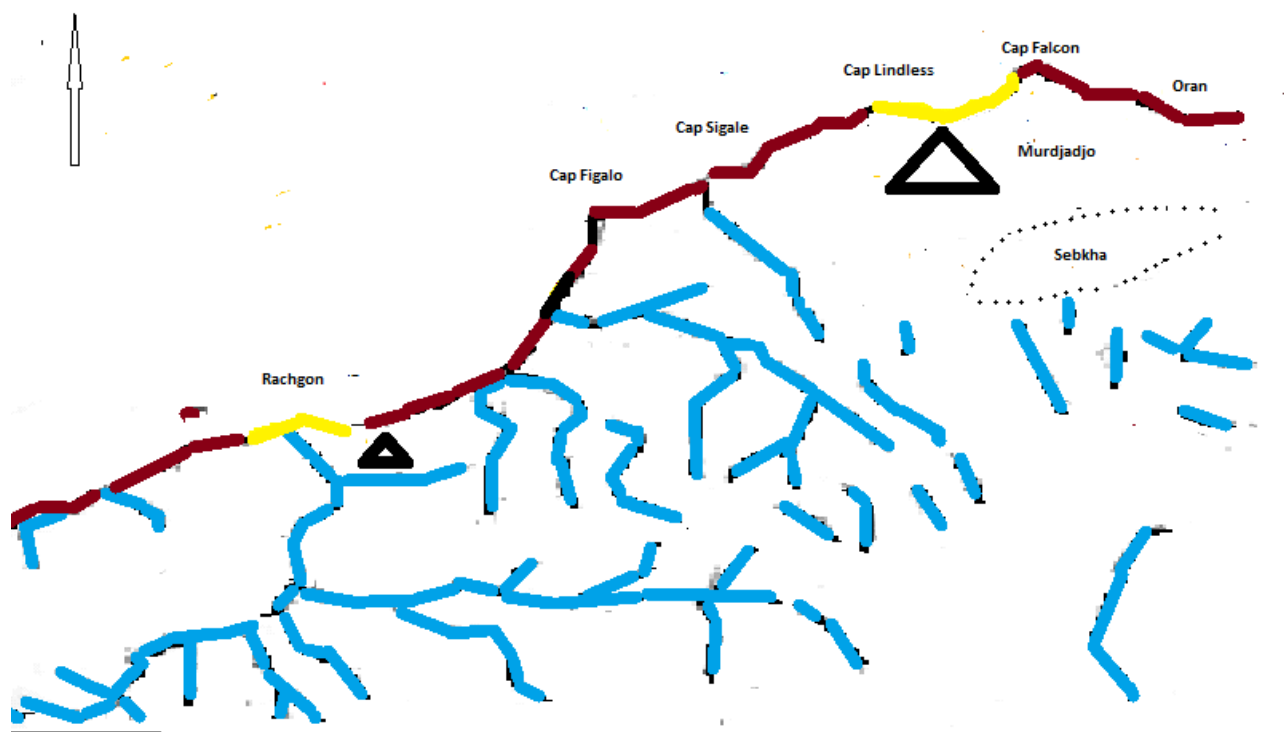
### 3. Comparison Test: "the Neolithics" of the Andalouses (Figure 2)

We considered it useful to recall research, in relation to our subject, carried out by these few researchers of the thirties, who laid the first milestones of a regional prehistory of Oran, at a time when prehistoric science had not yet established definitely its theoretical and methodological dials. Three of them stand out for having marked the prehistory of Oran, visibly "minor" with regard to the interest shown only in the search for Algiers and Constantine.

These are Pallary, Doumergue and Vuillemot who, from their first approach to the field had posed the problem of navigation and relations between the two African and European shores, in this western extremity from the Mediterranean Sea: the "Alboran Sea", a maritime territory facing the Spanish coast to the North, Algeria and Morocco

to the South and the Strait of Gibraltar to the West.

It is around the large islands of the coast of Béni Saf (Ile plane, Habibas archipelago and Rachgoun) to which must be added the islands of Zaffarines (three small towns, located 3.5 km from the Moroccan village of Ras el Ma and 48 km east of Melilla), visited by Pallary, that these authors supported their hypotheses on the possibilities of transmediterranean navigation, based on important discoveries. This research was interrupted, by the very fact of a scientific hegemonism which had fixed the conceptual and chronological anchors of the Maghreb prehistory. With the opening of the new Rachgoun site and by what characterizes it most, the relationship with the sea, we considered it useful to revisit these pioneering works, devoted to the coastal sites established between the mouth of the Lower Tafna, to the West and the western end of the Andalusian plain, to the east.



**Figure 2.** Distribution of *kyokkenmodding* deposits between Rachgoun and the Andalusian plain. The large triangle represents the many Neolithic stations of Andalouses. The small triangle represents the only station of Rachgoun.

The Andalusian plain (Figure 2) presents, from an archeogeographical point of view, great similarities with the hill of Rachgoun. They are part of the same prehistoric history: a low sand plain, open to the sea, inserted between mountain ranges, the Murdjadjo and its extensions to the sea, the Santon and the Lindlès massif. On the sandy expanse, which crosses the three municipalities of Aïn-El-Turck, Bou-Sfer and El-Ançor, along the shore, a profusion of "Neolithic" seaside resorts has been reported. These are contiguous foci spread over the sands of dunes. In addition to the archaeological interest, it is mainly the geomorphological characteristics of these sites that aroused our interest. We recall here some of them.

In the station, known as "«Le puits du Senôr », Vuillemot

made the following description: "Very close to there, in the first dunes, several foci appear around the [Puits du Senôr] of mussels in very large quantities, and other molluscs or crustaceans: limpets, *purpurea*, *trochus*, *helix*, barnacle; fragments of a gazelle's phalanx... The tools recovered during the excavation were almost nil and insignificant..." [14].

In the station known as "Le Sevinal", the author reports *A beautiful hearth, even several contiguous hearths in ruin [which] occupy a surface of several ares... The fauna of the vertebrates, disappeared, some shells: purpurea, ceriths, trochus, etc... as kitchen debris. Souvenirs of coquetry, coming from a single point of the station a crowd of "columbella rustica" pierced, several rolled scallops; several*

fragments of valves of the same mollusc intact, others pierced for suspension: one, very beautiful, triangular - on another the perforation is only initiated» [24].

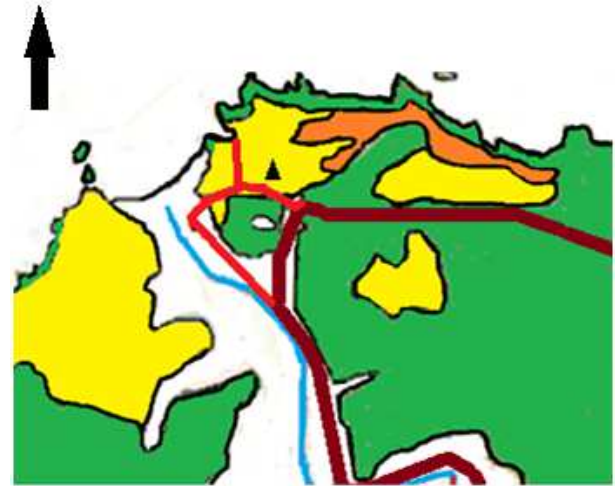
In the station known as the « Foyer des grandes dunes », the author notes that “On the flank of the large dunes... hang several beautiful hearths in place... Mussel shells and other marine mollusks abound in all of them, cemented by a layer of ash; the dimensions and number of limpet valves are striking in the highest. As always, the archaeological crust is thin and the tools do not correspond, in number, to the volume of the gastronomic debris...” [25].

The station known as the « Cimetière d'escargots », already studied by Doumergue in 1921 and 1937, is more instructive from the debate it has sparked. Here Vuillemot, espousing Doumergue's point of view, insisted that “It is not a question here of what one generally designates under this name [escargotiére]; one sees a whole of more or less ruined hearths (Doumergue counted about thirty of them), encumbered with marine shells - only two have helixes - perfectly separated from each other and not very thick. We are far from the heaps of several meters of the department of Constantine, even for the best preserved. The agglomeration seems to have been a true village of which it does not seem possible to reconstitute the shape of the dwellings, if dwellings there were”. [26].

Vuillemot had observed that « In each hearth you can note a predilection for a species: here mussels, there limpets, barnacles, sometimes *Helix* ». Seeing that “The thinness of the deposits, considering the devouring powers of the siliceous soil” he suggest the idea that “the tribe did not stay indefinitely in the same place” and that “It is possible to believe that they lived from the sea: The remains of fish and crustaceans no longer exist, but the shell heaps testify to their interest in seafood” [27].

This author had particularly insister on the geomorphological characteristics of the Andalusian archaeological sites: “cinerite crust”, “agglomerated shells”, “shells cemented by a layer of ash”, “hearths cluttered with marine shells”.. An archaeological malacological grammar that governs the reading and analysis of archaeological sites. We are here, on the specific ground of kjokkenmodding, which is a different type of story from that of the escargotiére.

At the end of all these observations, Vuillemot had put forward a hypothesis, which strongly inspired our approach: “As for the occupants of the Neolithic hearts of the Andalouses, they were probably sailors, fishermen, ichthyophagous, to whom the hunting only brought a complement of food. The breeding and the culture, if one takes into account the current data of the climate, seem random in the sands around their agglomerations. Their pottery of sedentary and the groupings of the hearths let think that they lived a long time in situ and in tribe and that they preferred a sandy ground to sit their hut, their tent or their lodging in sands” [28]. It is surprising that Camps did not mention this important research in his work on the Rachgoun deposit.



**Figure 3.** Situation of the prehistoric site of Rachgoun. The prehistoric site is represented by a black triangle. The national road by a dark brown line, the secondary road by a thinner orange line; Wadi Tafna with a solid blue line. The morpho-sedimentary units are presented as follows, from the oldest to the most recent: in dark green, the plio-quaternary volcanic formations; in orange the limestone plateau q1 4c; in yellow, the dune formation qD.

## 4. Rachgoun 2 Kjokkenmodding (Figure 3)

### 4.1. General Overview of the Deposit

A first field mission of around twenty days (from August 7 to 20, 2017) was organized as part of the CNRPAH research projects. This mission consisted in establishing an excavation-sounding program in the prehistoric site of Rachgoun and in carrying out surveys and field reconnaissance studies, from a paleo-environmental perspective and geoarchaeology.

On the Rachgoun 2 site, outcrop, over the 200 m extent of the trench, the first impression that emerges is the dazzling effect produced by the reflection of the shiny and pearly parts of the “*Mytilus provincialis*” mussels. It's a fairly strong and dense shine, which fades at the ends before disappearing. This first remark confirms our judgment on the longitudinal conformation of the deposit, which is in the form of a dark-colored, bioclastic-looking mega-lens, kjokkenmodding (K) - ending in a bevel on both extremities (Figure 3). This device reminds us somewhat of the case of the Iberomaurusian site of Courbet marine (Alger) excavated by C. Brahim [29].

Our observations are in line with those made by Camps, who wrote in 1966: “The insensible passage of the red-orange sandy layers of the subsoil to the beige earth of the top, at the extremities of the deposit, contrasts with the constitution of a true pedological crust more or less continuous, in the upper part of the archaeological deposit” [30]. He had noticed that at the two extremities of the site there were no longer any shell objects and that we passed «imperceptibly» from the sandy deposits, the «subsoil» to the «Beige earth from the top», Emphasizing that elsewhere, the archaeological layer “is separated from the beige earth by a true pedological crust more or less continuous” [31].

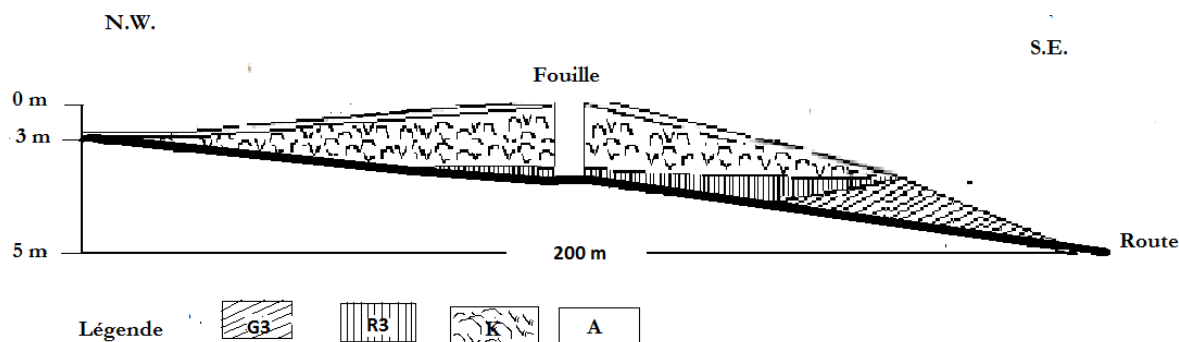


Figure 4. SE-NW longitudinal section of the Rachgoun 2 deposit.

By looking closely at the relationship of the « archeological layer », our formation (K), with the sandy and terrigenous layers (G3, R3 and A), we notice that at both extremities of the deposit, the rare shells and shell debris, associated with stony elements, are first dispersed in friable sands (R3) before disappearing completely. Also, from the very high concentration of shells, shell debris and stony elements, in the middle part of the deposit, we pass laterally, towards the extremities, to dispersion and a spreading of the elements with disappearance of the brunification which characterized the formation (K).

Another important element, the «soil crust» of Camps, our calcareous crust (Cr), is intrinsically linked to formation (K); it does not participate in the sedimentary history of sandy and earthy layers. It is surmounted, everywhere, by a continuous horizon of stones (Ca), which seems to form a covering or a covering mantle, sort of flattened heap of human origin.

In the transverse direction, NE-SW, the trench is not cut vertically, it is arranged in a whistle, by the very fact of a separation of friable elements, which draw a profile alternating between soft and concave levels, which slide downwards, and elements a little more indurated, which form slight protrusions. The result is topography in fine indentations, shaped by differential erosion, to which are added the phenomena of bioturbation due to burrowing animals and other micro-organisms (Figure 4).



Figure 5. Whistle profile of the deposit (excavation area).

This surface erosion model constitutes a first order stratigraphic indicator, in the sense that it organizes the succession of facies according to their nature and their resistance to erosion. The forms with inclined concavity

characterize the formation (K) in its parts not maintained by stony structures or indurations. When these line up over a few lengths, they form protrusions which help maintain the consistency of the sediment. The thin indurations, when they appear outcrop, form small rather fragile eminences.

#### 4.2. Terminological Aspects

For reasons of terminological harmonization and consistency, dictated by the specificity of the research object, a kjokkenmodding which associates a classic superposition stratigraphy with a heterogeneous and composite arrangement, we have agreed to specify the content of the terms and expressions employees, by locating their place in the hierarchy of the required spatial and -temporal scales.

The term "site" followed by the adjective "prehistoric" is understood here to mean a place which has been occupied, temporarily or permanently, by prehistoric men. It necessarily refers to strategic choices of location (proximity to water points, resources, raw materials, area of refuge, place of worship, etc.). The term "gisement" followed by the adjective "archaeological" is used in a more geological meaning, that of the concentration and conformation of remains and traces of an anthropogenic nature in a dynamic of fossilization. The scale of observation and analysis of the "prehistoric site" is not, necessarily, that of the "Archaeological site" and any amalgamation risks corrupting the coherence of the process of understanding. We will use them distinctly.

The difficulties encountered in identifying tools for stratigraphic reading of kjokkenmodding-type formations require us to consider a terminological protocol that respects the content and the approach scales of the entities analyzed.

The terms *formation*, *accumulation*, *depot* and *deposit* will cover a dynamic meaning, referring more to the dynamic agent (marin, fluvial, karst, glacial, wind, anthropogenic...); they will be used in their dynamic sense. The terms *layer*, *stratum*, *horizon*, *level*, *lens* will constitute stratigraphic units which relate to the observed and the measured; they will be used in their classic sense.

#### 4.3. Geomorphological and Lithostratigraphic Examination

A schematic section (Figure 6), taken on a transect which intersects the two large morpho-sedimentary units (qD and



q14c), allows to locate the stratigraphic position of the Rachgoun 2 deposit. The layers (G3) and (R3), which

complete the formation (qD), constitute the sedimentary beds of the kjokkenmodding (K).

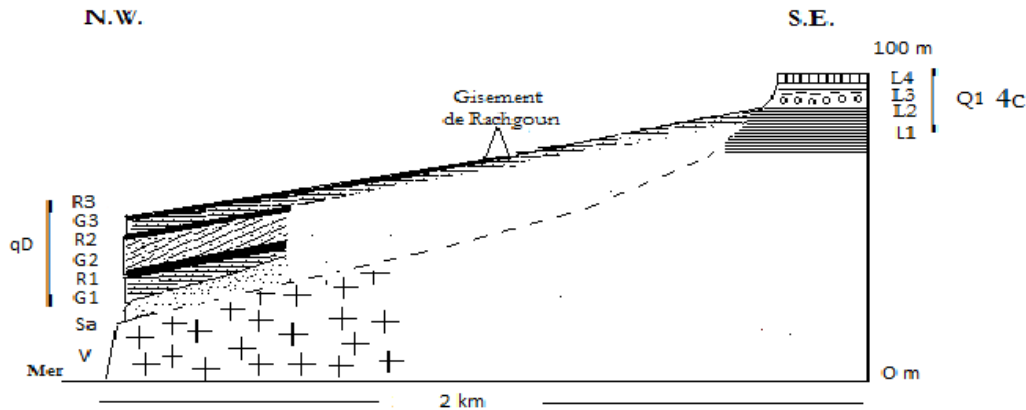


Figure 6. The Rachgoun deposit in the stratigraphic framework of Lower Tafna.

1. Dune sandstone (G3) extends inland to a level beyond which it no longer appears. It ends below the limestone cornice (L4). It has the particularity of ending in whitish zonal crusts (cr), which gives the landscape an appearance of glacis. Cereal crops avoid settling on these encrusted surfaces, preferring the silty parts.
2. Zonal crusts (cr) appear to terminate the sedimentary sequence (qD). The layer (R3), which follows them has a very local distribution; it is crumbly and its color is red tending to orange and brown. It seems to be part of another sedimentary story. It takes up, within it, debris of the zonal crust, proof of the absence of continuity and of gradual passage between (G3) and (R3).

contain any other heterometric element. Due to its compactness, it is not pierced by burrowing animal holes. At the S.E. extremity of the longitudinal section, it emerges on its own before disappearing under the thin deposit of a small wadi (currently filled and serving as a path). This sandstone with zonal crusts is an extension of the sandstone layer (G3) constituting the formation (qD).

2. Zoned limestone crusts (cr). Layer (G3) is traversed by thin sheets of whitish limestone crust, laid horizontally and bending in places to draw sinuosity's. These characters could suggest an origin by sheet runoff, of lime carbonate laden with water, flowing on a slight slope, the layers of crust hardening by exposure to the open air. This phenomenon would mark the end of an episode of dunes.

## 5. The Lithostratigraphic Units of the Rachgoun 2 Deposit

The longitudinal and transverse sections (Figures 4 and 7), which cover all the stratigraphic units, show the following successions, from the oldest to the most recent:

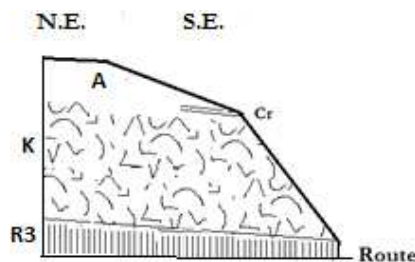


Figure 7. Section N.E. - S.W. Middle part.

1. Layer (G3) - The first stratigraphic unit, of sedimentary origin, consists of consolidated fine sandstone, light yellow in color, homometric, without any trace of bedding. It is crossed by a succession of very hard zoned limestone crusts, horizontal and parallel to each other, bending in places. These crusts are marked "cr". Undoubtedly of dune origin, this sandstone contains tests of fragile helicids, either whole or in debris. It does not



Figure 8. Zonal crusts (cr) and (Cr) and stony level (Ca).

The hypothesis of a syn-sedimentary migration of lime carbonates, precipitating in cement, by leaching from the upper levels is unlikely here. The contact between the layers (G3) and (R3) is brutal. The crusts (cr) were already hardened when the layer (R3) formed. The other hypothesis, by ascensum, in connection with some piezometric level of a water table, is also unlikely, in the absence of traces of hydromorphy, nodulations,



rust spots and encrustation which characterize the hydrogeological process. of the ascensum impregnation.

Layer R3 is formed of fine sands of orange-red color, friable, flowing between the fingers, when they are not clayey (arenized sands), or presenting a relative compactness, when they are maintained by a few binders clayey. In the latter case, they are recognizable by a figure of erosion in small vertical channels, reminiscent of the "badlands" and by a profusion of burrow holes of different sizes, which attest to an intense activity of rodents and animals. "Insects"(termite activity).

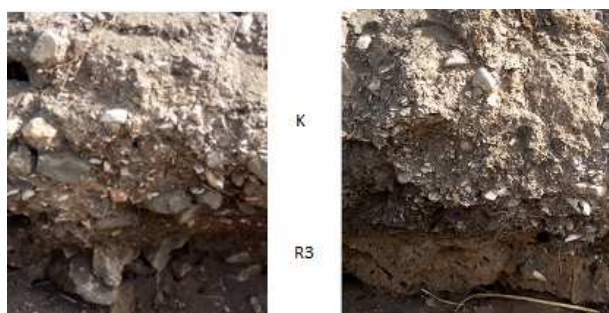
The layer (R3), 50 cm thickness, contains tests of fragile helicids, either whole or in debris. At the base, it rests squarely on the layer (G3), through a whitish lamellar crust (cr). The boundary between the two layers (R3) and (K) is clearly defined sedimentologically, but the elements of the formation (K) (shells, shell debris, stones, etc.) sometimes sink several centimeters into the sands (R3), where they have a fluid aspect.

Layer (R3) is an extension of the red-brown silt (R3) of the formation (qD). It takes part in a new sandy phase, probably corresponding to a new sedimentary sequence (Figure 9).



**Figure 9.** Level R3, reddish brown. It is separated from the layer (G3) by a whitish zonal crust (cr).

The shell formation (K), or kjokkenmodding, cannot be seen in the classical stratigraphic reading of sedimentary layers. Not-earthy, completely ashy, powdery and greyish in color, it is filled with shells, shell debris from marine molluscs (mussels, limpets, etc.) and continental (helicidae) arranged in heaps or horizontal beds. In the middle part of the deposit, where its thickness can exceed 2 m, this formation constitutes a real shell breach of blackish appearance, associated with stony elements. Towards the extremities of the deposit, the thicknesses decrease and the shell structure fades in favor of the sandy phase (Figure 10).



**Figure 10.** a-b. Formation (K) in contact with the layer (R3).

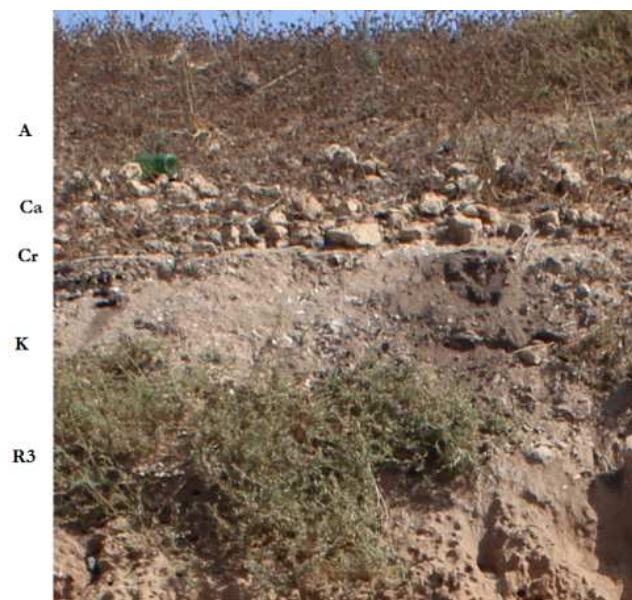
The predominance of mussel shells, of the species *Mytilus provincialis*, gives this formation a silvery sheen. This formation is crossed by structures and figures significant of human intervention (beds of stones, piles of generally burnt stones, structures in pits, etc.).

The calcareous crust (Cr). It is a thin limestone crust of gray to whitish color, very hard and of lamellar structure, less than 5 cm thick. It follows all the underlying topographic forms and seems to envelop, with a gangue, the shell formation and stone structures of the formation (K), participating in its sealing. It has no relation of continuity with the layer (A) and seems intrinsically linked to the formation (K) that it crowns everywhere (Figures 11 and 13).



**Figure 11.** a-b. Croûte zonaire (Cr).

The stony horizon (Ca) (Figure 11). It is a continuous horizon, composed of stones sub-angular to sub-rounded of anthropogenic origin. They are not bound by any matrix. Towards the inside, we are superimposed on the crust (Cr) without being united. They can, also be found in layer (A).



**Figure 12.** Stratigraphic relationship between the calcareous crust (Cr) and the stony horizon (Ca).

Layer A. The ultimate stratigraphic unit is constituted by an earthy layer, which we have designated by the capital letter (A), to inscribe it in a pedo-sedimentary meaning, by its relation to the topsoil. It is a homogeneous layer, 20 to 40 cm thick, formed by a loose sediment of light brown color [beige earth],

dry and grainy in texture, earthy and quite detrital. The upper 5 cm, of a slightly darker color, form litter with a thin, very loose, grassy and thorny vegetal carpet. This layer follows the formation (K) through an easily observable change of facies, from light brown to gray (from earthy to ashy).

This layer ends in a wedge in contact with the zonal crust (Cr). Camps had noticed this detail, about the "zonal crust", noting "that it is particularly well formed in the northern part of the deposit. Its formation is subsequent to the abandonment and recovery of the habitat; it does not seal a level.



**Figure 13.** Contact between Formation (K) and layer (A).

We share this idea about the relation between the calcareous crust (Cr) and the formation (K), but it does not explain the dynamic and stratigraphic relation with the layer (A) and the time that has elapsed between the two. From a longitudinal reading of the outcrops of the deposit, a determining character emerges, that of a morpho-sedimentary compartmentalisation with a SE-NW gradient:

1. At the S-E extremity, the sandstone dune layer (G3) outcrops on its own, without any protective cover. This character is easily observable on the surface. Where the sandstone, very hardened, is not affected by the plowed space; only a very thin wild herbaceous carpet is established there.
2. Then comes the layer (R3), first, under a slightly clayey sandy facies, resting on the dune sandstone (G3), through the zonal crusts (Cr). This layer, of orange-brown color passes, at the upper level, gradually to the formation (K), still not very charged with elements.
3. In the middle part of the deposit, the formation (K) has the greatest thicknesses and concentration of shells and shell debris as well as structures made of stones and burnt blocks. It rests, in a frank and brutal manner on the sandy layer (R3), which is arenized and fluid and which tends to lose its coloring.
4. At the N-W end of the deposit, only the upper part of the formation (K) is flush with the level of the road, the rest is no longer visible. The zonal crust (Cr) no longer appears, the stony horizon (Ca) alone constitutes the upper end of the deposit. This morpho-sedimentary compartmentalization is easily read in the landscape (Figure 4).

On figure 14 we can observe the surface of the hill which is in the form of a gently sloping glacis, dominated by the limestone plateau (q1 4c). The uncultivated part of the hillside, with wild herbs, appearing in light green in the

photo, is occupied by dune sandstone (G3), which extends up to the height of the limestone cornice (L4). The cultivated part of the hillside, in dark green, is directly established on the sands (R3) and especially the formation (K), which seems to constitute, at this level, a real reservoir of organic matter.



**Figure 14.** SE-NW gradient of morphosedimentary compartmentalization. The white triangle indicates the location of the excavation. (1 et 2) wadis currently tracks.

The two paths (1 and 2), which delimit the hillside in its lateral parts, occupy the place two old wadis with very low beds. These wadis bypass the hillside without crossing it, which excludes any sediment input of alluvial or colluvial type.

Thus, if we cannot exclude the wind-driven sandy inputs from the nearby beaches, most of the sedimentary substance of the archaeological site - which is a constituent element of the hillside - comes from an essentially pedological morphogenesis and bioturbation, to which must, necessarily, be added the frequent and repeated disturbances of plowing, at least in the upper parts of the layer (A).

These physical, geomorphological and pedological phenomena do not seem to have caused any significant changes since the deposit was buried. It would be necessary to know whether the time of constitution and burial was long or fast, so as not to eliminate any possible recent contaminations. Bioturbations, linked in particular to burrowing animals, is an important chapter, which will be mentioned later, in the taphonomic theme.

## 6. Elements of Chronology

In this geomorphological and lithostratigraphic approach of the archaeological site of Rachgoun, we have tried to collect the few data that allow access to the Mediterranean chronic-stratigraphic framework [19] and to the Moroccan classification [19, 32-39], to better frame the subject in its chronological and paleoclimatic dimensions, pending other indicators more measurable. In Rachgoun, faced with the scarcity of archaeological and paleobiological traces, we only had to rely on the geo-pedological data, in their ultimate finite expression Upper Pleistocene - Holocene (Formations qD and q1 4c).

As a test, we have established some chrono-stratigraphic correlations, which are, of course, subject to debate and discussion. The objective is to locate, from a sedimentary

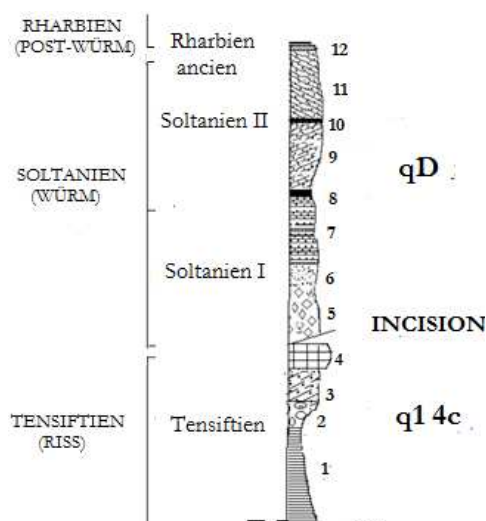


perspective, the succession of lithostratigraphic units, with reference to the theoretical framing required.

The terms and notions that we borrow from the current classifications are used here in a strictly chronostratigraphic understanding, the most widely agreed upon, which makes it possible to understand climate change, in its main trend and its impact on sedimentary dynamics. Much finer approaches, which intervene more directly on climate indicators, will not be considered at this stage of our work. Thus, when we speak of Tensiftien or Soltanien, under the Moroccan continental classification, we do so in the chronostratigraphic sense, that which allows correlations with the alpine stages of Riss and Würm.

Equivalences are made easier, in the coastal area, where the marine stages and sub-stages are better documented and put in relation with the associated continental formations, through the notions of climato-sedimentary and climato-eustatic cycle. The Sicilian and Tyrrhenian stages are understood in this sense and correlated with their Moroccan correspondents. q1 4 c and qD: Two Major Sedimentary Units.

From a chronostratigraphic perspective, the two large sedimentary formations (q1 4 c) and (qD) constitute the last two major units of the Upper Pleistocene. They are separated by an important incision phase, which determines the geometry of the compartmentalization (staging). In the coastal dynamics (transgression - regression), these two formations would correspond to the two successive cycles, Sicilian and Tyrrhenian and would be placed in the two great continental phases of Tensiftien (Riss) and Soltanien (Würm) (Figure 15).



**Figure 15.** General Chronostratigraphic diagram. TENSIFTIEN: 1- Argiles blanchâtres (L4). 2- Conglomérat (L3). 3- Grès tufacé (L2). 4- Croute calcaire (L4)- SOLTANIEN: 5- Basalte altéré. 6- Sables argileux (Sa). 7- Grès dunaires (G1). 8- Limons rouges (R1). 9- Grès dunaires (G2). 10 - Limons rouges (R2). 11 - Grès dunaires (G3). RHARBIEN: 12 - Limons rouge brun (R3).

Among the important indicators, it is undoubtedly the characteristic of alternation "red silt and sandstone", which holds the most interest. It is a constant throughout the Maghreb coast. In Rachgoun we counted in the formation

(qD) three layers of silt, successively "dark red", "light red" and "brown red".

The red silts (R1) and (R2) are in a relation of alternation with dune sandstones (G1) and (G2) and seem to correspond to phases of interruption of the aeolian accumulation and development of episodes of greater humidity, which promotes the mobilization of iron oxides, responsible for reddening. Red-brown silts (R3) are not associated with a dune sandstone episode.

We have seen that the layer (R3) reworked zonal crustal debris (cr) from the upper horizons of the dune sandstone (G3). This means that this layer is part of a sedimentary process which begins with an erosion phase. Layer (R3) completes the sedimentary sequence. There is no longer a dune phase, which supposes that the extent of the continental shelf, which allowed the mobilization of sands, (regression) has reduced considerably, due to a rise in sea level and the gradual approach to the current sea level.

These characteristics are associated, moreover, with a loss of reddening and the establishment of a browning context. The reddish brown silts (R3) lie chronologically between the Late Pleistocene and the Holocene. The reddish layers (R1) and (R2) follow the sandy dune accumulations (G2) and (G3). They were formed once the dunes were consolidated and sanded. Do they correspond to periods of biostasis, to chemical alteration favorable to the mobilization of iron oxides, or on the contrary to phases of rhexistasis, marking a sudden change in sedimentation?

From what we know about the Maghreb coastline, this second hypothesis, which is generally adopted moreover, is supported by the fact of its generalization to the whole of the Maghreb including Atlantic Morocco and southern Portugal. The "red silt" episode was placed in the recent Ouljien of Mediterranean Morocco and Atlantic Morocco [40-43].

In 1983, in a doctoral work of the 3rd cycle on the Upper Pleistocene of the western Algerian coast [44], then in subsequent publications [45-47], we noted, above the formation "neotyrhenian" marine, three layers of red silt, separated by dune sandstones. An almost systematic device on the Algerian coast.

We found very strong analogies with Tunisia and Sardinia. At the end of a field conference in Tunisia (1979) and Sardinia (1980), a team of Italian-Tunisian researchers concluded their work as follows: "The last beach is directly covered by a strongly rubbed sandy-silt horizon [...] generally corresponding not to in situ pedogenesis but to a deposit of colluvial red soils. This deposit began to form during the beginning of the last positive pulse of the sea (Chebba-Santa Reparata), but continued to form during the beginning of the regression that followed and only then did the dune beds that overlie them accumulate [...]. The dune accumulation" they continue, "has been interrupted several times, for reasons that are probably both climatic and eustatic, and new colluvial outwashings have been established. There are generally three red colluvial layers, the last of which is topped by a fairly old dune [...] probably of Würmian age." [48]. Rachgoun's red silts (R1) and (R2) are part of this same sedimentary

historiography of the Mediterranean coast and share the same chronostratigraphic meanings.

## 7. Rachgoun's Kjekkenmodding in the Holocene Context

The only radiometric data we have from the Lower Tafna Valley are those relating to volcanic outcrops, with an ultimate date of 800,000 years BP, corresponding to the last volcanic eruptions [49-51]. A date that situates us in relation to the Sicilian marine and Rissian Tensiftian continental stage. For the rest, the region constitutes a nomads land from the point of view of chronostratigraphy.

In our first approach to the archaeological site of Rachgoun, once the first stratigraphic was established and the excavation-sounding protocol implemented, we sampled the shells of "*Mytilus galloprovincialis*" mussels, at the base of the formation (K) and of layer A, which we subjected to dating by Carbon 14. The dating was carried out by the BETA Analytic Radiocarbon Dating laboratory, in Miami, Florida, in September 2018.

The sample noted "RCHG.17.D'1.USK", corresponding to the basis of the "K" formation, was dated 9490 +/- 30 BP. The one noted "RAC.A", at the base of layer A, has been dated to 9430 +/- 30 BP. These two chronological results, which would necessarily have to be consolidated by other data, would place us at the very beginning of the Holocene (early Rharbien), just after the climatic crisis of the Younger Dryas (11,000 and 10,000 B). Which, especially in Europe, was marked by a real break in balance, by the fact of a sudden return of the cold and the drought, after the short episodes of warming of the bölling (12.600-12.300) BP and the Alleröd (11,700-11, 200 BP).

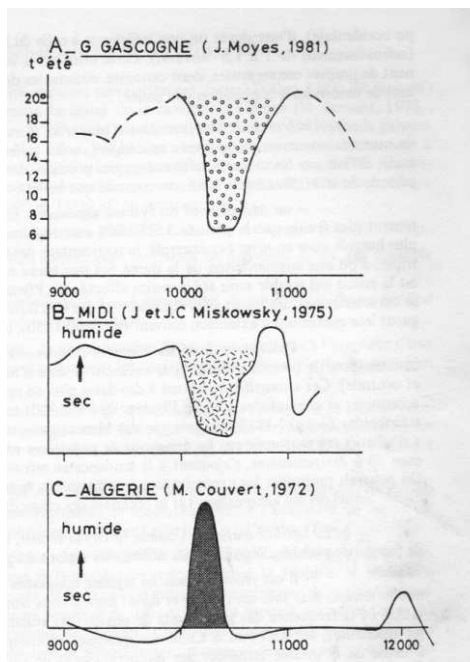


Figure 16. Climate crises around 11,000-10,000 BP (P. Rognon, 1983, p. 153).

In tropical and subtropical latitudes and especially in Algeria, this crisis was experienced in reverse. The period between 10,500 and 10,000 BP corresponded, in Algeria, to a peak of rainfall, as shown by the curve established by M. Couvert, in 1972, from the analysis of charcoal (Figure 7).

This peak in rainfall, at this precise stage, did it not have some impact on the production of marine biomass, which could explain new choices of subsistence with all the eco-cultural imagery that would emerge: a sea culture?

Interesting the work carried out in 2002, in the southern basin of Alboran, by a team of Franco-Moroccan researchers, on the sediments of a core (core 93TG-21), in which they were able to detect, by a correlation between the organic carbon and carbonate contents, an evolution in three phases: the importance of terrigenous inputs during the Upper Pleistocene, the increase in organic productivity during the Lower Holocene and a phenomenon of continentalization during the Upper Holocene [52]. A study based on variations in sedimentological and micropaleontological characteristics and carbonate and organic carbon contents, which gives the period of the Lower Holocene this characteristic of high organic productivity and therefore sustained growth of marine biomass.

In this regard, it is not without interest to underline the special attention given to the coast of Rachgoun and to the island of Lalla, to give it the status of marine protected area. The choice of this site is not random, it was decided upon following an assessment of the potential and characteristics of marine biodiversity, which showed the uniqueness and specificity of this coastal area, in terms of ecosystem richness and diversity..

Remarkable colonies of benthic, pelagic and terrestrial invertebrates, a floristic diversity (posidonia, green and brown algae) and especially an abundance of mussels (*Mytilus Gallo provincialis*), limpets (*Patella gigantea*), sea urchins (*Paracentrotus lividus*; *Arbacia* sp), barnacles (*Balanus* sp)), polychaete annelids (*Sterma spissuctata*; *Nephtys hombergi*; *Lumbrineris latreilli*; *Lumbrineris gracilis*; *Chone filicaudata*; *Chone duneri*...), crustacean arthropods (*Ampelis cacorophium*), crabs; Tanaidaceae, Molluscs (Tellinidae and Nuculidae) and Echinidae, to which must be added about twenty species of fish [53].

It is this stock of maritime resources that Rachgoun's men sought with their predilection for *Mytilus galloprovincialis*. A promising line of research, which could participate in the process of constructing the chronostratigraphic framework of Rachgoun's kjekkenmodding.

## 8. Conclusion

The field studies that we have been during the summer of 2017 and the results that have been drawn up to that point concerning the paleoenvironmental context and the geomorphological and lithostratigraphic aspects, come from an approach that we consider preliminary, from a subject which suffers from a stratigraphic and chronological framework, if one, except for the work devoted to volcanic



formations. The individualization of two morpho-sedimentary sets (q1 4c and qD) and their connection with the classification frameworks in force, is a first draft of a chronostratigraphic framework, which will need to be completed and compared, in a multidisciplinary approach.

The attribution of the prehistoric site of Rachgoun to the ancient Rharbian (first part of the Holocene) suggests, moreover, a new archaeological and paleoenvironmental perspective. This first corpus of geomorphological and stratigraphic data, from the point of view of the knowledge of the Quaternary littoral formations of the region, constitutes a useful point of reference, which invites a critical study on the geological and archaeological works.

In Rachgoun, we sought to grasp the links and possible relations between prehistoric human settlements and the dynamics of a landscape of volcanic essence, reshaped, after the last eruptions, 800,000 years ago BP, by a Sicilian - Tyrrhenian geodynamics.: beginning of the rhythmic "red sandstone-silt dunes" phenomenon. A rhythm which undoubtedly reflects variations in sea level, in relation to glacio-eustatism, but also fits into the "Regression-uplift-flexuration" scheme which characterizes this part of the Maghreb coast.

The current landscape of the Rachgoun region is the expression of a recent geography, established in the Tyrrhenian, in a new morpho-sedimentary cycle, which led to a new configuration of the relief, by rejuvenation, at the expense of old forms, partially or completely destroyed. Of this Tyrrhenian landscape, only the continental component (qD) emerges today, without its marine extensions. The absence of Tyrrhenian marine witnesses is almost general on the entire west coast of Oran. A situation that cannot be addressed by a simple research gap, since immediately to the east of the coast of Oran, the Tyrrhenian marine outcrops form the support of the coastal platform, between +30 m and the current sea level.

In this contribution, we approached the subject from the angle of geomorphology and Quaternary geology, which offers us guarantees of access to appropriate readings of Rachgoun's kjokkenmodding, considering the singularity of the deposit and the absence a chronostratigraphic framing device.

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