The Epipalaeolithic–Neolithic transition in the Eastern Rif Mountains and the Lower Moulouya valley, Morocco

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1. INTRODUCTION

The Neolithic transition, since decades in a particular focus of the Western Mediterranean archaeological research, recently receives new input concerning the chronological frame (Carvalho 2010), the development of regional groups (Manen et al. 2010) or raw material supply (Binder et al. 2010). One of the most interesting topics about this is the variability of the archaeological record in the Southern Iberian Peninsula. This seems to be closely linked to the complexity of the environment and the particular geographic position.

The complex environment originates from a landscape characterized by a considerable contrast between the high mountain ranges of the Bethic Cordillera who descend directly into the Mediterranean. These mountains on one hand produce a rain shadow resulting in more humid conditions in Western and a semiarid environment in Eastern Andalusia and Murcia. On the other hand the area lacks in plains or extended river deltas like the ones of Guadalquivir in the West or Rio Almanzora (Camalich *et al.* 2004) and Ebro (González-Sampériz et al. 2009) in the east who are more suitable for Neolithic lifestyle, e.g. agriculture. These manifold factors probably have resulted in a very particular pattern of Neolithic expansion not yet understand in detail. From the semiarid areas up to now no doubtless Early Neolithic inventory is known. It seems that these zones were hunter-gatherer retreats were the Epipalaeolithic of the area has lasted longer than in other areas. An Early Neolithic is known for instance from the cave site of Cariguela (Pellicer 1964, Navarette Inciso 1976), far from the coast a rather untypical feature for the Neolithic transition in the Western Mediterranean.

The geographic position of the described area first of all is characterized by its closeness to Northern Africa. The impact of the European Neolithisation process on the African continent is discussed by several authors (Gilman 1971). But recently again critique came up about the unidirectional character of this development. Manen et al. (2007: 148) mention a couple of features existing in Western Andalusia and Portugal but are not known from the Eastern part of the Southern Iberian Peninsula. These are amongst others pottery features like pointed bases, “bag-like” forms, *almagra* and several decoration techniques. But also the lithic industries show characteristics not known before like heat treatment, pressure technique and the fabrication of geometric microliths (e.g. trapezes). As a possible source of these features the authors propose the coast Northern Africa. To verify this hypothesis a direct comparison with the African material is required. But a unlike status of research on both sides concerning spatial coverage and temporal resolution as well as terminological differences complicate a direct comparison.

An appropriate region for this evaluation could be the Eastern Moroccan coast. Since fifteen years a Moroccan-German mission is working in the area to close the mentioned spatial and chronological gaps. This paper gives an overview about the recent state of knowledge concerning the Neolithic transition by introducing briefly the recently investigated Epipalaeolithic and Neolithic sites. By presenting their artifact inventories particular focus is on the first appearance of Neolithic inventions and how they have spread throughout the area. Finally some terminological differences will be mentioned and a system proposed that should facilitate the intercontinental comparison.

2. TERMINOLOGY

Concerning the Late Pleistocene and Early Holocene prehistory of Northwest Africa no consistent and generally accepted terminological system does exist. The reasons therefore are manifold. Northwest Africa or the Maghreb is a vast region offering a multiform landscape composed of coastal areas, floodplains, mountains and the deserts of the Northern Sahara. With its position at the northwestern edge of the continent, the region is exposed to the influences North Atlantic and continental air masses. This setting causes on the one hand strong annual weather fluctuations and on the other hand led to considerable climatic shifts in the past. In this process the extended arid and semiarid areas have reacted very sensitive to these shifts, causing dramatically changes in human land use. Beside this internal population dynamics, the area received cultural influences from the Mediterranean and from continental Africa as well.

Adjacent to multifaceted landscape and dynamic

environmental and population history the history of archaeological research is multifaceted as well. Although investigated since more than hundred years the knowledge of the area is disparate and from geographical point of view very patchy. A short but intensive fieldwork in one of the still unexplored areas as it is done recently in the eastern Rif is able to change existing concepts considerably. As influenced by spatial factors, archaeological research is affected by diverse national traditions and methodological approaches to the same degree. Altogether all these factors have created an inhomogeneous and locally restricted terminology complicating communication and interregional comparisons.

For the Mediterranean Maghreb a terminological system is already proposed elsewhere (Linstädter 2008: 44) but will be summarized here shortly. While other authors (e.g. Nehren 1992) the Iberomaurusian and the Holocene hunter-gather communities subsume under the term Epipalaeolithic, in the here proposed concept both will be considered as different cultural units. The Iberomaurusian ends at about 11.500 cal BP at the end of the Younger Dryas thus with the end of the Pleistocene in general. The late Pleistocene offered an open steppic environment and therefore particular conditions. From their long-term residential camps they hunted herbivores like horse, Barbary sheep and gazelle (Mikdad *et al.* 2000: 150). This land use pattern ends at the beginning of the Holocene when local groups were forced to adapt their lifestyle to the afforestation of the landscape. Only this phase here is called Epipalaeolithic and it ends with the transition to food production between the 8th and 6th millennium cal BP (see chapter "The Epipalaeolithic-Neolithic transition in the Eastern Rif"). This phase of Holocene hunter-gatherers is called by Camps (1974: 204) "Épipaléolithique de transition" and by Nami (2008: 230) "Épipaléolithique indifférencié". Here the term ***Mediterranean Epipalaeolithic*** will be used in order to the distribution area which corresponds on the one hand to the zone of Mediterranean vegetation and on the other hand to the zone where the following Mediterranean Neolithic is spread. The term Mediterranean Neolithic, or "Néolithique méditerranéen" itself was introduced by Camps & Camps-Fabrer (1972: Abb. 16).

Finally there is one complex phase that needs an unambiguous label. In the time between 7.600 and 5.800 cal BP inventories appear, that show an Epipalaeolithic lithic industry combined with Neolithic pottery (see chapter "The Epipalaeolithic-Neolithic transition in the Eastern Rif"). Most probably with these inventories we catch late Epipalaeolithic groups who already had contact with Neolithic communities from whom pottery was adopted. The lack of evidences for food production may indicate that these groups followed their lifestyle far into the 6th millennium cal BP. To cope with those circumstances these groups will be called as ***Epipalaeolithic with pottery***. Terms like "Paraneolithic" or "Perineolithic" were avoided deliberately because they seem to be misleading. The term ***Epipalaeolithic with pottery*** however shall clarify that the creator of these inventories were local hunter-gatherer, and that pottery did not appear before the arrival of the Neolithic at 7.600 cal BP.

3. EPIPALAEOLITHIC AND EARLY NEOLITHIC SITES IN THE EASTERN RIF REGION

The area of the Eastern Rif (Fig. 1) has been studied since 1995 by a Moroccan-German research team with a participation of the *"Institut National des Sciences de l'Archéologie et du Patrimoine du Maroc"* (INSAP), the *"Komission für die Archäologie Außereuropäischer Kulturen des Deutschen Archäologischen Instituts"* (KAAK) and the University of Cologne. The research area stretches between the Moulouya River in the east and the Rif mountains in the west, south of Al Hoceima. The southern boundary is marked by the Msoun River and in the North it is limited by the Mediterranean Sea. Several hundred sites were discovered and some excavated. The more detailed investigated sites cover the time span from the Lower Palaeolithic (Jebb 2008) up to Islamic times (Linstädter et al. in press). From the beginning of the project a particular focus was on the Upper Palaeolithic, or Iberomaurusian. Extensive excavations were carried out in the cave sites of Ifri N'Ammar (Moser 2003), Ifri el Baroud (Nami 2007) and the open air site of Hassi Ouenzga.

But an additional focus was on the Epipalaeolithic Neolithic transition coming to the fore in the last years because of the newly discovered littoral sites of Ifri Ouzabour, Ifri Armas and Ifri Oudadane (Linstädter 2010). Altogether twelve sites with Epipalaeolithic or Neolithic inventories are available up to now (Fig. 1). From the interior part of the working area, the surroundings of the Plain of Gerrouaou, the Epipalaeolithic sites of Ifri el Baroud, Taghitt Haddouch as well as Hassi Ouenzga Abri and Hassi Ouenzga open air are known. While Ifri el Baroud (Nami 2007) and Hassi Ouenzga Abri (Linstädter 2003, 2004) are already published, the materials of Taghitt Haddouch and Hassi Ouenzga open air are still under examination. Early Neolithic sites from the interior showing a full Neolithic economy are not known up to now.

The second project key area is the valley of the Lower Moulouya (Fig. 1). Here the Epipalaeolithic open air sites of Mtlili 1, Hajra 1 & 3 and Taoungat 1 are investigated in the last years (Linstädter et al. 2011). Furthermore the sites of Mtlili 5 & 6 dating in the first half of the 7th millennium cal BP are excavated. Both sites dispose of pottery. But the assignment to the Epipalaeolithic with pottery or the Early Neolithic seems to be difficult because any indication for food production is lacking. Bones in general are not preserved in the

alluvial sediments before the medieval period and remains of domesticated plants were not found within the charcoal samples. Otherwise the small lithic assemblage contains a few geometric microliths showing a tendency towards the Neolithic (Fig. 2, top). Anyhow, in the absence of clear evidences for food production, the sites for the moment will be regarded as an Epipalaeolithic with pottery.

The third key area is the Mediterranean coast east of the Melilla peninsula. In the course of road building activities several cave sites were discovered (Linstädter 2010). Epipalaeolithic deposits were investigated at Ifri Ouzabour and in the shelter of Ifri Oudadane, Neolithic layers at Ifri Ouzabour, Ifri Oudadane as well as Ifri Armas.

Ifri el Baroud

Ifri el Baroud first of all yielded a considerable Iberomaurusian artifact ensemble. But from the inner part of the cave comes a small-sized Epipalaeolithic inventory dated by two ^{14}C-data of 9530 ± 24 cal BP (Bln 4872) and 11030 ± 141 cal BP (Bln 4755, Tab. 1) to an Early Epipalaeolithic. After Nami (2007: 230) the lithic material shows tendencies towards the Neolithic by an increase of general dimensions and a higher proportion of notched pieces. In fact backed bladelets come under 20% and notches go beyond 30%. Nami calls the material an *"Épipaleolithique indifférencié"* and mentions difficulties by the interpretation because of the limited size of the inventory and the origin from the very internal of the cave. The latter may have an impact of the selection of particular tool types caused spatial organization within the cave.

Hassi Ouenzga Abri

This site is of particular interest because it marks well the transition to the Neolithic (Linstädter 2004, 2008). A mixture of a Late Epipalaeolithic lithic inventory with Early Neolithic pottery and a lack of domesticated species probably show a local hunter-gatherer community in contact with Neolithic groups before food production was adopted.

Open air site and shelter show no temporal overlap. The open air site, excavated 1996 and 2003, is dated to the 15th until 11th millennium cal BP and therefore to the Late Iberomaurusian and Early Epipalaeolithic. The 12 m^2 large excavation yielded the enormous artifact ensemble of more than 80.000 stone artifacts, still under examination. In contrast to the limited inventory of Ifri el Baroud, the open air site of Hassi Ouenzga offers ideal conditions to define differences between Late Iberomaurusian and Epipalaeolithic stone tool production.

From the bottom layer of Hassi Ouenzga Abri comes a ^{14}C-date of 8.804 ± 125 cal BP (KIA 433, Tab. 1). No archaeological material can doubtless be assigned to this date, but it suggests an occupation subsequent to the open air site. The charcoal sample that has offered the Epipalaeolithic date comes from a nearly 1 m thick part of the stratigraphy dated by nine ^{14}C-data in a period between 7.600 and 6.800 cal BP (Tab. 1). The sample might be a residues of an Early Epipalaeolithic occupation contemporaneous to the use of the nearby the open air site. Due to the small dimensions of the shelter an occasional cleaning is likely. Attempts to link the 9th millennium cal BP date with the early pottery, to establish an independent invention of ceramic before the general Neolithisation of the Western Mediterranean are wrong and with the knowledge of the internal characteristics of the site unacceptable.

In contrast the existence of pottery from the middle of the 8th millennium cal BP onwards can be accepted certainly. The mentioned approx 1 m thick part of the stratigraphy dated in the period between 7.600 and 6.800 cal BP for the moment can seen as the most recent appearance of the Epipalaeolithic in the region. The more than 2.300 pieces containing lithic inventory is clearly originated in the local tradition of bladelet orientated industries. Frequent tool types like points, truncations, notched blades and flakes and pieces with semi abrupt as well as occasionally occurring microliths are typical all Epipalaeolithic sites from the 11th to the 8th millennium cal BP (Fig. 2). A wild fauna shows the clear hunter-gatherer character of the occupation (Linstädter 2004: 74ff.). But what the material distinguishes from the other Epipalaeolithic inventories is the first time appearance of pottery in the area. The approx 2.500 fragments on the one hand show a clear affiliation to the Westmediterranean Early Neolithic, but demonstrate on the other hand also a strong local imprint (Linstädter 2004: 120ff.). While *Cardium*-impressions are rare (Fig. 3.3), impressed (Fig. 3.5-6) and incised decorations (Fig. 3.7-9) are much more frequent. The latter, mostly formed as so-called *"criss-cross-pattern"* are well known from the Oran area in Algeria and show a clear connection to the African coast further east (Balout 1955, Aumassip 1971, Camps & Camps-Fabrer 1972). The few *Cardium*-impressions do not resemble the decorations from the Tangier area (Gilman 1975, Daugas & El Idrissi 2008) and impressed decoration rather show to the Iberian Peninsula (Camalich et al. 2004, Pellicer & Acosta 1997) Altogether connections arise more to the east and the Spanish coast, then to the Tangier peninsula in the West.

Mtlili 1

In a natural profile of the Holocene Moulouya deposits three palaeosoils could be traced within a distance of several meters. The palaeosoils were separated by sterile alluvial layers marking high flood

events that have stopped the soil formation processes. The soils itself as indicators of ancient surfaces were connected with the remains of Epipalaeolithic occupations that could be excavated on an area of 3m². Within this relatively small trench of 3m² a lithic inventory of 1550 pieces could be recovered. Because of the interruption by the flood events the Epipalaeolithic occupation of this site could be divided into three temporal closely limited occupation events. The lower and middle occupation (Fig. 2, bottom) are dated at 9.845 ± 103 cal BP (KIA 39293) and 9.748 ± 113 cal BP (KIA 31007) and therefore follow shortly after each other. The Epipalaeolithic occupation of the upper palaeosoil dates to 8833 ± 110 cal BP (KIA 39295) and thus follows the former with a gap of around 1.000 years.

Nevertheless the lithic material is rather homogeneous. The raw material consists to 96-98% of local flint from the Moulouya gravel beds. The pebbles have a maximum diameter of 8 cm resulting in a limited size of the blanks. The fake and bladelet orientated *chaîne opératoire* is equal in every layer, starting with a unipolar reduction, changing to a more opportunistic irregular mode to exploit small cores as far as possible. The tool assemblage is characterized by points, truncations, notched and edge retouched pieces and therefore shows parallels to the other epipalaeolithic inventories of the region (Fig. 2). Scrapers and perforators complete the Mtlili 1 tool kit.

Hajra 1 & 3

Hajra 1 and Hajra 3 are also two open air sites, situated about 1 km upstream of Mtlili 1. The sites are located very close to each other and refer also to a palaeosoil like the occupations of Mtlili 1. A ^{14}C-date of 8639 ± 48 cal BP (KIA 39295) sets Hajra 3 in a phase shortly after the occupation of the Mtlili 1upper palaeosoil. Beside an artifact scatter on top of the palaeosoil also small pits and fireplaces could be examined. The lithic inventories are small consisting of 141 (Hajra 1) and 38 (Hajra 3) pieces. Like at Mtlili 1 the tool production is based on the reduction of Moulouya gravels. What is noticeable about the tool kit is the limitation on backed bladelets and edge retouched flakes and blades. After Löhr (1979) and Richter (1990) such homogeneous inventories are typical for short term occupations. The existence of fragmented backed bladelets, probably used as arrowheads, suggests an interpretation as hunting camp where used arrows were repaired.

Taoungat 1

Taoungat 1 is the third example for an Epipalaeolithic open air site buried by the Moulouya alluvial deposits Linstädter et al 2011). The site also is connected to a palaeosoil and by a ^{14}C-date of 7803 ± 53 cal BP placed at the very end of the Epipalaeolithic, some hundred years before the arrival of Neolithic communities. Only 2 m² were excavated, but the 30 cm thick archaeological layer yielded the notable inventory of nearly 1.000 lithic artifacts. In general no important differences to the earlier Epipalaeolithic sites like Mtlili 1 could be identified suggesting a continuity of land use in the area.

Mtlili 5 & 6

These two sites are located some hundred meters upstream of Mtlili 1. Their desistance of about 20 m let assume that both spots are belonging to the same settlement. Even here the archaeological remains are connected to three palaeosoils. Four available ^{14}C-dates scatter between 7.100 and 6.600 cal BP and therefore at the transition from Early to Middle Neolithic. Altogether seven pottery fragments are preserved, among that one very small rim sherd with impressed decoration. But the inventory is too small to draw any typological comparison. However a mineralogical analysis was done after what a sherd of Mtlili 6 shows a clay composition that refers to volcanic material. Similar raw material is frequently used for pottery from Ifri Oudadane, Ifri Armas and Hassi Ouenzga Abri. From that point of you the Moulouya pottery integrates well into the Early Neolithic context of the region (Linstädter 2011). The lithic industry is also based on the reduction of Moulouya gravel, but the tool kit shows remarkable differences. Backed bladelets are lacking, while geometric microliths appear more frequently (Fig. 2, top).

Certainly no indications for food production could be identified. But bones are never preserved in the alluvial sediments before the medieval period and while animal husbandry cannot be proofed for the Neolithic. Furthermore no evidence for cereals or other domesticated plants is to be found. Therefore a doubtless allocation to the Early Neolithic is not possible, why the inventory for now should be classified as an Epipalaeolithic with pottery.

Ifri Oudadane

From the three sites with Early Neolithic inventories discovered at the littoral west of the Melilla peninsula, the Ifri Oudadane offers optimal conditions for studying the Neolithic transition. On the one hand the Neolithic inventory of the heavily destroy cave site of Ifri Armas is mixed with Late Iberomaurusian material and is therefore difficult to interpret (Linstädter 2011:231). And on the other hand activities from the nearby medieval settlement have disturbed the sediments of the small cave site of Ifri Ouzabour.

At Ifri Oudadane 10 m² are excavated up to now. The excavation is still in progress. Their ca. 2,50 m deep sediments can be classified in an Epipalaeolithic, an Early Neolithic and a Middle to Late Neolithic absolutely dated up to now by nine ^{14}C-data (Tab. 1). After the available data the onset of the Neolithic can be established earliest at 7.400 cal BP. These data fits well into scenarios of the westmediterranean neolithisation, but is still 200 years younger than the earliest appearance of pottery in Hassi Ouenzga Abri. The running investigations will determine a definitive temporal frame for the Neolithic occupation of Ifri Oudadane.

The study of the artifact assemblage is still in progress, but some interesting features are already observable. Compared to the huge stone inventories in Epipalaeolithic and Epipalaeolithic with pottery sites like Hassi Ouenzga, the amount of lithic material in the contemporaneous Early Neolithic of Ifri Oudadane is very limited. Beside the quantity even the spectrum of tool types is limited. Flakes with edge retouch dominate and backed bladelets are completely absent. Another evident feature is the raw material composition. Inventories of the interior sites are dominated by flint from the Moulouya gravel or from Ain Zora in the South. The Ifri Oudadane raw material is divers with use of types whose source is unknown up to now. Altogether the impression occurs that the people who left this material did not have the same knowledge about local resources and made their stone tools for other purposes. Maybe hunting had not the same importance like in the time before.

A short survey through the Early Neolithic pottery of Ifri Oudadane shows a clear domination of *Cardium*-impressed ware mostly carried out in rocker stamp technique (Fig. 3, bottom). Other techniques are also represented as well as impressed decorations made by different tools like spatula. Frequent forms are pointed based vessels with outwards inclined rim, a shape which is not known from West-European Neolithic inventories. A mineralogical analysis shows a high percentage of pots made by clay characterized by volcanic minerals as already described for Mtlili 6. Compared with the contemporaneous pottery of Hassi Ouenzga some common characteristics are visible like pointed bases, plastic applications, shell, comb and other impressions as well as some incised decorations with wavy line patterns. But also some remarkable differences become obvious like the clear domination of *Cardium*-impressions at the littoral and *criss-cross* incised patterns in Hassi Ouenzga like they are known from the Oran region (Balout 1955, Aumassip 1971, Camps & Camps-Fabrer 1972). The Hassi Ouenzga pottery therefore cannot simply be deduced from the littoral ware like the geographical position would suggest.

Finally the faunal and botanical material of Ifri Oudadane shows clear indications for food production. The bone assemblage consists to a high percentage of domesticated species like sheep goat and cattle. And beside collected fruits the botanical macro remains show fragments of cereals. The latter are still in processing but it seems that the results will contribute to the question of early agriculture in the region. Altogether the Early Neolithic material of Ifri Oudadane indicates a full Neolithic group from outside the area. The pottery differs remarkable from the one of interior sites and the lithic industry varies both in tool composition and in raw material supply. Where these people came from and how the relation to the local people have developed will be subject of future research and will bring light in the question of the Neolithisation process of the Western Mediterranean in general.

4. THE EPIPALAEOLITHIC-NEOLITHIC TRANSITION IN THE EASTERN RIF

After 15 years of intensive fieldwork a preliminary transition scenario can be established for the former nearly unknown region of the Eastern Rif. As a database twelve sites are available five thereof dispose of Epipalaeolithic as well as Neolithic material.

The Epipalaeolithic starts at about 11.500 cal BP with the beginning of the Holocene (Fig. 4). Rising temperatures and precipitation (deMenocal *et al.* 2000, Cacho *et al.* 2001, Kuhlmann *et al.* 2004, Combourieu Nebout *et al.* 2009: 510) result in afforestation and a modified fauna effect different land use strategies of the local hunter gatherer communities (Linstädter 2008). The lithic inventories of the Epipalaeolithic show clear affinities to the foregoing Iberomaurusian. Both show a bladelet industry and a domination of the tool kit by backed bladelets. The same raw material sources were exploited – first of all Ain Zora – and in many cases Iberomaurusian sites were frequented again. Future research has to prove if differences as remarked by Nami (2008: 230) are a possible tribute to the changing environment.

The End of the Epipalaeolithic is hardly to define. The Epipalaeolithic people maybe never have disappeared but with the emergence of the Neolithic their life style and lithic technology seem to disperse slowly. The upper part of the Hassi Ouenzga Abri stratigraphy dated to 5.790 ± 78 cal BP (UTC 6184) shows a lithic inventory in clear Epipalaeolithic tradition (Linstädter 2004: 70ff.). The lithic material is associated with domesticated animals and a typical Late Neolithic pottery mainly decorated by comb impression not made in rocker stamp technique, which is statistically well distinguishable from the Early Neolithic ceramic (Linstädter 2004: 100ff.). This record might be one of the indications that Epipalaeolithic traditions have continued far into the 6th millennium cal BP.

The onset of the Neolithic is slightly better to define. The earliest dated pottery comes from the site of Hassi Ouenzga Abri (7.575 ± 45 cal BP, KIA 434). Certainly

the inventory is classified as Epipalaeolithic with pottery because no evidence of food production could be found. If we assume that the site was occupied since the Epipalaeolithic one may ask if the temporal resolution of a dynamic cave site is high enough to give a correct date. As a secure data for the onset of the Neolithic we can suppose the ^{14}C-date of 7.327 ± 81 cal BP from Ifri Oudadane. The concerning charcoal sample comes from a record with *Cardium*-decorated pottery as well as domesticated animals and plants and therefore indicates the arrival of a full Neolithic in the area. The little older date of 7.387 ± 50 cal BP from Ifri Ouzabour can be considered in the same context.

How the Neolithic inventions have dispersed throughout the area is hardly to say at the moment (Fig. 4, bold dashed line). The sites of Mtlili 5 & 6 as well as Taoungat 7 and Hassi Ouenzga Abri (lower layer, 7.600-5.800 cal BP) do not dispose of any domesticated species. The first appearance of domesticated animals in an interior site is the mentioned date of 5.790 ± 78 cal BP (UTC 6184) from the upper layer of Hassi Ouenzga. So far the relative long period of 1.600 years from the first appearance of Neolithic inventions at the coast up to their arrival at the interior can be confirmed. The fast spread of pottery however let assume that the dispersal of food production was even faster than proofed until now. Further research in the area has to be focused on the topic.

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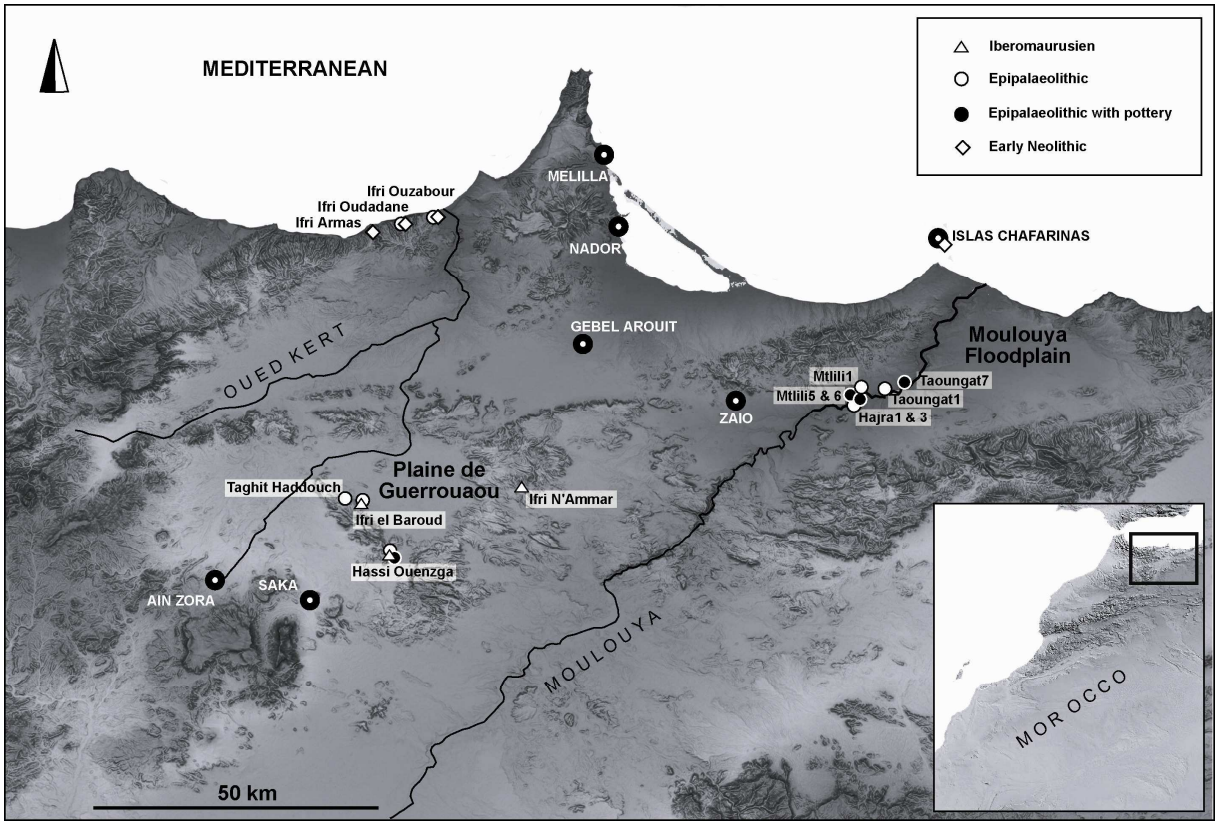
MEDITERRANEAN
Iberomaurusien
Epipalaeolithic
Epipalaeolithic with pottery
Early Neolithic
MELILLA
NADOR
Ifri Ouzabour
Ifri Oudadane
Ifri Armas
ISLAS CHAFARINAS
GEBEL AROUIT
OUED KERT
Moulouya
Floodplain
Mtlili1
Mtlili5 & 6
Taoungat7
Taoungat1
Hajra1 & 3
ZAIO
Plaine de
Guerrouaou
Taghit Haddouch
Ifri el Baroud
Ifri N'Ammar
Hassi Ouenzga
AIN ZORA
SAKA
MOULOUYA
MOROCCO
50 km

Figure 1.

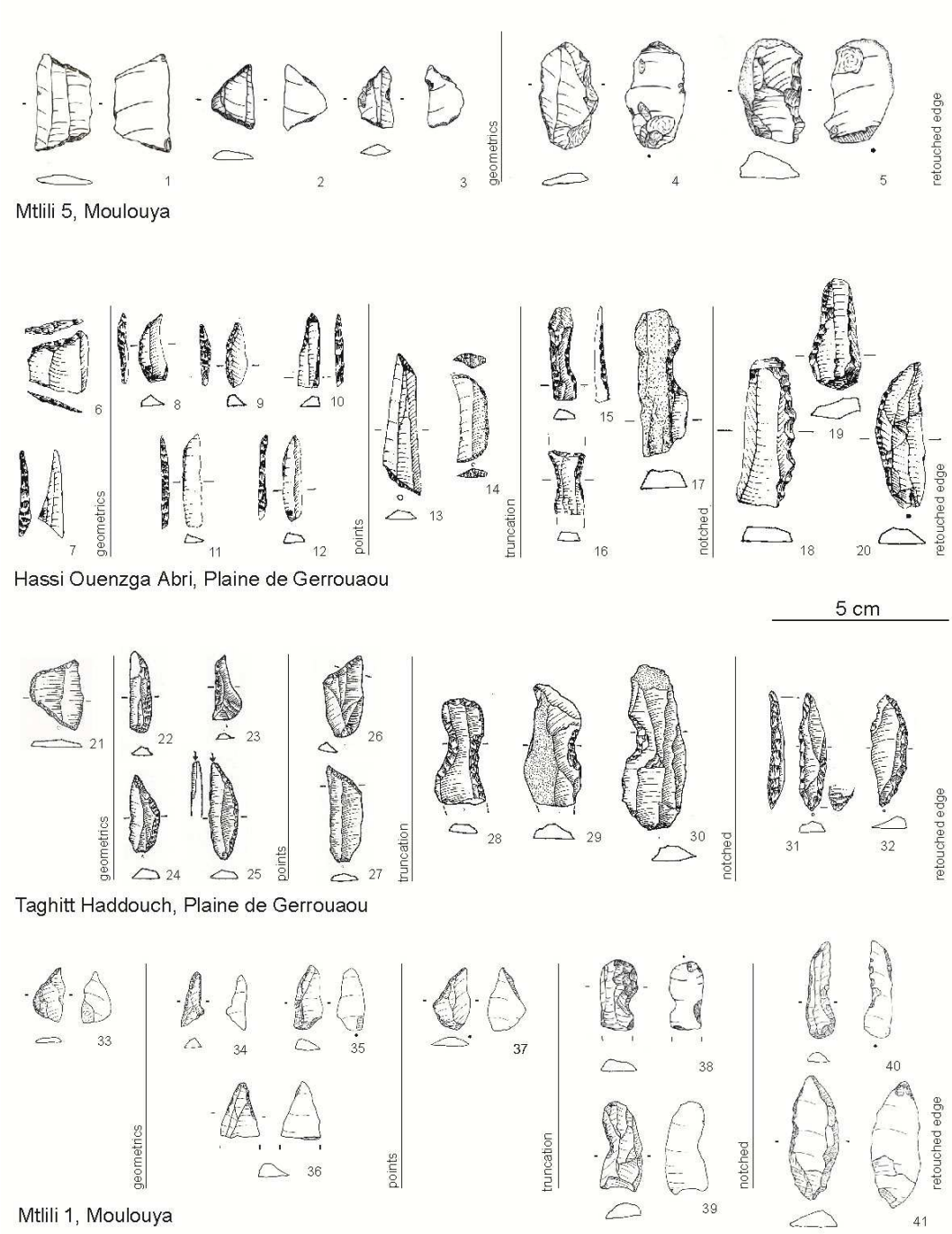
Mtlili 5, Moulouya
geometrics
retouched edge
Hassi Ouenzga Abri, Plaine de Gerrouaou
points
truncation
notched
5 cm
Taghitt Haddouch, Plaine de Gerrouaou
Mtlili 1, Moulouya

Figure 2.

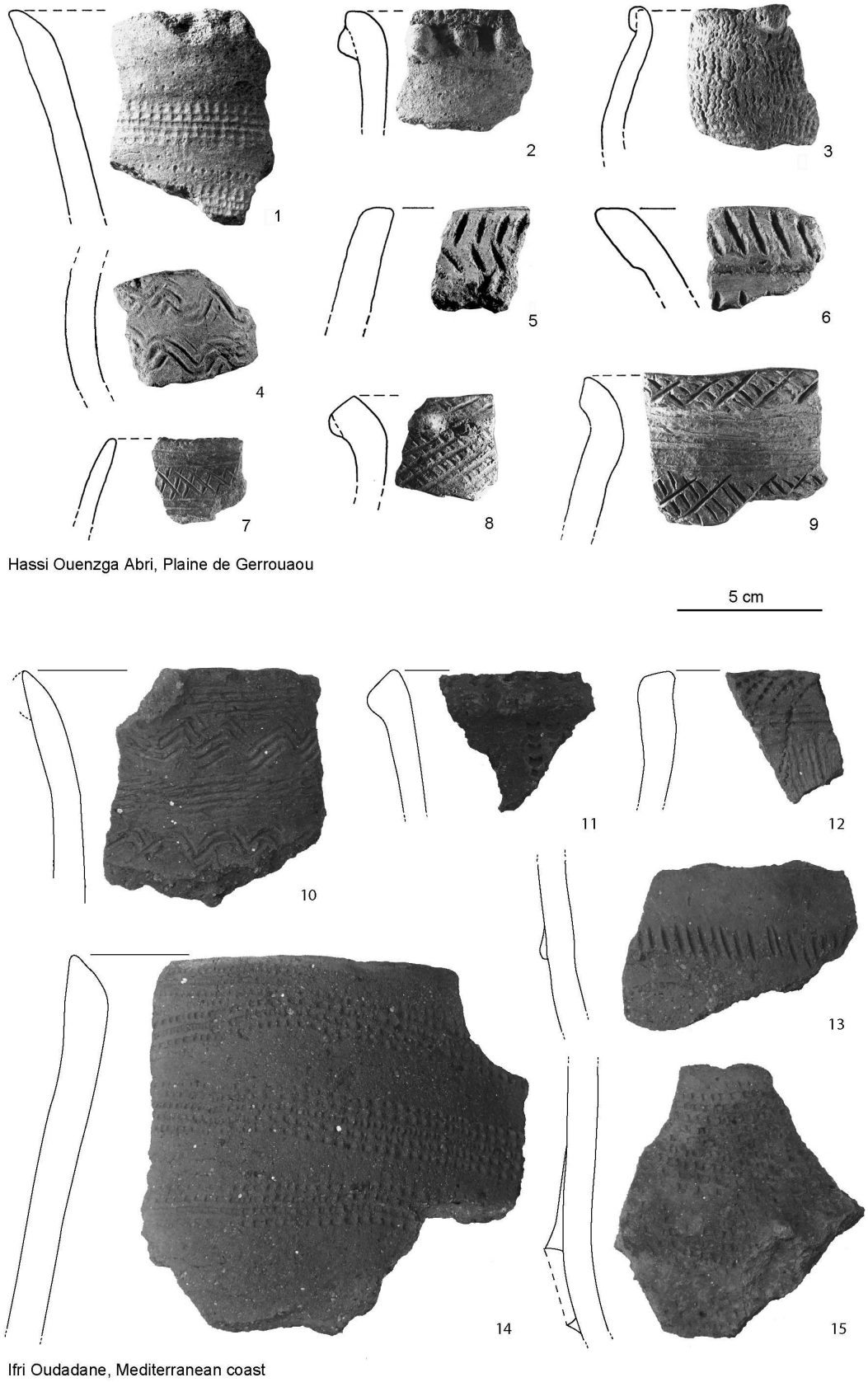
1
2
3
4
5
6
7
8
9
Hassi Ouenzga Abri, Plaine de Gerrouaou
5 cm
10
11
12
13
14
15
Ifri Oudadane, Mediterranean coast

Figure 3.

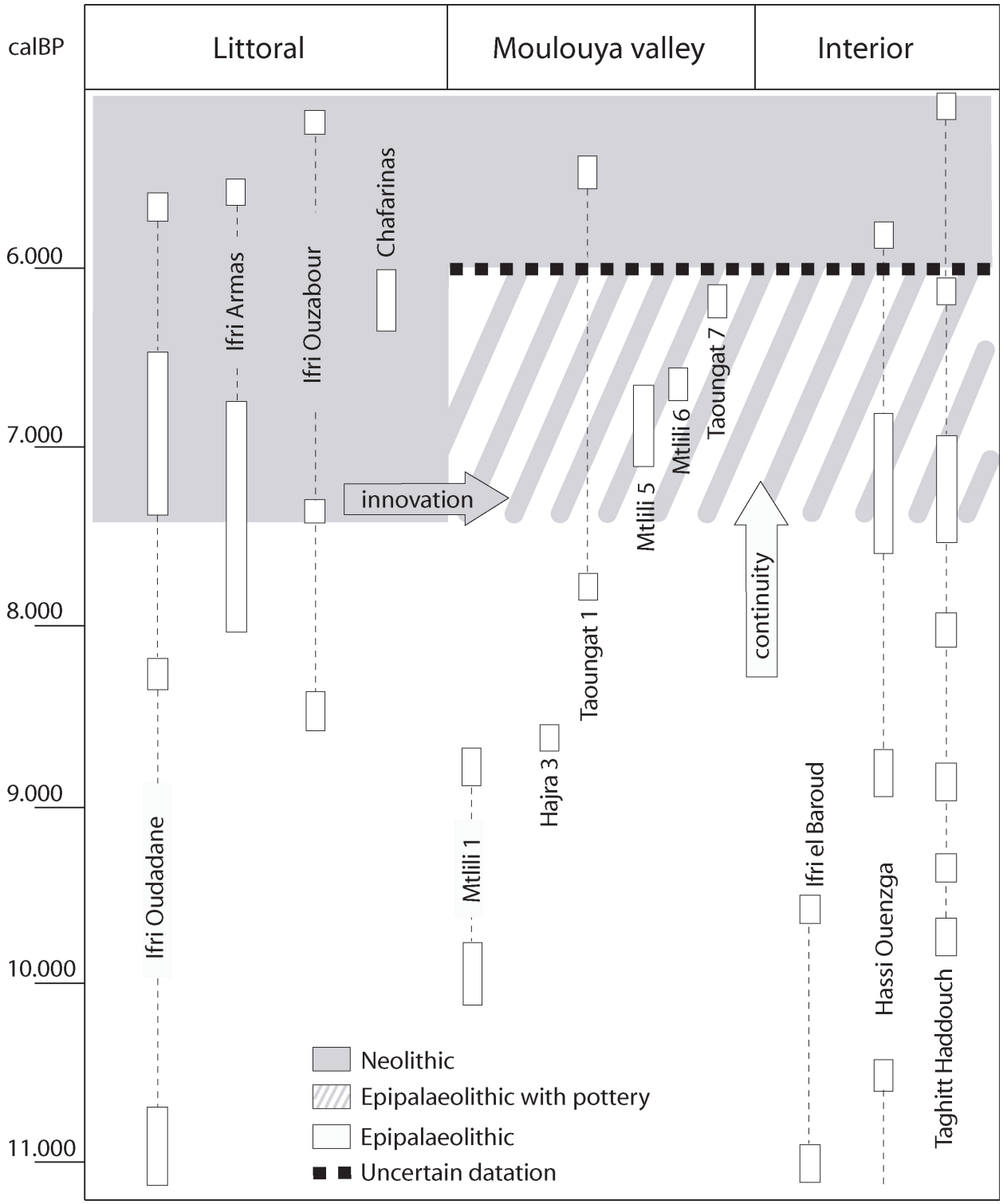
calBP
Littoral
Moulouya valley
Interior
6.000
7.000
8.000
9.000
10.000
11.000
Ifri Oudadane
Ifri Armas
Ifri Ouzabour
Chafarinas
innovation
Mtlili 1
Hajra 3
Taoungat 1
Mtlili 5
Mtlili 6
Taoungat 7
continuity
Ifri el Baroud
Hassi Ouenzga
Taghitt Haddouch
Neolithic
Epipalaeolithic with pottery
Epipalaeolithic
Uncertain datation

Figure 4.

PHASE	SITE	LAB.NR	14C-AGE	calBC	calBP	δ13C	MATERIAL	REFERENCES
Late Neolithic (5.8-4,7 calBP)	Ifri Ouzabour	Erl 9983	4571 ± 45	3266 ± 112	5216 ± 112	-22	charcoal	not published
	Taoungat 1	KIA 39287	4745 ± 65	3515 ± 98	5465 ± 98	-25,88±0,24	Juniperus	Linstädter 2011
	Ifri Armas	Erl 9994	4916 ± 47	3710 ± 45	5660 ± 45	-23,3	charcoal	Linstädter 2010
	Ifri Oudadane	KIA 39296	5000 ± 30	3813 ± 80	5763 ± 80	-25,12±0,12	charcoal	Linstädter 2010
	Hassi Ouenzga Abri	UtC 6184	5029 ± 47	3834 ± 81	5790 ± 78	-20,5	charcoal	Linstädter 2004
Early Neolithic (7.6-6.0 calBP)	Islas Chafarinas	KIA 20053	528030	4133 ± 74	6083 ± 74	0	sus sp.	Rojo Guerra et al. 2010
		KIA 36743	545027	4307 ± 31	6257 ± 31	0	sus sp.	Rojo Guerra et al. 2010
		KIA 36742	558426	4413 ± 33	6363 ± 33	0	sus sp.	Rojo Guerra et al. 2010
		KIA 17373	5600 ± 30	4420 ± 40	6372 ± 37	0	sus sp.	Rojo Guerra et al. 2010
	Ifri Oudadane	Erl 9987	5756 ± 49	4613 ± 62	6563 ± 62	-22,9	charcoal	Linstädter 2010
		Erl 9988	6175 ± 50	5131 ± 70	7081 ± 70	-23,9	charcoal	Linstädter 2010
		Erl 9989	6053 ± 50	4957 ± 70	6907 ± 70	-23,8	charcoal	Linstädter 2010
		KIA 39298	6085 ± 25	5001 ± 35	6951 ± 33	-20,99±0,12	charcoal	Linstädter 2010
		KIA 39297	6155 ± 30	5124 ± 63	7074 ± 63	-19,55±0,17	charcoal	Linstädter 2010
		KIA 39299	6400 ± 90	5377 ± 81	7327 ± 81	-24,68±0,39	charcoal	Linstädter 2010
	Ifri Ouzabour	Erl 9984	6481 ± 53	5437 ± 50	7387 ± 50	-22,7	charcoal	not published
	Ifri Armas	UBA 8082	5989 ± 33	4884 ± 44	6834 ± 44	-19,3	Bos primigenius	Linstädter 2010
		Erl 9996	6739 ± 52	5659 ± 39	7609 ± 39	-23,3	charcoal	Linstädter 2010
Epipalaeolithic with pottery (7.6-6.2 calBP)	Taoungat 7	KIA 39291	5390 ± 35	4254 ± 61	6204 ± 61	-22,44±0,19	Pistazie	Linstädter 2011
	Mtlili 6	KIA 31003	5840 ± 35	4710 ± 50	6655 ± 54	-23,01±0,40	charcoal	Linstädter 2011
	Mtlili 5	KIA 31008	5880 ± 30	4760 ± 30	6706 ± 30	-19,85±0,22	charcoal	Linstädter 2011
		KIA 31001	6020 ± 40	4920 ± 60	6870 ± 60	-25,54±0,13	charcoal	Linstädter 2011
		KIA 31002	6110 ± 35	5080 ± 90	7030 ± 90	-25,17±0,23	charcoal	Linstädter 2011
	Hassi Ouenzga Abri	Bln 4956	6035 ± 47	4930 ± 70	6882 ± 64	0	charcoal	Linstädter 2004
		UtC 6185	6230 ± 70	5180 ± 100	7134 ± 97	-22	charcoal	Linstädter 2004
		KIA 437	6240 ± 40	5200 ± 80	7154 ± 80	-23,04	charcoal	Linstädter 2004
		KIA 436	6270 ± 40	5260 ± 40	7212 ± 36	-22,36	charcoal	Linstädter 2004
		UtC 6186	6378 ± 44	5380 ± 60	7334 ± 56	-23,4	charcoal	Linstädter 2004
		UtC 6187	6540 ± 50	5510 ± 40	7463 ± 35	-21,5	charcoal	Linstädter 2004
		Bln 4957	6611 ± 40	5560 ± 40	7511 ± 42	0	charcoal	Linstädter 2004
		Bln 4913	6683 ± 48	5600 ± 40	7553 ± 36	0	charcoal	Linstädter 2004
		KIA 434	6710 ± 50	5630 ± 50	7575 ± 45	-21,12	charcoal	Linstädter 2004
Epipalaeolithic (11.5-7.6 calBP)	Taoungat 1	KIA 39288	6970 ± 40	5853 ± 53	7803 ± 53	-22,50±0,14	Juniperus	Linstädter 2011
	Ifri Armas	Erl 9995	7106 ± 53	5979 ± 49	7929 ± 49	-23,1	charcoal	Linstädter 2010
	Ifri Ouzabour	Erl 9986	7633 ± 81	6504 ± 70	8454 ± 70	-23,1	charcoal	not published
		Erl 9985	7666 ± 76	6527 ± 63	8477 ± 63	-23,2	charcoal	not published
	Hajra 3	KIA 39295	7840 ± 40	6689 ± 48	8639 ± 48	-21,61±0,11	charcoal	Linstädter 2011
	Mtlili 1	KIA 39292	7955 ± 40	6883 ± 110	8833 ± 110	-21,38±0,11	Juniperus	Linstädter 2011
		KIA 31007	8745 ± 55	7789 ± 113	9748 ± 113	-22,50±0,14	charcoal	Linstädter 2011
		KIA 39293	8800 ± 45	7895 ± 103	9845 ± 103	-21,31±0,11	Juniperus	Linstädter 2011
	Hassi Ouenzga open air	Erl 9993	9350 ± 65	8614 ± 91	10564 ± 91	-22,2	charcoal	not published
	Hassi Ouenzga Abri	KIA 433	7930 ± 50	6857 ± 133	8804 ± 125	-17,46	charcoal	Linstädter 2004
	Ifri el-Baroud	Bln 4872	8556 ± 52	7580 ± 30	9530 ± 24	0	charcoal	Nami 2007
		Bln 4755	9677 ± 60	9080 ± 150	11030 ± 141	0	charcoal	Nami 2007
		KIA 5110	8290 ± 40	7355 ± 83	9305 ± 83	-22,99	charcoal	Nami 2007
	Ifri Oudadane	Erl 12419	745156	6328 ± 61	8278 ± 61	-17	Sus scofra	Linstädter 2010
		Erl 12418	9496183	8860 ± 262	10810 ± 262	-23,9	Ammothragus	Linstädter 2010

Tab. 1: ^{14}C-data of Epipalaeolithic and Neolithic sites of the Eastern Rif and Moulouya valley. The data are calibrated using the CalPal program (B. Weninger, university of Cologne, www.calpal.de).