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Human palaeontology and prehistory

The Mendieta site (Sopelana, Biscay province, northern Spain): Palaeoenvironment and formation processes of a Lower Palaeolithic open-air archaeological deposit

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Abstract

A rescue archaeological excavation on the Mendieta area (Sopelana, Biscay province) has shown the presence of lithic industry within an original stratigraphic context of possible Lower Palaeolithic age. The materials containing the lithic industry exhibit stratigraphic and sedimentary features derived from fluvio-alluvial and pedogenic processes. The formation procedures of this open-air site took place under warm and humid palaeoenvironmental climatic conditions, as has been partially confirmed by palynological data. This geoarchaeological characterization supplies important information in order to understand the genesis and location of the scarce open-air archaeological sites of the Lower Palaeolithic age present in the Cantabrian region. ***To cite this article: J. Ríos et al., C. R. Palevol 7 (2008).***
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Résumé

Le gisement de Mendieta I (Sopelana, Biscaye, Espagne) : paléoenvironnement et processus de formation d'un gisement Paléolithique inférieur en plein air. La réalisation d'une intervention archéologique préventive sur le site de Mendieta (Sopelana, province de Biscaye) a révélé la présence d'une industrie lithique dans un contexte stratigraphique original d'âge Paléolithique

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inférieur probable. Les matériaux qui renferment cette industrie lithique montrent des traits sédimentaires et stratigraphiques en relation avec des processus pédogéniques et fluvio-alluviaux. Les modalités de formation de ce site en plein air suggèrent des conditions climatiques et paléoenvironnementales chaudes et humides, comme l'indiquent partiellement les données palynologiques. Cette caractérisation géoarchéologique apporte d'importantes informations pour comprendre la genèse de la localisation des rares sites archéologiques de plein air présents au Paléolithique dans la région cantabrique. ***Pour citer cet article : J. Ríos et al., C. R. Palevol 7 (2008).***
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Mots clés : Paléosol ; Pédogenèse ; Fluvio-alluvial (matériau) ; Sédimentologie ; Géoarchéologie ; Palynologie ; Gisement en plein air ; Paléolithique inférieur ; Biscaye ; Nord de l'Espagne

1. Introduction

In the twentieth century numerous archaeological findings were made in the coastal region stretching from Getxo to Gorliz (Biscay). In the 1950s, different sites were tested [3] certificating human presence, at least from the Middle Paleolithic; in the 1980s, the Middle Paleolithic open-air site of Kurtzia [13] was excavated, but the archaeological richness of this region was far from being well assessed.

Survey and rescue archaeological works carried out in the Mendieta area (Sopelana, Biscay) (Fig. 1) led to the discovery of abundant lithic tools scattered in an 8.5 Ha area that locally formed significant accumulations. Nearby, one hundred archaeological excavation tests were made to evaluate the archaeological content of the studied area. One of the most fruitful and significant examples was the 2 m^2 wide 17A excavation test; its archaeological and geoarchaeological detailed study and the complementary stratigraphic study of other excavation tests have permitted the establishment of the stratigraphy and geomorphologic processes acting in the area. This work has led to an important improvement in the knowledge of the depositional palaeoenvironment and processes affecting open-air sites during the Lower to Middle Paleolithic in the studied area, almost unknown until now [13].

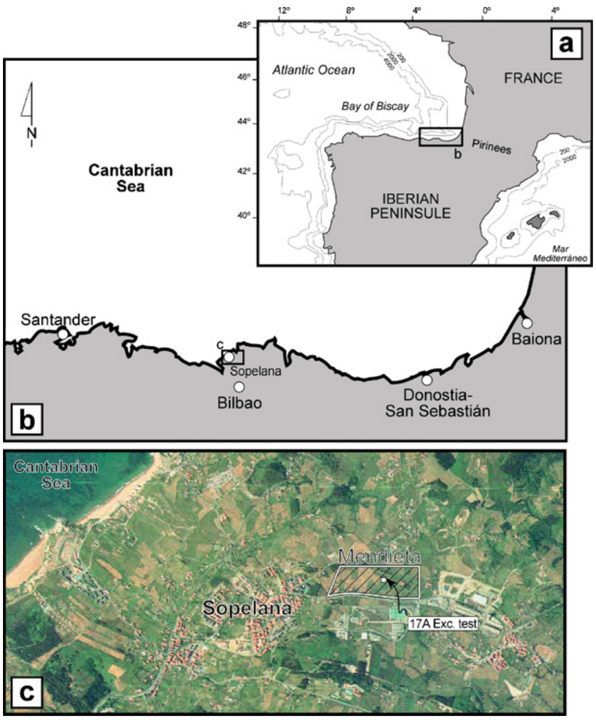


Fig. 1. Geographical location of the Mendieta site.
Localisation du site de Mendieta.

2. Stratigraphy and sedimentology

Different excavation test profiles show distinct stratigraphic units covering the Cretaceous bedrock (Figs. 2 and 3). The thickness of these units varies from the order of some meters to zero thickness in areas where the Cretaceous marls and limestone outcrop. As mentioned above, the 17A excavation test (2 m × 2 m × 1.5 m) is representative of the most significant stratigraphic, sedimentologic and archaeological features observed in the area prospected. All the area is covered by soil, composed of three soil horizons, from top to bottom:

2.1. 0 Horizon

This is the most superficial unit and it is covered by grass. It is a brown, silty unit which includes abundant vegetal remains (humus and roots) and modern anthropic remains, such as ceramic tile and brick pieces, metallic objects, glass pieces, marine shells, quartzite gravel and flint lithic tools (Fig. 2). The thickness of this unit is variable, from 15 cm to 100 cm. This horizon is archae-

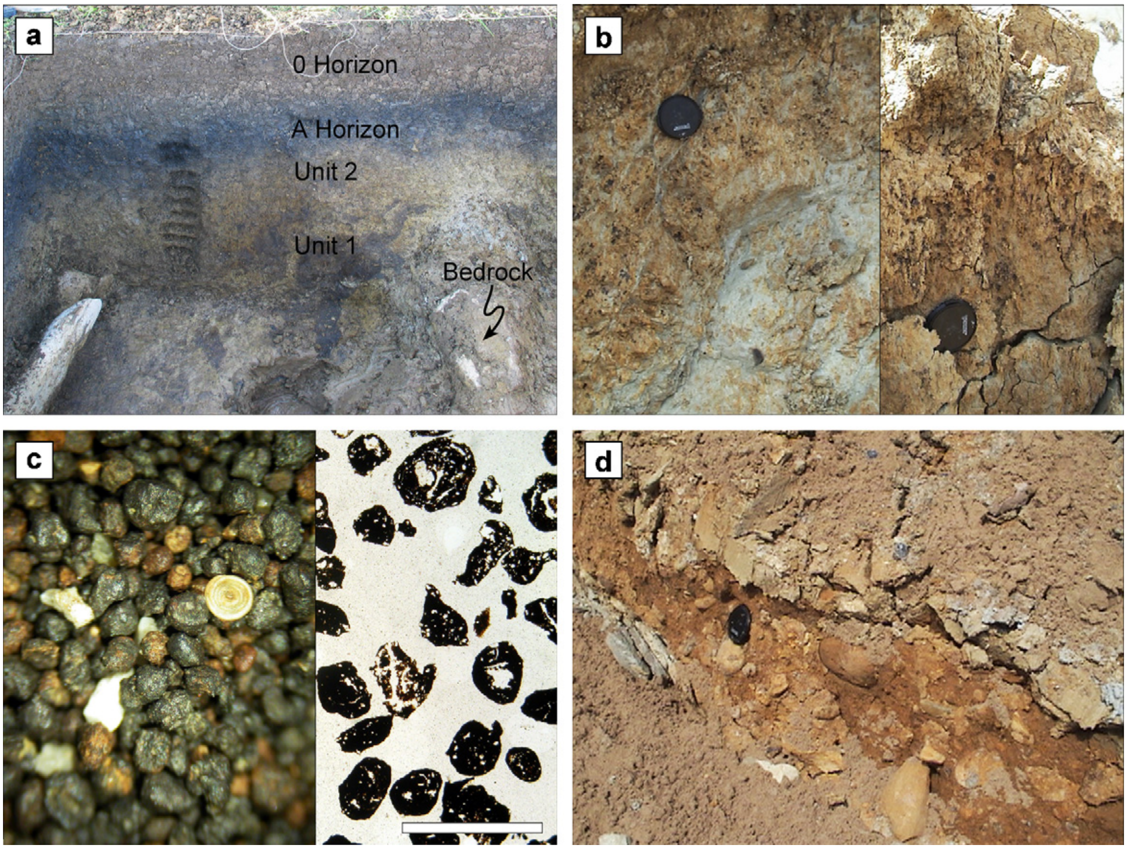


Fig. 2. Different materials from the Mendieta site: a: general view of the 17A trench; b: mottled lutites and ferrous concretions from the Horizon B (scale: 5 cm); c: ferrous nodule sand and reworked benthic foraminifera from the Level 1 under binocular and transmitted light microscopes (scale: 2 mm); d: paraconglomerate bed.

Différents matériaux du site de Mendieta : a : vue générale de la fosse17A ; b : lutites tachetées et concrétions ferreuses de l'horizon B (échelle : 5 cm) ; c : sable à nodules ferreux et foraminifères benthiques remaniés du niveau 1, observés à la loupe binoculaire et au microscope à lumière transmise (échelle : 2 mm) ; d : lit paraconglomératique.

ologically fertile, but materials are considered to be in a derivate position, affected by agricultural reworking.

2.2. A Horizon

This horizon has a sharp contact with the 0 Horizon. Its mean thickness is 35 cm and passes downwards gradually to the underlying B Horizon. It is a blackish sandy silt unit due to its high vegetal organic material content. Granulometrically, it is composed of 96.5% fine sediments (silt and clays) and 3.5% sand-size grains, mainly of ferrous composition (Fig. 2). This horizon is archaeologically fertile.

2.3. B Horizon

It is composed of mottled grey clays that can reach a maximum measured thickness of 165 cm. However, its thickness normally is 25–60 cm. This unit lies directly on the marly substrate and the contact is a sharp irregular surface; sometimes there is a thin yellowish alteration layer in the contact corresponding to the C Horizon. The clays from the B Horizon have abundant yellow and/or orange mottles and enclose abundant brownish iron hydroxide rounded concretions and anastomosed crusts (Fig. 2). It has abundant root bioturbation and exhibits prismatic texture near the A Horizon. This horizon has no archaeological evidence.

Furthermore, in the 17A excavation test, additional stratigraphic units have been detected due to the presence of an erosional gully approximately 1 m wide and 1 m deep. The channeliform erosive surface is filled with two sedimentary units that include lithic tools (Fig. 2). These stratigraphic units are, from bottom to top (Fig. 3):

2.3.1. Unit 1

It corresponds to ferruginous sands that onlap the erosive surface and the marly substratum (Fig. 3). The

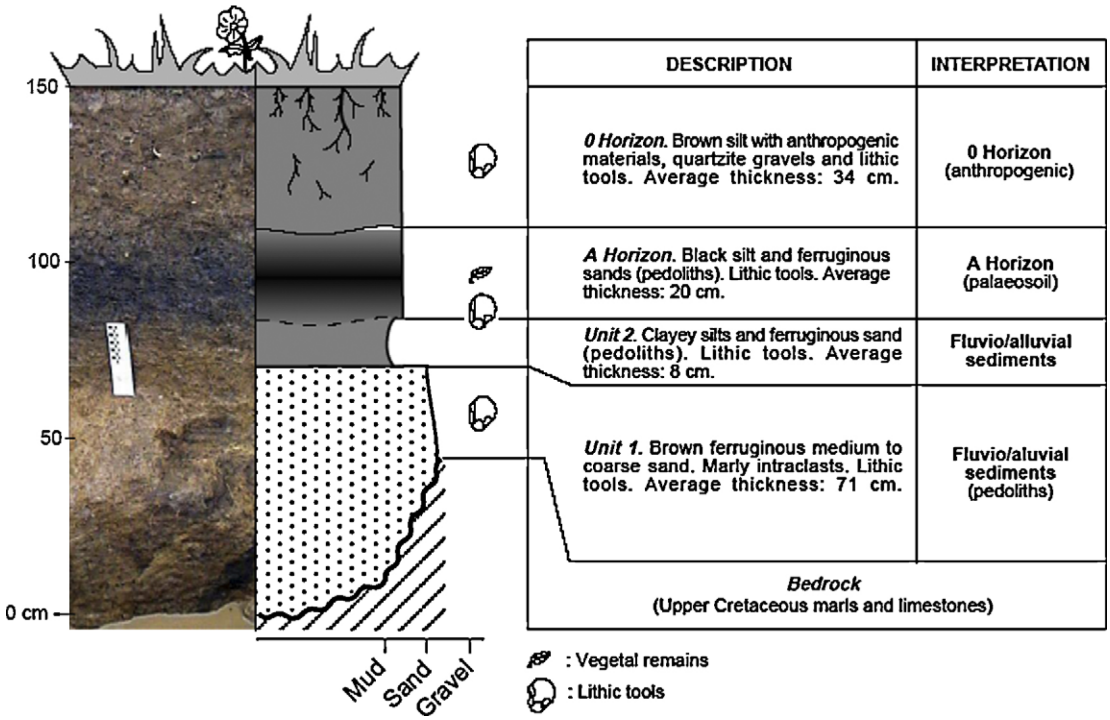


Fig. 3. Stratigraphy of the 17A excavation test of Mendieta I.
Stratigraphie de la fosse test Mendieta I.

maximum measured thickness is 71 cm and the lateral extent is limited to a narrow channel fill. The sediment is mainly (59%) composed of ferruginous homometric medium-coarse sand; quartz grains and resedimented Cretaceous microfossils, benthic foraminifera, are minor components (Fig. 2). X-ray diffraction analysis indicates that the ferruginous grains are composed of fine quartz grains embedded in a layered pseudolithic to pisolithic iron hydroxide matrix corresponding to lepidocrocite (γ-FeO(OH)) (Fig. 2). This unit has numerous flint lithic tools.

2.3.2. *Unit 2*

It corresponds to grey clayey silt with the same lateral extent as Unit 1. Its thickness is 8 cm and onlaps the Cretaceous marl substratum (Figs. 2 and 3). The contact with Unit 1 is gradual and is composed of 13% of ferruginous and quartz sand grains and 87% of fine sediments (clay and silt). Although the sand grains have the same mineralogical composition as in Unit 1, in Unit 2 the fine to very fine quartz grains are dominant. This unit passes gradually upwards to A Horizons' blackish materials (Figs. 2 and 3). This unit is archaeologically fertile.

2.4. *Other stratigraphical evidence*

Excavations and construction works carried out in the southeastern part of the prospected area permitted the recognition of a fluvial terrace level composed of a centimetric to decimetric gravel layer up to 15 cm thick (Fig. 2). Topographically, the terrace level is 1.5 m below the 17A excavation text surface level. The gravel unit lies discordant eroding the Cretaceous bedrock and gravels exhibit westwards oriented sedimentary imbrication (Fig. 2). The gravels are mainly quartzite and sandstone and are identical to many archaeological tools recovered during excavations.

3. Palaeoenvironmental and pedogenic inferences

The prospected area is covered by a soil that is composed of three horizons, horizons 0, A and B, with variable thickness. The soil is formed due to the pedogenic alteration of the Upper Cretaceous marl and limestone substratum, and thus is classified as an alterite or cambisol. In some uphill areas, some or all edafic horizons are absent due to erosion and only a

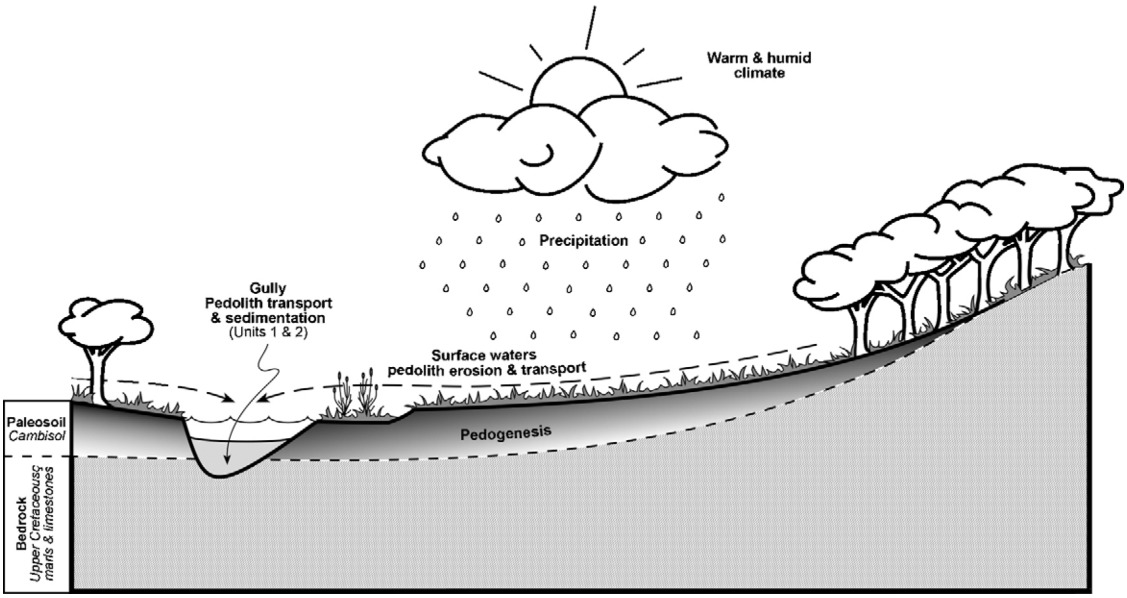


Fig. 4. Schematic model of the formation process in the Mendieta site.
Modèle schématique du processus de formation du site de Mendieta.

pedorelict sequence composed of one or two horizons is visible.

The *0 Horizon* is clearly of anthropic origin. It corresponds to a modern agricultural soil with evidence of leveling, material addition and ploughing. The recovered archaeological lithic tools from this horizon are mainly ascribed to Upper and post-Paleolithic assemblages, but some of them could be ascribed to Middle-Lower Paleolithic assemblages [16,17]. Nowadays, this archaeological evidence is in secondary position, derived from the underlying horizons and sedimentary units that have been assimilated into the superficial 0 Horizon due to agricultural working (Fig. 6).

The *A Horizon* passes gradually into underlying B Horizon. Its black coloration is due to the high organic matter content derived from the vegetal remains of plants that colonized its surface. The vegetated surface of the A Horizon was episodically affected by surface drainage water flows that transported and deposited sandy sediment on the surface and waterlogged the terrain, permitting the settlement of finer sediments and the preservation of the organic matter.

The *B Horizon* is composed of mottled grey clays with ferruginous crusts and concretions. All its pedogenic features are typical of poorly drained gley or hydromorphic gley soils [5]. Mottling and ferruginous concretions are formed due to ion lixiviation and iron hydroxide/oxide dissolution/precipitation processes in soils from humid and warm environments [9,20,21]. The contact with the bedrock is gradual and irregular, the marly layers are more deeply altered than the limestone layers.

Besides the 0, A and B soil horizons, in the 17A excavation test two more sedimentary units (Units 1 and 2) were detected, filling an erosive superficial drainage channel or gully. This gully was eroded and filled up along a north–south oriented tributary thalweg of a nearby east–west flowing river channel, parallel to the modern Gobelas river. Although it is undated, the possible remains of this fluvial course is the residual gravely terrace present nearby the site (Fig. 2). This terrace is topographically 1.5 m lower than the 17A excavation test and 17 m above the present Gobelas river course.

The gully channeled the superficial drainage water that firstly eroded the soil horizons and the marly substratum and, finally, was filled up with sediments derived from the erosion of the surrounding soil horizons, pedoliths, and the underlying Cretaceous marls and limestones (Figs. 3 and 4). Thus, the sediments or pedoliths from Units 1 and 2 are mainly ferruginous grains derived from the erosion of the ferruginous crust and concretions embedded in nearby B Horizon. The depth of the gully was at least 50 cm and moderate energy events transporting ferruginous sands and more quiet flooding stages permitting the sedimentation of fine sediments alternated when it was active (Fig. 5). The scour and fill processes of gullies are typical in slopes that have an impermeable substratum from humid climate areas [6,15,22,23]. The absence of forests and/or high precipi-

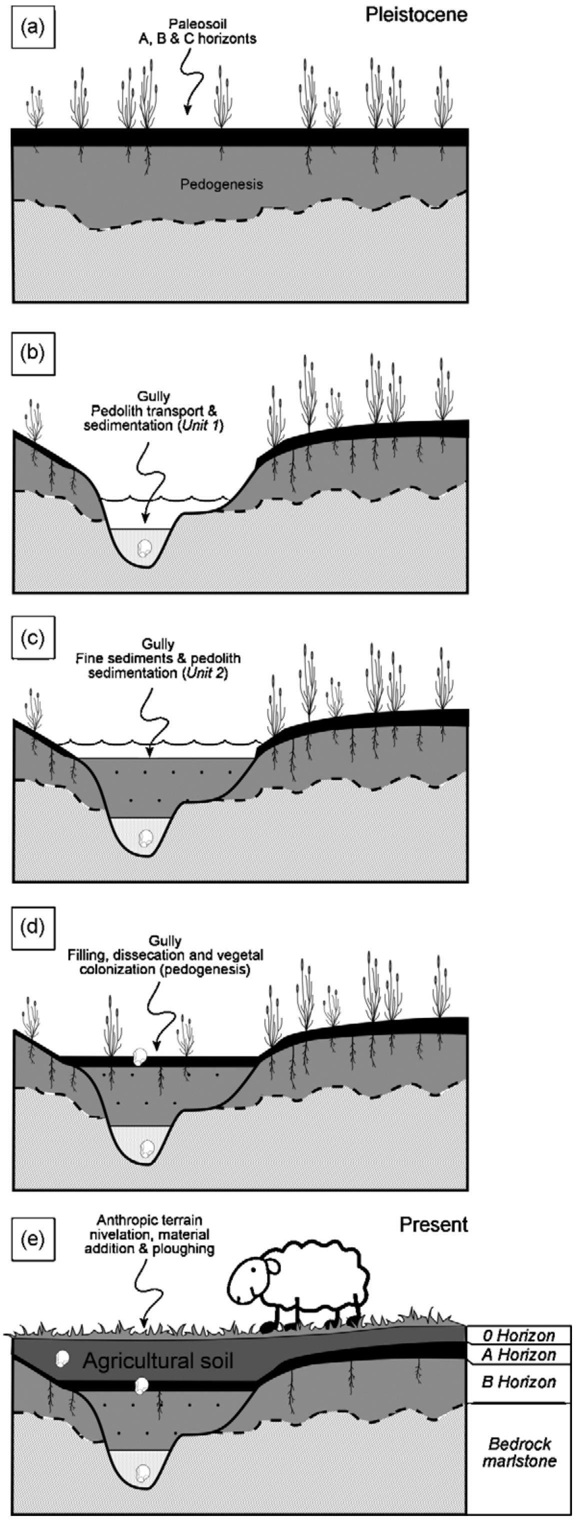


Fig. 5. Palaeoenvironmental conditions and sedimentary processes involved in the Mendieta I site formation.

Conditions paléoenvironnementales et processus sédimentaires impliqués dans la formation du site de Mendieta.

tation rates are the main controls in gully formation. The time involved in the scour and fill of a gully could be quite fast, only a few hundreds of years [23].

The presence of lithic tools in Units 1 and 2 is dispersed at different stratigraphic heights and not concentrated in bottom lags, the allochthonous nature of these lithic tools (flint, quartzite and sandstone) and the relatively large (centimetrical to decimetrical) dimensions are in strong contrast to the sandy and clayey texture and to the ferruginous and carbonate mineralogy of the sediments filling the gully. Moreover, although ferruginous sands from Unit 1 point to the existence of low to moderate energy flows through the gully, the absence of coarser sediments suggests that the flows were not strong enough to transport coarser particles, such as decimetric lithic tools. These sedimentologic assumptions and other archaeological features such as the absence of transport-related erosion marks and the presence of refits allow us to infer that lithic tools were deposited intermittently in or nearby an active gully, probably by humans.

Finally, the gully was filled up and the sedimentary materials vegetated, promoting the onset of pedogenic processes that led to the formation of an A Horizon covering the inactive gully (Fig. 5).

4. Palynological remains

The conservation of pollen and spores in 17 tests is very poor, probably due to continuous washing and water saturation of the sediment. The only palynological remains came from A Horizon overlaying the gully. The results are so poor that only a qualitative approach has been possible. The sample taken at the base of A Horizon (sample No. 8) only conserved four pollens, seven fern spores, and five *Pseudoschizaea*. The quantity in the uppermost part of A Horizon (sample No. 9) is significantly more abundant (702 palynomorphs). The major part are *Pseudoschizaea* (576), the arboreal pollens correspond to coniferous (*Pinus sylvestris* tp. and *Picea*) and alder (*Alnus*). Herbaceaous-shrub taxa are dominated by *Poaceae* and *Juncaceae*. Highly deteriorated pollens reach similar values. Fern spores are constituted by *Filicales monolete* tp., *Filicales trilete* tp., *Polypodiaceae* and *Pteridium*.

4.1. Discussion

The palaeobotanic information from the Cantabrian coastal area is very scarce due to the geomorphological transformations of the coast during Eemian. The major part of the information comes from open-air human settlements. This is the case of Irikaitz (Zestoa, Gipuzkoa)

Table 1
Lithic assemblage composition of nonaltered levels of Mendieta I
Composition de l'assemblage lithique des niveaux non altérés de Mendieta I

	Unit 1	%	Unit 2	%	A Horizon	%
Tested nodules	1	5.56	0	0.00	3	25.00
Nuclei	2	11.11	1	8.33	0	0.00
Flakes	9	50.00	6	50.00	6	50.00
Formal tools	4	22.22	5	41.67	3	25.00
Macrotools	1	5.56	0	0.00	0	0.00
Modified pebbles	1	5.56	0	0.00	0	0.00
Total	18		12		12	

with Lower Paleolithic occupations at interglacial period with a clear dominance of deciduous arboreal taxa like *Carpinus, Quercus, Frangula, Corylus, Alnus, Fagus, Fraxinus*, etc. [1].

The sea level descent after the Eemian [4] propitiated the development of coastal humid zones with very interesting information of initial Würm [8]. At the Pre-Würm (OIS 5d-5a) there is a hegemony of deciduous trees: *Betula*, *Quercus robur* tp., *Fagus* or *Carpinus*, and in a lesser extent *Corylus*, *Acer*, *Alnus* and *Pinus*, and discontinuous presence of other taxa as *Picea, Arbutus, Castanea, Juglans*, etc. The landscape inferred from this data shows a clear hegemony of deciduous arboreal cover with a minimum representation of gymnosperms, a landscape clearly different from those of Mediterranean and Continental Europe [14].

In Mendieta I it is not possible to determine the vegetal evolution corresponding to different sedimentary levels, but some insight about the environment can be proposed. The dominance of herbaceous vegetation is linked to flooded and humid substrata (*Juncaceae* and *Alisma*), and the presence of alder shows the absence of important low-water periods. The high humidity is also reflected in the great amount of *Pseudoschizaea*, preliminarily associated with mild and humid conditions, with some seasonal variations [18]. It is very significant the absence of deciduous taxa (with the exception of alder) present in other interglacial, Early Würmian records. These deciduous taxa are also present in a turf level situated in the coast two kilometers (Kurtzia) away from Mendieta, which has been dated in 41,400 ± 2500 BP. The dominance of *Alnus*, followed by *Pinus, Betula* and *Abies* and other thermophile species, and the presence, among the herbaceous-shrub stratum, of *Ericaceae* and *Poaceae* indicate a mild and humid climate [13].

5. Anthropic evidence at Mendieta I

In the nonaltered levels of Mendieta I, 42 in situ, anthropic lithic remains have been recovered in a surface of 1.73 m^2. The composition of different levels is shown in Table 1. The conservation degree of these pieces is similar to those of Lower-Middle Palaeolithic remains found in the surroundings.

5.1. Lithic raw material

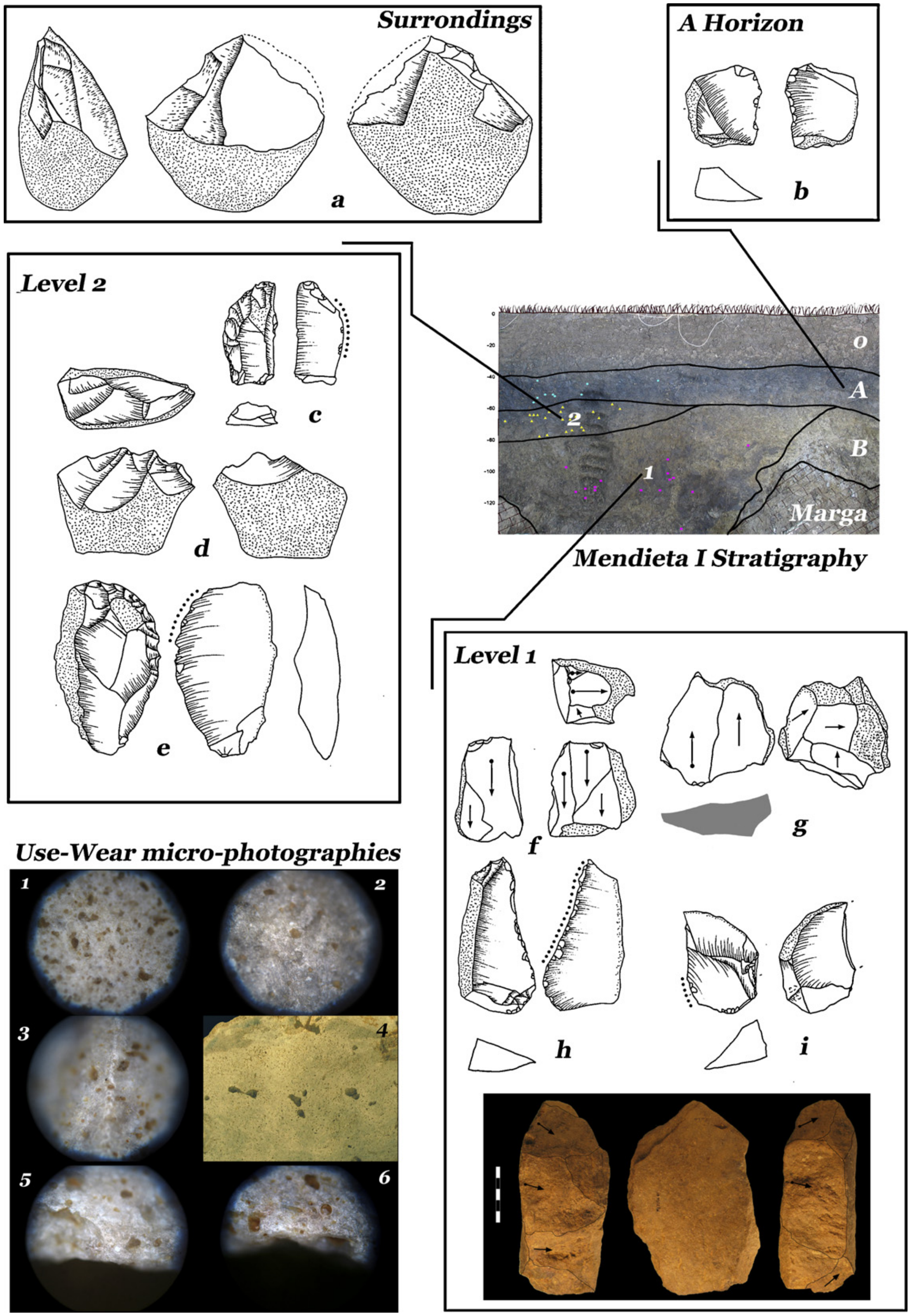
Almost the totality of lithic remains are made of flint (77.7% in Unit 1, 100% in Unit 2 and in the A Horizon), picked up from Upper Cretaceous Flysch outcrops located 2 km from the site. Other local raw materials like sandstone or quartzite are also utilized.

5.2. Technological features

Two different tool-making systems are utilized at Mendieta I. On the one hand, pebble and little nodule shaping to obtain chopping-tools as observed in Unit 2 (Fig. 6d) and in some tools recovered close to Mendieta I (Fig. 6a). The macrotool of Unit 1 also shows a rough shaping of the contour to perform a pick-like tool (Fig. 6j). On the other hand, flake production is the more important. The two nuclei recovered from Unit 1 (Fig. 6f, g) show little preparation, with scarce corrections of convexity or platform. The flaking is unifacial and unipolar, obtaining quadrangular with asymmetrical cross-section flakes (cortical-backed knives) with plain, cortical and asymmetric dihedral talons. Unit 2 nucleus shows platform preparation and changes of flaking surface; nevertheless, the products are also cortically backed, asymmetrical flakes. A Horizon has delivered three tested nodules and some cortical-backed, asymmetrical flakes similar to those of precedent levels.

5.3. Tool management

Tools seldom are modified by retouch; the more abundant tool is cortical-backed knife sometimes with light


Surrondings
a
A Horizon
b
Level 2
c
d
e
O
A
2
B
1
Marga
Mendieta I Stratigraphy
Level 1
f
g
h
i
Use-Wear micro-photographies
1
2
3
4
5
6

modifications in distal part to facilitate handling, while edges are utilized without modification (Fig. 6a, h).

At Unit 1 no flake is retouched, only a retouch flake coming from a broad Quina sidescraper has been identified. Nevertheless, two of the backed knives from this level show use-wear traces of cutting some resistant material (butchery, wood) with the acute edge opposed to the cortical back (Fig. 6, photo 5). The sandstone macrotool has also use-wear traces of percussion of a resistant material.

At Unit 2, two sidescrapers made in outpassing flakes have been modified by step retouch to conform a convex edge opposed to a cortical back (Fig. 6c, e). These sidescrapers show use-wear traces of scraping a medium material (Fig. 6, photo 6). This level also has delivered a chopping-tool with no use-wear traces (Fig. 6d) and two partially retouched flakes.

Finally at A Horizon only three cortically backed knives (Fig. 6b) have been recovered.

These partial results are not enough to characterize the function of the site but show us the range of activities carried out at Mendieta I. At Unit 1, extractive working (cutting resistant material) and transformation activities (medium material scraping) in Unit 2 have been identified. There is also an indication of some degree of functional selection of morphologies of blank and edges, sometimes intentionally modified by retouch. Similar phenomena have been observed in other Lower Palaeolithic sites [7,10].

5.4. Discussion

Lithic industry management strategies carried out by Mendieta I visitants (raw material, fabrication, use) reveal a great simplicity. The raw material has been picked out from local high quality outcrops, showing a clear preference for flint. This tendency has been observed in other Lower Palaeolithic open-air sites next to flint outcrops (Le Basté, Lestaulan) [20] while other raw materials are majority in sites with no local flint (Cabo busto, La Verde, Irikaitz etc.) [2,11]. Flaking is also expedient with almost no management of nuclei. Searched supports are quadrangular flakes with asymmetrical section exhibiting an acute edge opposed to a cortical back. These supports are used without major modification to cut resistant materials, while retouch is used to adequate edges to softer material scraping. Some pebble and nodule based tools are also present, perhaps to do the heaviest tasks.

This simplicity of raw material gathering, flake production, tool making and use shows us that expedient strategies are chosen to supply group needs. The low density of findings along with this simplicity characterizes an ephemeral occupation without specialized function that is characteristic of Cantabric Lower Palaeolithic sites [11].

6. Paleoclimatology and chronology

In general, the study of the Pleistocene in the Cantabrian region has still many difficulties related to the secondary position and the absence of unequivocal stratigraphic contexts for the majority of the archaeological remains. This situation means that they are very few the sites with an adequate context that permit the study of reliable paleoenvironmental proxies such as sediments, pollen or faunal associations [1,11,19]. Because of this, the geoarchaeological knowledge of the Lower to Middle Pleistocene deposits is very limited and even nowadays the paleoenvironmental origin (glacial, fluvial, marine, etc.) of many archaeological sites and depositional sequences is still unknown.

The establishment of a chronology for the Pleistocene edaphic sequences and structures is still limitedly developed in the Cantabrian region. Some previous works concerning the study of soils formed in calcareous areas [12,13] indicate that they were formed in warm (even hot) and humid climatic phases that must be ascribed to long-term interglacial periods [11].

In this context, the studied paleosoil in Mendieta area is formed due to the alteration of a carbonate substratum (alternating marls and limestones) and shows pedogenic features as ferruginous crusts and mottling that suggest a temperate and humid climate. The sedimentary materials and processes in Mendieta site indicate, moreover, moderate precipitations contemporary of the paleosoil formation. For all that, the sedimentologic and pedogenic characteristics observed in Mendieta area are considered indicative of humid and temperate to hot conditions

Fig. 6. Antrophic materials from Mendieta I: a: chopper found in Mendieta I's surroundings; b: cortically backed knife from A Horizon; c–e: lithics from Unit 2; f–j: lithics from Unit 1; 1–4: microphotography of flint's altered surfaces; 5: resistant material cutting 100 ×; 6: soft material scraping 100 ×.

Matériaux anthropiques de Mendieta : a : chopper trouvé aux abords de Mendieta I ; b : couteau vue sur la tranche en provenance de l'horizon A ; c–e : éléments lithiques de l'Unité 2 ; f–j : éléments lithiques de l'Unité 1 ; 1–4 : microphotographies de surfaces altérées de flint ; 5 : matériau résistant pour couper × 100 ; 6 : matériau tendre pour couper × 100.

during the formation of the studied materials. The results of pollinic analysis from the A Horizon coincide with the interpretation of high humidity at this period.

On the other hand, the lithic industry recovered in the site can be ascribed to a Lower Palaeolithic assemblage, but most accurate chronological ascription is not possible by the moment due to the scarcity of lithic remains and the lack of absolute dates. Nevertheless, the combination of Lower Palaeolithic lithic industry with humid and temperate to hot climate conditions points to an interglaciar phase as the most probable period for the formation of the materials observed in Mendieta area. Although this assumption has obvious, previously stated, limitations, it is noteworthy that it agrees and completes the information obtained from other Lower to Middle Pleistocene open-air sites in the Cantabrian region [13].

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