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Examples of quartzite handaxes found in the terrace T3 (+21-29 m) at Gándara site (A Guarda, Pontevedra). Photo: Eduardo Méndez-Quintas.

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Early human occupations in Northwest Iberia: The archaeological record of the Lower Miño basin during the second half of the Middle Pleistocene

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ABSTRACT
The Miño River is one of the main Atlantic basins of Iberia and preserves extensive Pleistocene deposits. However, there is presently limited information concerning the first human occupation history of this region. Existing research undertaken across the region has identified a significant number of

KEY WORDS
Lower palaeolithic,
acheulean,
Iberian Peninsula,
Middle pleistocene,
Miño River,
fluvial terraces.

Large Flake Acheulean (LFA) sites with African affinities. These sites are associated with former fluvial environments and are now preserved as a sequence of fluvial terraces along the Miño River, located between relative elevations of + 40 m and + 20 m, and dated to between Marine Isotope Stages (MIS) 9 and 6. The chronological range and observed technological patterns are similar to those recognised in other areas of South western Europe, particularly the central Iberian Peninsula and Aquitanian region (France) during the second half of the Middle Pleistocene.

MOTS CLÉS
Paléolithique inférieur,
acheuléen,
péninsule Ibérique,
Pléistocène moyen,
rivière Miño,
terrasses fluviatiles.

RÉSUMÉ
Les peuplements humains anciens du Nord-Ouest de la péninsule Ibérique : l'enregistrement archéologique de la partie inferieure du bassin du Miño au cours de la seconde moitié du Pléistocène moyen.
Le bassin de la rivière Miño est l'un des principaux bassins atlantiques de la péninsule Ibérique et préserve une grande extension de dépôts pléistocènes. Cependant, les informations existantes concernant les premières occupations humaines dans cette région demeurent limitées. Les recherches entreprises dans la région ont permis d'identifier un nombre significatif de sites avec des assemblages lithiques présentant des grands éclats acheuléens (LFA) d'affinités africaines. Ces sites sont associés à des environnements fluviatiles antérieurs et sont à present préservés au sein d'une séquence de terrasses fluviatiles le long de la rivière Miño, localisées à des altitudes relatives se situant entre +40 et +20 m et datées entre les stades isotopiques marins (MIS) 9 et 6. Ces chronologies ainsi que les caractéristiques technologiques des assemblages lithiques observées sont similaires à celles reconnues dans d'autres régions du Sud de l'Europe occidentale, en particulier le centre de la péninsule Ibérique et la région Aquitaine (France), pendant la seconde moitié du Pléistocène moyen.

INTRODUCTION

Traditionally, the Northwest of the Iberian Peninsula has been a region of limited research regarding early human occupation dynamics. This is especially apparent when compared with other areas of the Peninsula or South western Europe (Senín Fernández 1995). In recent years, this situation has changed, with the discovery of numerous Lower Palaeolithic sites in stratigraphic position, the establishment of reliable dating frameworks, and more detailed examination of typical tool assemblages (Cunha Ribeiro *et al.* 2017; Vaquero *et al.* 2017; Méndez-Quintas *et al.* 2018a; Méndez-Quintas *et al.* 2019). In this context, the largest volume of new archaeological data comes from the main regional river basin (Miño River), which preserves numerous Large Flake Acheulean (LFA) (Sharon 2006) assemblages.

Although archaeological research in the Miño basin has gathered significant momentum over recent years, the existence of Lower Palaeolithic lithic industries has been known within this region since the early 20th century. In the first half of the 20th century, researchers identified numerous surficial lithic remains along different parts of the lower Miño River basin. Many of these surface finds comprised handaxes or flake cleavers, bearing close resemblance to Acheulean type technologies (Viana 1930; Álvarez Blázquez & Bouza Brey 1949; Bouza Brey & Álvarez Blázquez 1954). Nevertheless, the first Acheulean site in stratigraphic context was not discovered until 1961 at the locality of Gándaras de Budiño (Pontevedra, Spain) (Aguirre 1964; Nonn 1966). This site was excavated by E. Aguirre with the collaboration of prominent researchers such as K. Butzer, who at the time was actively involved in researching the sites of Ambrona and Torralba (Soria, Spain) under the direction of F. C. Howell. Publication of the research carried out at Budiño (Butzer 1967; Aguirre & Butzer 1967) had a notable impact on the scientific community at the time, although some of these findings (especially the age of the site) hindered subsequent development of research programs within the region; not least because they established the regional Palaeolithic record as geographically atypical and anachronistic, and therefore difficult to reconcile with other regional records from southwestern Europe. In the following decades archaeological research therefore remained sporadic, with notable developments in the surrounding areas of Ourense (Vázquez Varela 1973; Rodriguez Gracia 1976) and those developed by J. Vidal Encinas (Vidal Encinas 1981, 1982a, b, 1983).

Only in recent years has the archaeological potential of the region been re-established throuhg several ongoing projects into the different stages of the Palaeolithic record (Fábregas Valcarce *et al.* 2010; Méndez-Quintas *et al.* 2013; Rey-Rodríguez *et al.* 2016; Cunha Ribeiro *et al.* 2017). This review paper details the findings of these latest studies and outlines the current state of knowledge regarding the first human occupation of the Lower Miño basin during the late Middle Pleistocene.

ABBREVIATIONS

ESR	electron spin resonance;
LCT	large cutting tools;
LFA	large flake acheulean;
MIS	marine isotope stage;
OSL	optically stimulated luminescence;
pIR-IRSL	post-infrared infrared stimulated luminescence;
TT-OSL	thermally transferred optically stimulated luminescence.

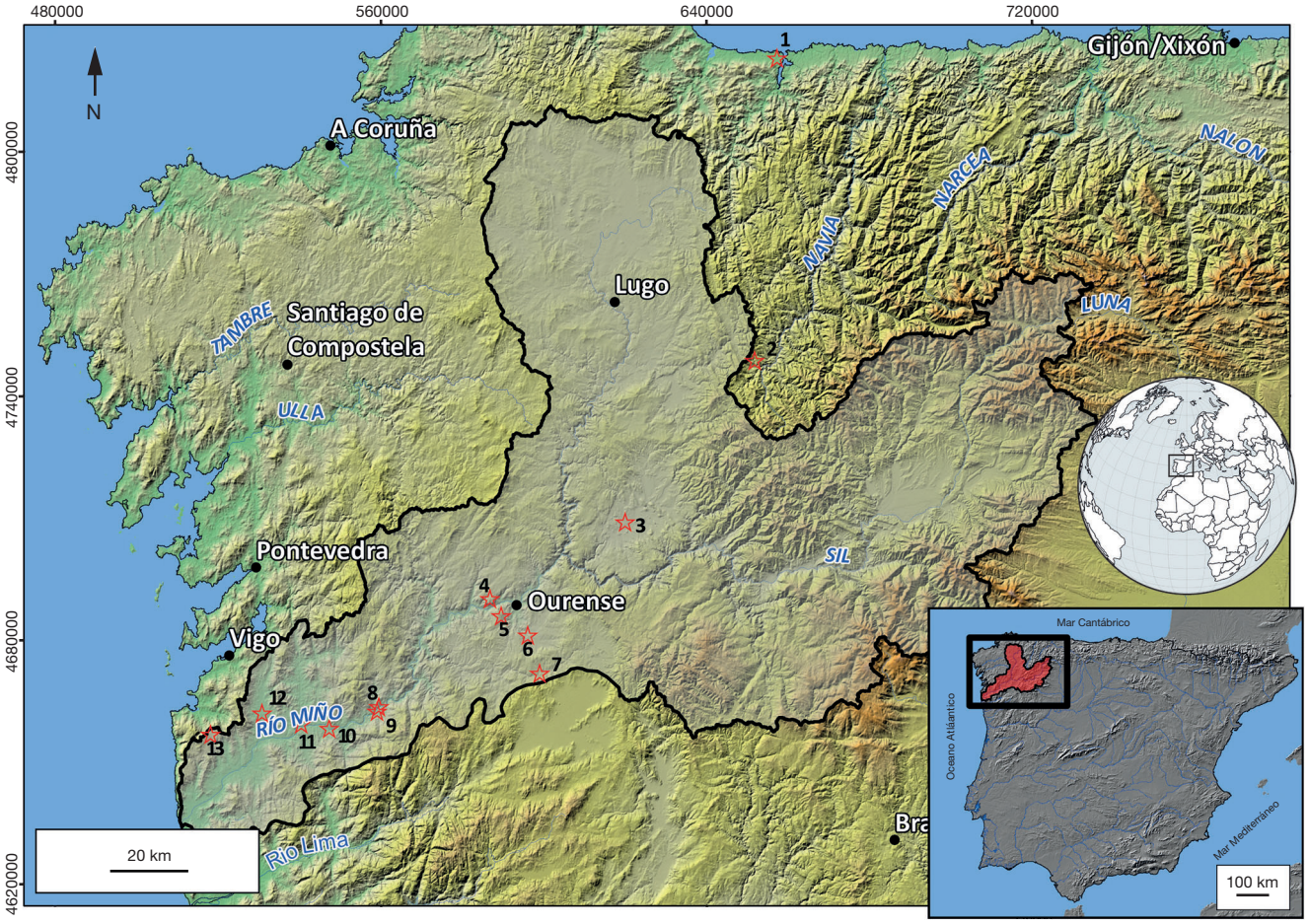

FIG. 1. — Geographic location of the area of study with the indication of some sites referred to in the text: **1**, Louselas; **2**, Valdavara; **3**, As Lamas; **4**, A Chaira; **5**, A Piteira; **6**, A Regata; **7**, A Veiga-Campo da Mama; **8**, Arbo; **9**, As Carvalhas; **10**, Porto Maior; **11**, Fillaboa; **12**, Gándaras de Budiño; **13**, Chan do Cereixo.

GEOLOGICAL AND GEOMORPHOLOGICAL FEATURES OF THE MIÑO RIVER BASIN

The Miño River basin, with an area of 17 027 km^2 and length of 350 km, is the largest river network in the Northwest of the Iberian Peninsula (Fig. 1). The Miño River cuts into Precambrian and Palaeozoic formations, which are the remains of the ancient Varisca chain that stretched between Western Europe and North America before the opening of the Atlantic Ocean (Pérez-Estaún & Bea 2004). Additionally, this region has been affected by intense fracturing processes since the end of Varisca orogeny (during the Alpine orogeny), which has defined the current configuration of the Miño River basin (De Vicente & Vegas 2009; De Vicente *et al.* 2011).

Metamorphic rocks are predominantly the main lithological component of the eastern side of the basin, with abundant slates of Cambrian and Ordovician quartzites supporting Precambrian shale and limestone. The western side of the basin crosses pre-Cambrian granitic outcrops, as well as Tertiary sediments in specific areas of the lower basin (Martín-Serrano 1994; Pérez-Estaùn Bea 2004; Martín-Serrano & Molina 2005). The dense network of pre-existing faults has conditioned the river's development, preventing the main valleys of the basin from draining the Tertiary sub-basins of the Galician hinterland (Martín-Serrano 1994; Martín-Serrano & Molina 2005).

FLUVIAL TERRACE SYSTEMS

The area with the largest extent of Pleistocene deposits is found within the lower basin of the Miño River. Current data allows for the identification of 9 stepped terrace levels (T1 to T9) with relative heights as follows: T1 (+4-7 m), T2 (+13-17 m), T3 (+21-29 m), T4 (+30-39 m, T5 (+45-51 m), T6 (+53-61 m), T7 (+65-77 m), T8 (+78-89 m) and T9 (+91-108 m) (Méndez Quintas *et al.* 2020) (Fig. 2).

The identified terraces are essentially of an accumulated type (fill or depositional terraces), characterised by extensive levels of *Gh*, *Gp* and *Gt* lithofacies (Miall 1996) and coarse layers of interbedded sand and mud facies (St, Sm, Sp or Fsm), which formed in response to the final phase of channel filling or to vertical accretion processes (Méndez-Quintas *et al.* 2020). The lithological composition of these sediments is marked by extensive occurrences of quartzite (>80% of the total), quartz, and to a lesser degree, granites and metamorphic rocks of a regional origin (Teixeira 1952; Butzer 1967; Nonn 1967; Méndez-Quintas *et al.* 2020).

The arrangement of terrace levels, the morphology of the basin, and the association of identified lithofacies, collectively indicate that most of these terraces formed under a bedload pattern characterised by coarse facies and low sinuosity channels. This observation seems to suggest that the Miño River has displayed a (Méndez-Quintas *et al.* 2020). In addition to river terrace deposits, there are also small alluvial fan systems linked to areas with strong slope breaks, where older terrace levels are usually fossilized. This stratigraphic pattern is characterised by extensive metric sequences with alternations of massive mud and clast levels.

The age of the terrace sequence for the lower Miño basin has long been discussed, with most researchers linking terrace formation with the climatic and glacio-eustatic cycles of the alpine glacial model (Breuil & Zbyszewski 1942; Lautensach 1945; Zbyszewski 1943, 1958; Teixeira 1952; Butzer 1967). To date, there is reliable chronological approximation for at least some of the terrace levels across this region. In particular, minimum ages have been obtained for T2 (+13-17 m) using luminescence dating of quartz (optically stimulated luminescence; OSL) and feldspar (post-infrared infrared stimulated luminescence; pIR-IRSL) (Viveen *et al.* 2012), while ^{10}Be cosmogenic dating has also been applied to T2 (+13-17 m), T4 (+30-39 m), T5 (+45-51 m) and T6 (+53-61 m) (Viveen *et al.* 2012). More recently, a series of new numerical ages has been obtained through electron spin resonance (ESR) of optically bleached quartz, thermally transferred optically stimulated luminescence (TT-OSL) and pIR-IRSL methods for the fluvial sequence at Porto Maior site (T4 +30-39 m) (Méndez-Quintas *et al.* 2018a; Demuro *et al.* 2020). According to these existing datasets, T2 (+13-17 m) was likely deposited within Marine Isotopic Stage (MIS) 6-5, T4 (+30-39 m) is dated to between MIS 9-8, T5 (+45-51 m) formed in MIS 12-11, and T6 (+53-61 m) was deposited sometime prior to MIS 13 (Méndez-Quintas *et al.* 2020).

THE HUMAN PRESENCE DURING THE MIDDLE PLEISTOCENE

The current data reveals a considerable amount of archaeological information directly related to the fluvial deposits of the Miño River. These sites, with the exception of the aforementioned site of Gándaras de Budiño (Aguirre 1964), had not been excavated previously. To date, there are detailed archaeological datasets for the sites of Arbo (Pontevedra, Spain), Porto Maior (Pontevedra, Spain), As Carvalhas (Melgaço, Portugal) and As Pedreiras (Monção, Portugal) (Cunha Ribeiro *et al.* 2017; Méndez-Quintas *et al.* 2018a, 2019) (Figs 1, 2). The Lower Palaeolithic records of human activity in this region, however, are not simply restricted to the fluvial environments of the valley bottoms, with extensive Acheulean assemblages having been additionally identified in the interfluves, on pre-fluvial surfaces.

The archaeological records on interfluves and peneplain surfaces

The existence of Acheulean sites on the interfluves surrounding the Miño River has been known for many years. For example, this is the case for sites such as Chan do Cereixo (Pontevedra, Galicia), A Piteira (Ourense, Galicia), A Chaira (Ourense, Galicia), and A Veiga-Campo da Mama (Ourense, Galicia) (Rodriguez Gracia 1976; Garrido Rodríguez 1978; Vidal Encinas 1981; López Cordeiro 1998; Villar Quinteiro & Llana 1998) (Fig. 1). These sites usually have a repeated association with wetlands (river headwaters or endorheic areas). In cases where stratigraphic relationships have been established, the tools are generally associated with the coarse facies (massive levels of gravel and cobbles with poor sorting) that fill these small valleys.

Typically these sites preserve extensive collections of LFA tools, made mostly on quartzite that has been imported from the Miño basin (for sites such as Chan do Cereixo, the quartzites have been transported over relatively long distances of *c.*12 km) or on local raw materials such as quartz. These sites usually include a low percentage of flakes, cores or waste. Instead, they show extensive percentages of Large Cutting Tools (LCT), such as handaxes, flake cleavers or large retouched tools (Vidal Encinas 1981) (Fig. 3). These handaxes and cleavers usually have a progressive appearance, which could be related to re-sharpening activities in the case of the handaxes. The cores have elementary exploitation patterns (mainly unidirectional), although more complex patterns such as discoidal and, eventually, Levallois are also observed (Vidal Encinas 1981) (Fig. 3D, E). However, these artefacts often exhibit a high degree of rounding and appear to have been significantly affected by post-depositional disturbance processes (Villar Quinteiro 2009).

It seems clear that these interfluvial areas must have had some strategic appeal for Pleistocene human groups, given their favourable ecological conditions. Despite these circumstances, these types of geological environments suffer from limited sedimentary accumulation capacities, which has resulted in successive human occupations becoming concentrated in coarse levels due to recent erosive processes (including during the Holocene). These sites therefore often represent palimpsests, whereby the accumulated records of human activities are separated by long time lapses, as is evident by the incorporation of Post-Palaeolithic materials in some sites (Villar Quinteiro 2009). Conservation problems aside, we must note the existence of extensive routes and occupations by populations with LFA technology beyond the valley bottoms. This has important behavioural implications, especially in the acquisition and management of raw materials, as well as in understanding the subsistence strategies themselves. These sites reveal insights into the cognition behind the creation and use of tools (in exploitation phase or already finished) on exogenous rocks (mainly quartzite) brought from distant catchment areas sometimes more than 10 km away. Any further interpretation becomes however too speculative given the absence of a reliable chronological framework for these localities.

The archaeological record associated with the highest terrace (> +40 m)

The alleged presence of artefacts on fluvial terraces above +40 m, and therefore at ages close to or older than 500 000 years (ka)

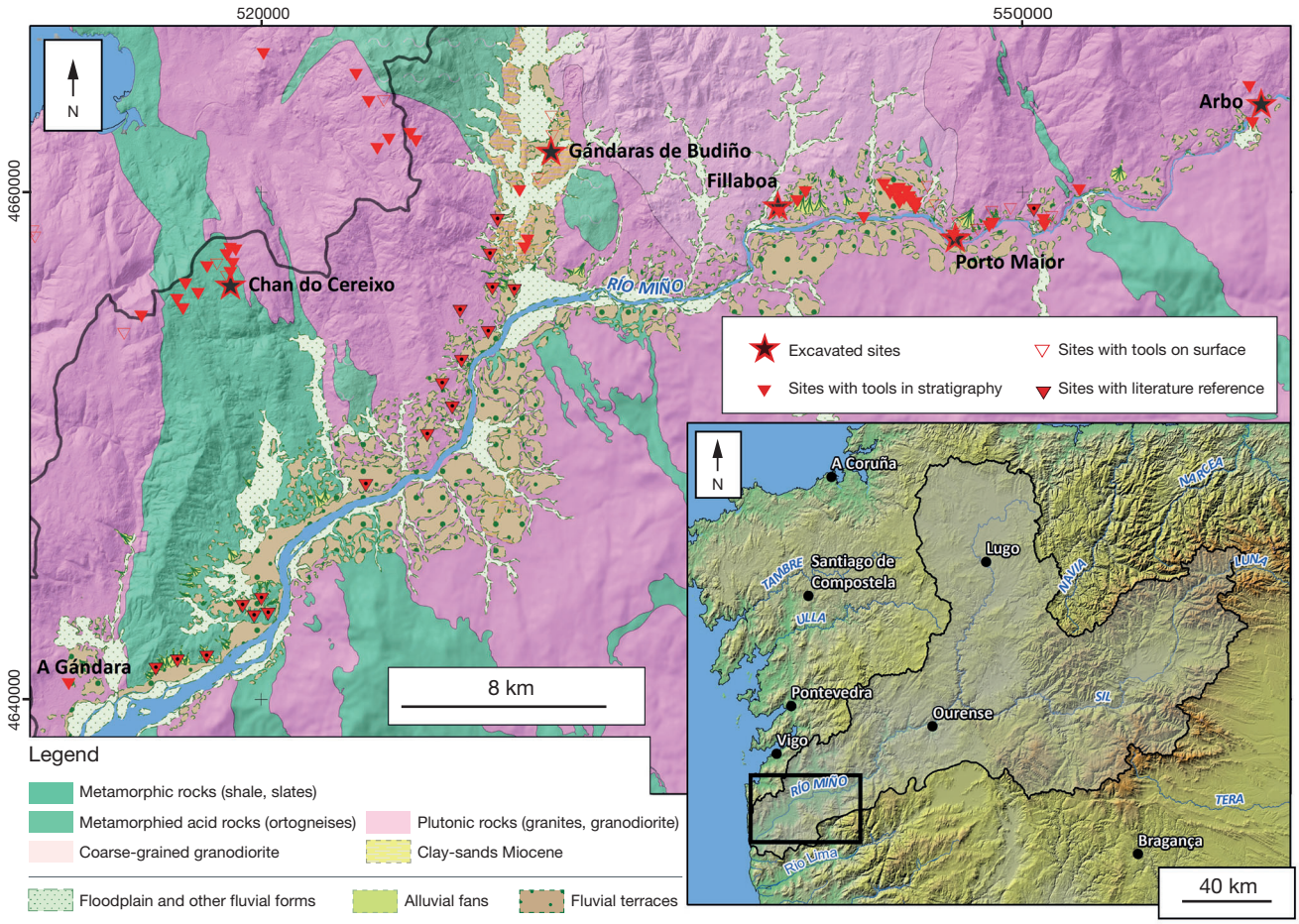

Fig. 2. — Geological and geomorphological maps of the Lower Miño basin with the main sites with Lower Palaeolithic lithic industries.

ago, was proposed more than 20 years ago (Cano Pan *et al.* 1997, 1999). The existing data shows a restricted extension of assemblages that, depending on interpretation of the limited published descriptions, consist of pebbles with a small number of extractions and whose stratigraphic and geographical origins are not well defined. Examples can be found at localities such as Peteira (Pontevedra, Spain) and the Campo de Fútbol de Salvaterra (Pontevedra, Spain) at relative heights of +76-98 m, the Campo de Fútbol de Tomiño and Chan de Vide (Pontevedra, Spain) at +56-72 m, and Oleiros and Chan de Vide (Pontevedra , Spain) at +42-55 m (Cano Pan *et al.* 1997, 1999). Given the technological features of the artefacts and their provenance from supposedly ancient sediments, these assemblages were initially identified as "Mode 1", much like the other contemporary non-Acheulean assemblages of the late Lower Pleistocene (Cano Pan *et al.* 1997, 1999). Based on the published data, we consider it precarious to associate some of these materials with any particular anthropic activities, while in other cases the absence of stratigraphic details does not preclude the possibility that these find may be associated with younger lateral deposits, and therefore may be posterior to the formation of the terrace itself (Santonja & Villa 2006; Santonja & Pérez-González 2010; Rubio-Jara *et al.* 2016).

In recent years, this problem has become apparent with the publication of a lithic artefact assemblage directly associated with high terraces (Villar Quinteiro 2012). The most extensive assemblage comes from a section in the area of A Gabacha (Pontevedra, Spain) on the T7 terrace at +67 m (incorrectly noted as the +70-80 m terrace in the original paper; Villar Quinteiro 2012). Eight quartzite pebbles have been identified with alleged traces of anthropic knapping in the lower section of the visible profile, within the matrix-supported gravel facies (Villar Quinteiro 2012). The anthropic origin of these tools seem equivocal and they could easily be interpreted as stones with natural fractures from cleavage planes (geofact) or with fortuitous scars due to the action of the machinery used to excavate the profile. At some of the other reported sites (e.g. Medans II (Villar Quinteiro 2012), the artefacts were not recovered from the +60-70 m terrace, but from colluvium formed at the foot of a small outcrop of the T7 (+66 m) terrace, or else they were found lying on the surface, without direct stratigraphic connection to the in situ terrace deposits (Villar Quinteiro 2012).

Given the potential stratigraphic insecurity and disputed anthropic nature of the materials published so far, we remain cautious about the significance of these finds. As such, we do not consider that there is sufficient objective evidence at

present to argue for the presence of early human populations in the fluvial deposits of the region found above +40 m.

The archaeological sites of terrace T4 (+30-39 m)

Currently, the first well-documented evidence of human presence in the region is associated with the fluvial sequences of the T4 terraces (+30-39 m). Earlier literature refers to scarce materials associated with a +32-42 m terrace at Monte Seo (Pontevedra, Spain) (Cano Pan *et al.* 1997) and a +30-40 m terrace at Minas del Condado (Pontevedra, Spain) and Fillaboa (Pontevedra, Spain) (Cano Pan *et al.* 1999). Additionally, a portion of the materials published by Alvarez Blázquez and Bouza Brey in the area of Goián (Bouza Brey & Alvarez Blázquez 1954) may also be connected with this fluvial terrace.

Among the sites listed above, Fillaboa is the only one that can currently be pinpointed to a specific location. This site is associated with terrace T4 (+30-39 m) in the confluence area between the Miño and Tea Rivers. Here the profiles of an old quarry reveal a sequence of more than 5 m of river sediments, of which only the upper 3 m are accessible. The sequence displays a centimetre deep layer of massive mud over an extensive succession of gravel and cobble channel bars. Artefacts have been observed within the massive muds of this sequence, and include handaxes, cores and large flakes with extensive features of the LFA (Fig. 4A-D).

The construction of an industrial complex (PLISAN) has affected an area that preserves the largest development of terraces in the studied area. In particular, T4, T6 and T7 have mostly been impacted, although outcrops corresponding to T2 (+13-17 m), T3 (+21-29 m), T4 (+30-39 m), T6 (+53-61 m), T7 (+65-77 m) and T9 (+91-108 m) terrace deposits have nevertheless been identified. Moreover, the area also includes numerous old quarries that had already adversely affected almost all the levels of the identified terraces. Archaeological work during the construction of the PLISAN complex has allowed the recovery of a significant lithic assemblage of 767 artefacts (López Cordeiro 2015) including handaxes and flake cleavers, as well as flakes, flake tools and cores with expedient reduction patterns (Fig. 4E, F). In the absence of more detailed analyses, these pieces appear to fit perfectly within the LFA industry. Additionally, from available published information it can be ascertained that most of these materials are in stratigraphic association with the upper mud facies of the T4 terrace (+30-39 m), such as those described at the sites of Fillaboa or Porto Maior (Méndez-Quintas *et al.* 2018a).

The Porto Maior site

Porto Maior represents the main archaeological site associated with fluvial terrace T4 (+30-39 m) in the basin. This locality is positioned along the northern margins of the Miño River, and includes a *c.* 6 m stratigraphic sequence made up of five levels, characterised from bottom to top as follows: levels PM1 and PM2 – fluvial facies composed of clast-supported gravels; levels PM3 and PM4 – fluvial facies composed of massive fine-grain (silts and sands) overbank deposits affected by pedogenesis, and; level PM5 – comprises a colluvium gravel deposit at its base and fine loam sediments of aeolian origin in the upper section (Méndez-Quintas *et al.* 2018a).

The chronology of the site has been established by a combination of three numerical dating methods, ESR, TT-OSL and pIR-IRSL. These methods have been able to provide consistent dating results and constrain the chronology of the main Acheulean levels (PM3-4) to between *c.* 300-200 ka (Demuro *et al.* 2020; Méndez-Quintas *et al.* 2018a). As a consequence, Porto Maior is probably the Acheulean site showing the most robust chronostratigraphic framework in the Miño Basin. It also provides an indirect age constraint for the other localities found in association with T4 fluvial deposits.

The site has been excavated over an area of 26 m², with approximately 4000 pieces having been recovered from levels PM3-5. All levels of this site preserve assemblages with LFA features, and analysis of materials from the main level (PM4) shows that one set of pieces is characterized almost exclusively by elements related to use and discard phases (LCTs and a few flake tools). The number of pieces associated with acquisition and production phases (flakes, waste or cores) is insignificant. The site contains many LCTs – consisting primarily of large sized quartzite handaxes (Fig. 5A, B) – without elements pertaining to the configuration process (flakes, large blanks or cores). These characteristics suggest that the macro-tools were configured elsewhere and brought to the site for usage and subsequent abandonment. Taphonomic observations indicate that most of the LCTs are found in an autochthonous position. Currently, this is the only known example in Europe of a site with an exclusive and extensive accumulations of LCTs (Fig. 4C) (Méndez-Quintas *et al.* 2018a).

The archaeological sites of terrace T3 (+21-29 m)

Reports of Acheulean materials associated with this terrace have largely focused on several vague locations (Cano Pan *et al.* 1997). Apart from these poorly described localities, the main archaeological site for the T3 terrace fluvial unit is that of Gándaras de Budiño, as well as the very interesting assemblage from terrace T3 (+21-29 m) at A Gándara (Pontevedra, Spain; Fig. 2). The latter has yielded lithic artefacts come from a mud level associated with the main body of this terrace. The assemblage includes handaxes (Fig. 6), some of which show progressive appearance and knapping with soft hammer (Fig. 6A). The position of the site within the Lower Miño terrace system suggests that A Gándara assemblage is younger than that from Porto Maior (Fig. 10).

The Gándaras de Budiño site

Gándaras de Budiño is the most renowned and frequently cited site of the Galician Palaeolithic record, although its initial interpretation and age (Aguirre and Butzer 1967) has frequently attracted criticism (Méndez-Quintas *et al.* 2018b). This site is located on the T3 (+21-29 m) fluvial terrace of the Louro River, the westernmost major tributary of the Miño River. The stratigraphy of the site consists of several fluvial sand facies with extensive accumulations of lithic industry (Butzer 1967, Méndez-Quintas *et al.* 2018b) (Fig. 7A). The assemblage comprises local (quartz) and non-local (quartzite) raw materials, with quartz being used for flake production while quartzite was selected to shape more complex artefacts,

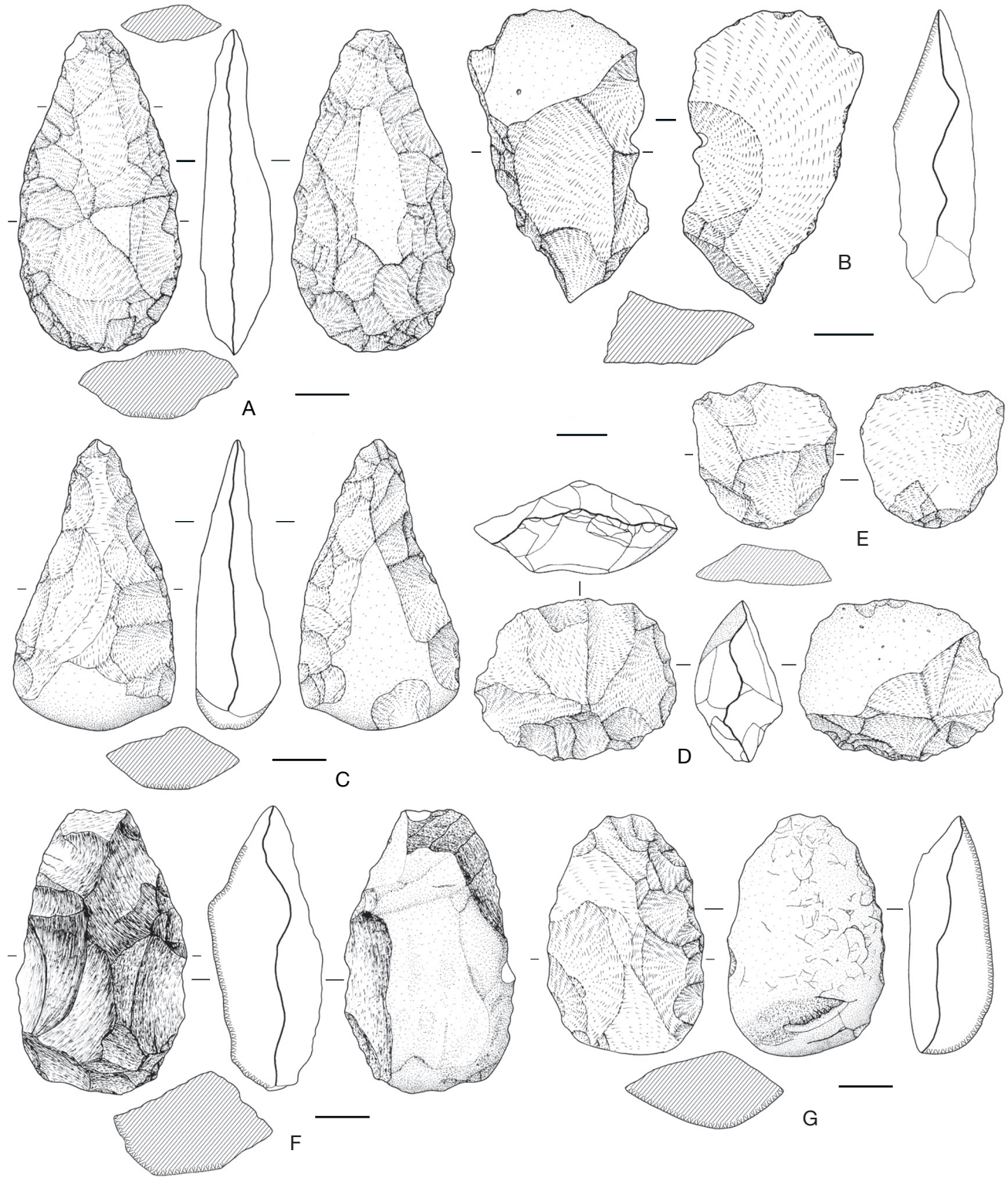

Fig. 3. — Examples of lithic tools from interfluve or peneplains sites: **A**, **B**, quartzite handaxe and cleaver on flake of Casa de Couso (Nigrán, Pontevedra); **C**, quartzite handaxe from Chan do Cereixo (Gondomar-Tomiño, Pontevedra); **D**, Levallois core on quartzite from Chan do Cereixo; **E**, retouch Levallois flake on quartzite from Chan do Cereixo; **F**, handaxe on quartz pebble from Chan da Lagoa (Vigo, Pontevedra); **G**, massive scraper on flake quartzite from Gondomar (Pontevedra). Scale bars: 3 cm.

such as flake tools or LCTs. The reduction core patterns are elementary (mainly composed of unidirectional or orthogonal cores), although there is a notable presence of discoidal patterns. Flake tools are predominantly of a basic type (mainly denticulate and single or transverse scrapers), followed by a large number of LCTs, with an equally high number of flake

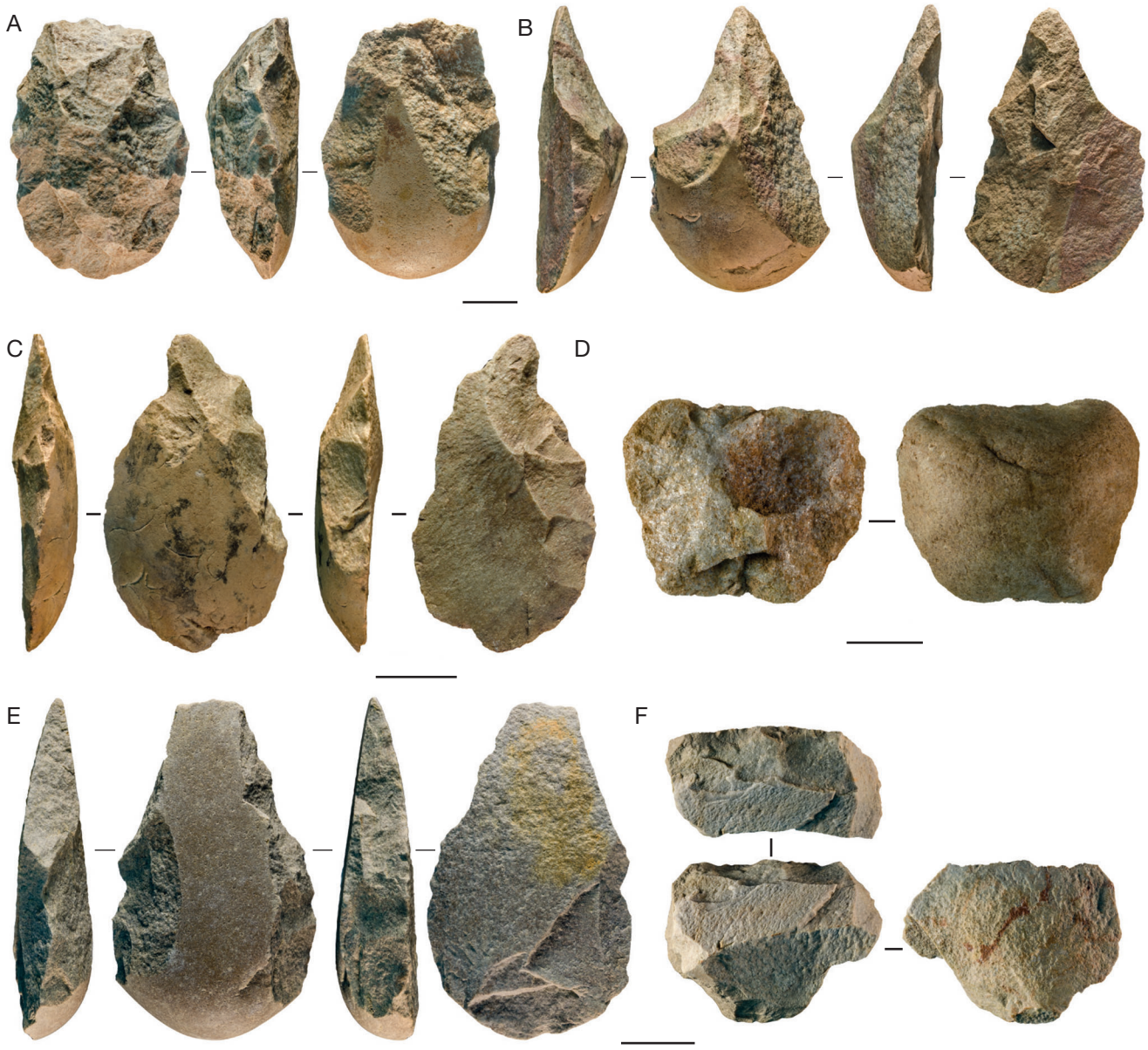

Fig. 4. — Lithic industry from fluvial terrace T4 (+30-39): **A**, handaxe on quartzite; **B**, trihedral pick on quartzite flake; **C**, partial handaxe on quartzite flake; **D**, discoidal core on quartz; **E**, handaxe on quartzite flake; **F**, transversal scraper on non-cortical flake. A-D from Fillaboa site (Salvaterra de Miño, Pontevedra); E-F from Plisan industrial area (Salvaterra de Miño-As Neves, Pontevedra). Scale bars: 3 cm.

cleavers and handaxes (Vidal Encinas 1983; Méndez-Quintas 2007, 2008; Méndez-Quintas *et al.* 2018b) (Fig. 7B-F).

Alluvial fans and another sedimentary environment

The presence of LFA materials in stratigraphic association with alluvial fans has not been previously documented in the literature. Lithic assemblages recovered from such sedimentary environments can have greater limitations for establishing chronological relationships in comparison to fluvial terraces, given their spatially discontinuous distributions. However, alluvial fans preserved in the basin generally have sedimentary features compatible with the preservation of materials in autochthonous positions, as evident from the presence of extensive mud levels. The alluvial fan features in the Miño River basin are usually related to the T2 (+13-17 m), T3 (+21-29 m) and T4 (+30-39 m) terraces, thus indicating a similar chronology to these terraces. The materials recovered from these fans, both from the coarsest facies and the fine levels, represent homogeneous assemblages with LFA features, including morphotypes such as handaxes and flake cleavers (Fig. 8).

The Arbo site

Apart from sites in connection with alluvial fans, several archaeological assemblages are known from other geomorphological contexts, such as Arbo site. This site is in a small hanging valley on the northern side of the Miño River and is incised into a fluvial surface (erosive or dismantled terrace) lying +62 m above the current river level. The sedimentary

FIG. 5. — Level PM4 at Porto Maior site (As Neves, Pontevedra): **A**, large handaxe on quartzite pebble; **B**, large cleaver on quartzite flake; **C**, main view and detail of extensive concentration of LCT found in the PM4 level. Scale bars: A, B, 3 cm; C, 100 cm.

sequence preserved at Arbo, which is situated on top of the altered feldspar alkaline granite, is composed of a lower thin level of matrix-supported gravels and cobbles (level OC1) that have been eroded (cut and filled) by another layer of matrix-supported cobbles and boulders (level OC2). In the north sector, level OC1 is represented by a very thin layer of gravel- and cobble- supported sedimentary matrix, which disappears towards the northern excavated area, and

Fig. 6. — Examples of quartzite handaxes found in the terrace T3 (+21-29 m) at Gándara site (A Guarda, Pontevedra). Scale bars: 3 cm.

is overlain by a massive fine sandy level (level OC3) and a capping Holocene organic Ap soil (level OC4) (Méndez-Quintas *et al.* 2019).

ESR and pIR-IRSL dating of levels OC2 and OC3 reveal a laterally diachronous sedimentary history for the Arbo sequence. The pIR-IRSL age (118 ± 9 ka) obtained for level OC2 in the south sector provides an estimate for the timing of the debris flow sedimentation and localised reworking of the lithic assemblage from an older level or lag deposit (level OC1 or another unknown level). The collective chronological evidence available for the Arbo site (sedimentological properties of the Arbo infill sequence, and the new numerical chronologies presented by

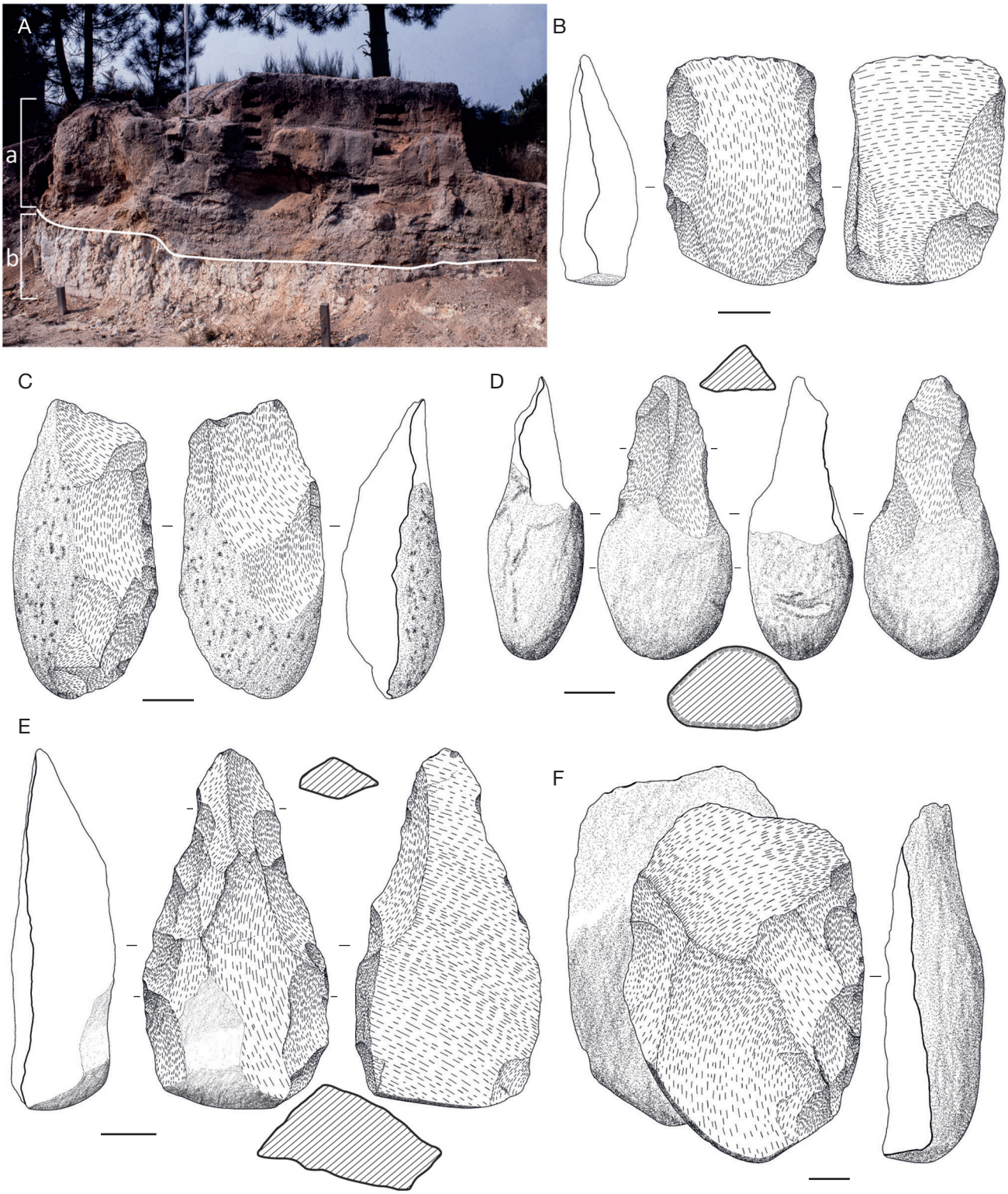

Fig. 7. — Gándaras de Budiño site (O Porriño, Pontevedra): **A**, view of the main section of the site in the 1982 excavation campaigns (**a**, fluvial coarse sand with lithic remains; **b**, Tertiary clays); **B**, cleaver on *kombewa* flake; **C**, handaxe on pebble; **D**, trihedral pick on cobble; **E**, trihedral pick on large flake; **F**, large cleaver on flake. All tools on quartzite. Scale bars: 3 cm.

Méndez-Quintas *et al.* 2019) enable the original Acheulean occupation to be constrained to sometime prior to MIS 5, most likely during MIS 6 and no earlier than MIS 7. The original infill sequence was then partly eroded as sediment continued to accumulate (level OC3) during the late Upper Pleistocene (Méndez-Quintas *et al.* 2019).

The lithic industry recovered from both levels OC1 and OC2 are extensive in nature, with 3 142 pieces found *in situ*

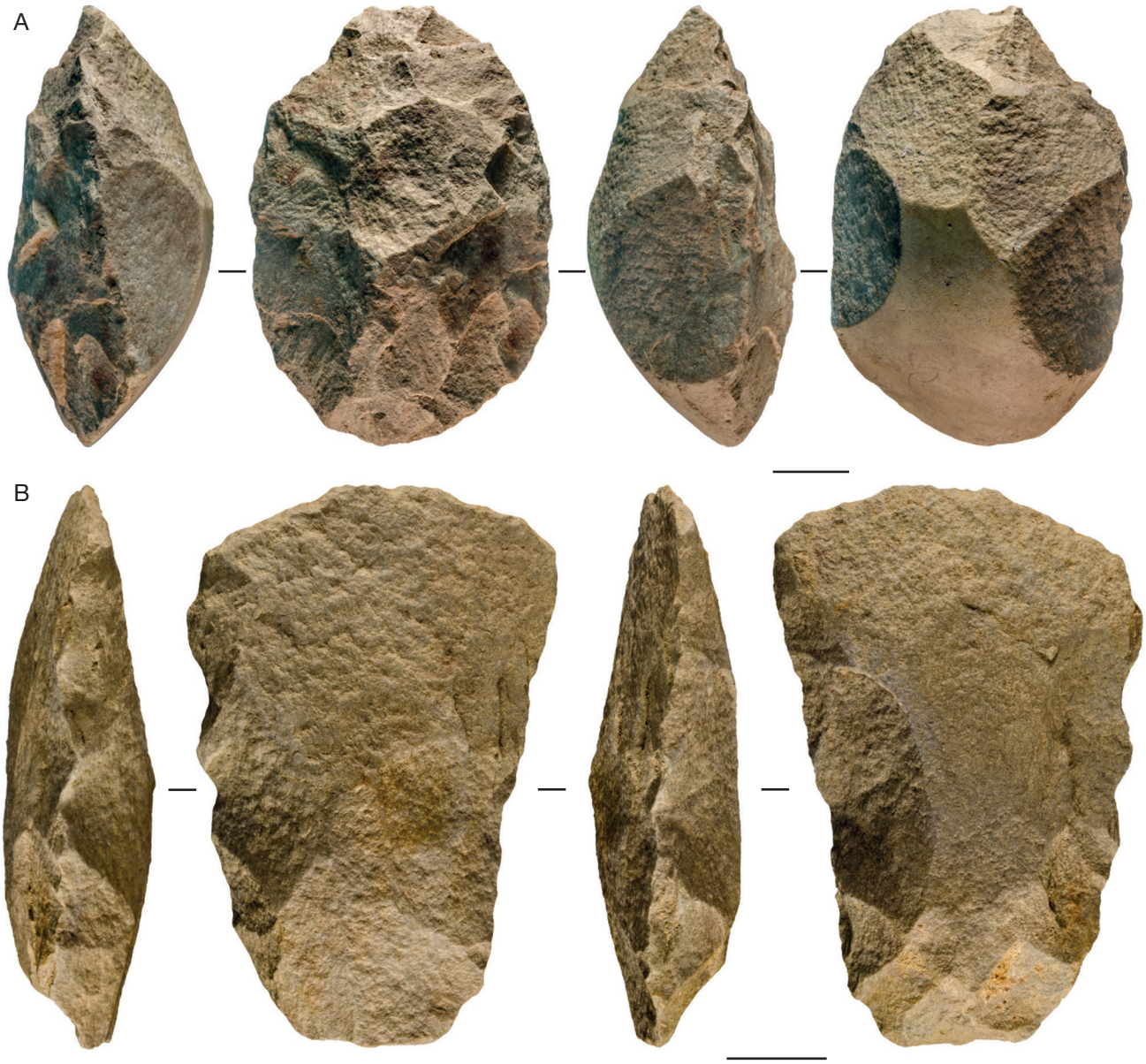

Fig. 8. — Examples of lithic tools from alluvial fans: **A**, handaxe on quartzite from Salvaterra de Miño (Pontevedra); **B**, large cleaver on *kombewa* flake from As Neves (Pontevedra). Scale bars: 3 cm.

during excavations (Fig. 9A) and 1 826 surface finds additionally recovered, and the tools display similar technological and techno-economic features indicative of shared or repeated behavioural trends. The lithic assemblages can be classed as LFA industries due to the use of large flake blanks. The selected raw materials are quartzite and quartz. Quartzite is common in all phases of the *chaîne opératoire*, while quartz has a complementary role linked to flake production. The technological characteristics of the industry are based on some elemental systems of flake production, with a total absence of predetermined schemes of the Levallois tradition. Flake tools are of non-standardised types and include some regular shaped LCTs (mainly handaxes and flake cleavers), usually finalised with the use of soft hammers (Méndez Quintas *et al.* 2018c, 2019) (Fig. 9B-E).

DISCUSSION

The results of recent archaeological research in the Miño River basin have revealed an extensive human presence during the second half of the Middle Pleistocene (Fábregas Valcarce *et al.* 2010; Cunha Ribeiro *et al.* 2017; Méndez-Quintas *et al.* 2018a, b, 2019). These data are in marked contrast with earlier archaeological studies, which suggested a gap in regional occupation dynamics and relatively scarce

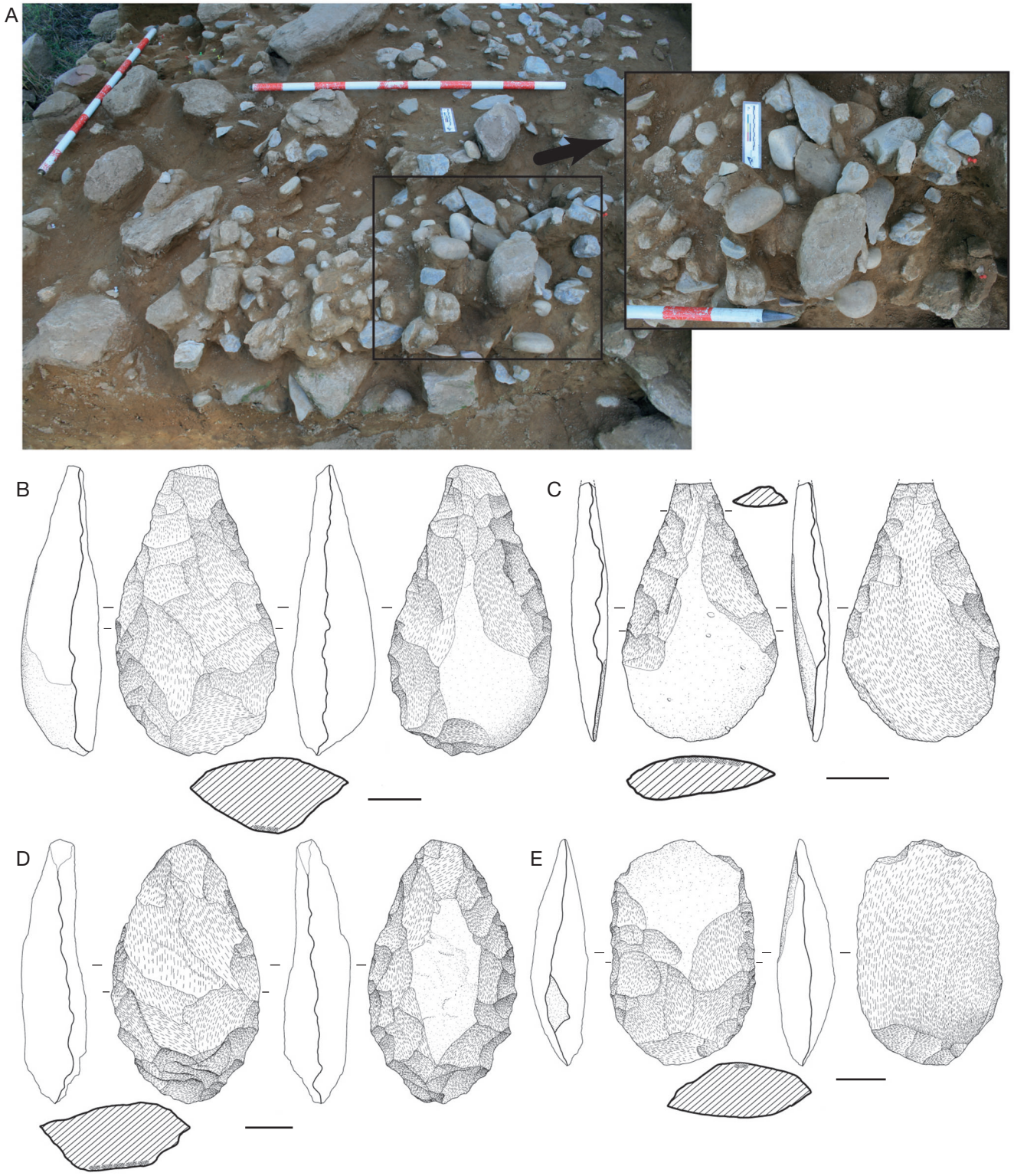

FIG. 9. — Arbo site (Arbo, Pontevedra): **A**, main view and detail of extensive concentration of tools in OC2 level; **B-D**, handaxe on quartzite from OC2 level; **E**, cleaver on quartzite flake from OC1 level. Scale bars: 3 cm.

available evidence that was atypical of the broader biological and cultural histories seen across southwestern Europe during the Lower Palaeolithic (Freeman 1976; Aguirre & Butzer 1967).

Current data indicate that there is no conclusive evidence for human activity on fluvial terraces above +40 m (Fig. 10). The sites cited in literature either do not have clear stratigraphic association with the terrace deposits, or the anthropogenic

nature of the tools is questionable. In comparison, the earliest evidence of human presence in the Iberian Peninsula have been documented in the chronological range of 1.4-0.8 Ma, as documented by the Oldowan-like lithic artefacts and palaeoanthropological remains found at different sites such as Barranco León and Fuente Nueva 3 (Guadix-Baza basin, Granada), Sima del Elefante and Gran Dolina TD4-6 (Sierra de Atapuerca, Burgos) (Carbonell *et al.* 2008; Oms *et al.* 2011; Duval *et al.* 2012; Moreno *et al.* 2015). Apart from these sites, some artefacts of possibly similar ages have also been found on the high terraces of Duero, Tajo or Guadiana basins (Raposo & Santonja 1995; Santonja & Pérez-González 2001; Santonja & Villa 2006; Rubio-Jara *et al.* 2016; Rubio-Jara & Panera Gallego 2018). These existing regional chronologies imply the plausible existence of human populations in the Miño region >500 ka. Nevertheless, the current data available from the Miño basin does not yet support this interpretation due to the lack of conclusive archaeological evidence.

The first unambiguous evidence of human activity in the region is the LFA technology found in association with fluvial terrace T4 (+30-39 m) at the archaeological sites of Porto Maior (levels PM3-4) and Fillaboa. The age of these sites is estimated to be around MIS 8-9, based on the data obtained from the Porto Maior sequence (Méndez-Quintas *et al.* 2018a; Demuro *et al.* 2019). This chronological window is further constrained by the published MIS 11 ages for terrace T5 (+45-51 m) (Viveen *et al.* 2012), which has not yielded any archaeological records so far. The presence of LFA industry continues through to terrace T3 (+21-29 m), where there are sites such as Gándaras de Budiño (Méndez-Quintas *et al.* 2018b). At present there is no direct chronology for this terrace level, however the proposed minimum age for T2 (+13-17 m) is currently MIS 6-5, which would suggest a likely MIS 8-7 age for terrace T3 (Méndez-Quintas *et al.* 2020). This data, pending additional age constraint for the T2 and T3 terrace, would indicate continuity of the LFA tradition across the region up to at least MIS 7. This is supported by the data obtained from the Arbo site, which reveal a MIS 7-6 age for the associated LFA assemblage (Méndez-Quintas *et al.* 2019). At present there is no specific archaeological data for the time period after MIS 6 in the basin, although there is evidence for the presence of Neanderthal populations with Middle Palaeolithic technology across the broader region during MIS 3 (Rey-Rodríguez *et al.* 2016).

The known age range of human presence in the Miño River basin (terraces between +40-20 m) during the second half of the Middle Pleistocene (MIS 9-6) (Fig. 10) has a direct correspondence with other large Iberian river basins, as well as other basins across southwestern Europe (Santonja & Villa 2006; Santonja & Pérez-González 2010; Turq *et al.* 2010; Hernandez *et al.* 2012, 2015; Jaubert *et al.* 2013; Rubio-Jara *et al.* 2016; Santonja *et al.* 2016; Chauhan *et al.* 2017; Proença Cunha *et al.* 2017a; Silva *et al.* 2017). In the Iberian Atlantic basins of the Duero, Tajo and Guadalquivir Rivers, there is consistent evidence for human presence on terraces between +40-20 m (Santonja & Villa 2006; Santonja & Pérez-Gonzalez 2010; Baena Escudero *et al.* 2014; Rubio-Jara *et al.* 2016; Santonja *et al.* 2016; Proença Cunha *et al.* 2017b). In the Guadiana River basin, given its unique geological features, the sites are related to terrace levels between +13-8 m (Santonja & Villa 2006). The chronology of sites in these basins range between MIS 11 at Arganda I in the valley of the Jarama River (Panera *et al.* 2011; Moreno *et al.* 2017) or the Lower member of Ambrona (Falguères *et al.* 2006), to MIS 7-6 for the +18-20 m terraces of the Tagus River (López-Recio *et al.* 2015), the complex terrace of Butarque (Rubio-Jara *et al.* 2016; Rubio-Jara & Panera Galleg 2018) and Galeria at Atapuerca (Demuro *et al.* 2014). The evidence for expansion of human populations during this age range represents a significant change in population dynamics when compared to the much smaller record known before 0.5 Ma (Rolland 2013; Bermúdez de Castro & Martinón-Torres 2013; Bermudez de Castro *et al.* 2013; Mosquera *et al.* 2013; Sharon & Barsky 2016; Rocca *et al.* 2016).

The Iberian archaeological record for the second half of the Middle Pleistocene is dominated by the presence of LFA industries of an African tradition, as well as some assemblages of the Early Middle Palaeolithic (EMP) tradition (Santonja *et al.* 2014, 2016). The current data for the Miño River basin shows an exclusive and continuous presence of LFA traditions during this time period. This same technological continuity is observed in other areas of the South Western Europe up to at least MIS 7, and even during the beginning of MIS 6 (Demuro *et al.* 2014; Rubio-Jara *et al.* 2016 ; Santonja *et al.* 2016; Proença Cunha *et al.* 2017a; Méndez-Quintas *et al.* 2019). Nevertheless, the final limit of this technocomplex is not fully established and the coexistence of Acheulean LFA and EMP in different regions of Europe (Turq *et al.* 2010; Cologne *et al.* 2013; Jaubert *et al.* 2013) is currently being investigated (Santonja *et al.* 2016; Villa *et al.* 2016; Soriano & Villa 2017). The LFA industries are characterised by the production and management of large flake-support (>100 mm) to make LCTs, such as handaxes or cleavers (Sharon 2010; Kleindienst 1962). Associated with these industries are other *chaîne opératoire* aimed towards the production of small flakes for direct use or for their eventual transformation into small unsystematised tools (Santonja & Villa 2006; Gallotti 2016). In the Miño basin, sites such as Porto Maior, Arbo and Gándaras de Budiño, are exceptional examples from the technological perspective of the LFA. These sites show extensive use of large flakes for the knapping of handaxes or cleavers, with secondary *chaîne opératoire* focused towards the production of small flakes (Méndez-Quintas 2007, 2008; Méndez-Quintas *et al.* 2018a, c, 2019). In addition, at Porto Maior level PM4, there is also evidence of an occupation pattern typical of African Acheulean sites, with an extensive accumulation of LCTs. The accumulation is composed mainly of large handaxes, its origin does not appear to be related to post-sedimentary accumulations, and it is indicative of distinctive anthropic behaviour (Méndez-Quintas *et al.* 2018a).

The Acheulean sites identified in the Miño River basin maintain an overall pattern of being found in close relation to fluvial environments and the ancient bottoms of valleys, as observed in other regions of South Western Europe (Santonja & Villa 2006). These environments would meet population needs for freshwater and raw materials and ensure access to diverse

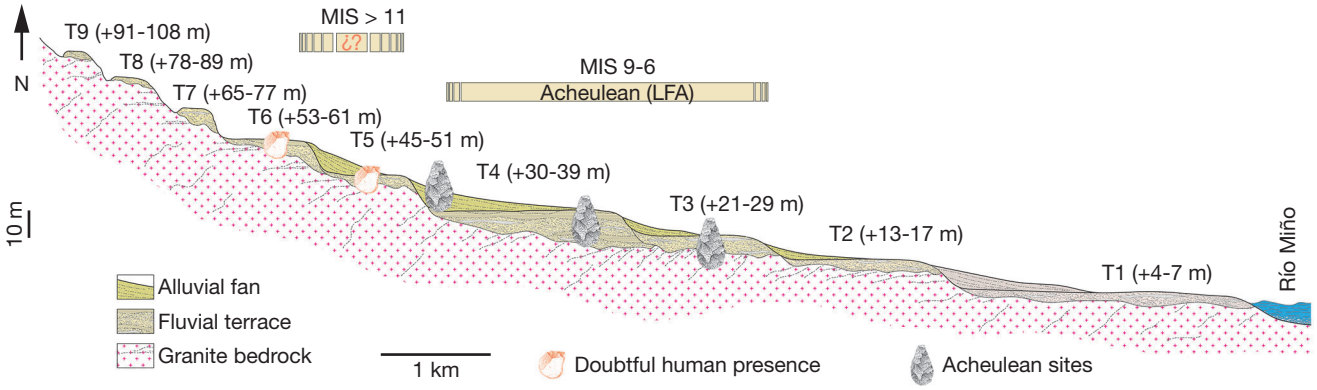

Fig. 10. — Synthesized geomorphological cross-section of the terrace system of the right bank of the Lower Miño basin with the main episodes of human presence.

food resources (both vegetal and animal). Nevertheless, the Miño basin also preserves good examples of sites beyond the valley bottoms, within interfluves or on peneplains (such as Chan do Cereixo or the main sites surrounding Ourense town). Elsewhere across Iberia there are similar examples of sites found outside the valley bottoms, such as the River Duero Basin Plateaus (Díez-Martín *et al.* 2008), the interfluve of the Manzanares-Jarama (Bárez *et al.* 2016) or the few Acheulean sites with cave occupations such as Galeria (Ollé *et al.* 2013) and Gruta da Aroeira (Daura *et al.* 2018). The River Duero Plateau sites (Díez-Martín *et al.* 2008) exhibit characteristics that are very similar to those observed in the River Miño basin, whereas the interfluve sites in the Manzanares-Jarama basins seem to be focused primarily on obtaining and managing good-quality raw materials (Bárez *et al.* 2016). The environments outside of these river valleys bottoms provide access to freshwater and food resources, but not always to raw materials. In the case of the Miño basin sites, the archaeological raw materials (quartzites) are located at distances that can far exceed 10 km. Traditionally it has been considered that Acheulean groups tended to exploit raw materials of immediate access, being the use of raw materials of long-distant origin unusual (Féblot-Augustins 1990; Santonja & Villa 2006; Ashton 2008). However, the Miño basin sites provide evidence for exogenous quartzite management, complemented by using local raw materials such as quartz. This pattern of raw material management implies organised behaviour, where the concepts of anticipation and planning are pre-requisites. It is also worth noting the abundance of finished artefacts, such as handaxes and cleavers, whose high representation at these sites is not necessarily an artefact of site formation processes. Needless to say, an explanation is required for these type of "mobile" pieces that would have been an essential part of the basic tools used by Acheulean groups in their movements (Santonja 1992; Ashton 2008; Díez-Martín *et al.* 2008; Turq *et al.* 2010).

CONCLUSIONS

Recent and ongoing research being carried out in the Miño River basin has shown that the area has great potential for the study of cultural processes during the second half of the Middle Pleistocene. This is an unexpected revelation, considering that the prevailing opinion of the 20th century focused on the area having a scarce and problematic archaeological record and in the absence of fossil remains. Current evidence reveals an extensive and apparently continuous human presence with LFA Acheulean technologies during MIS 9-6, particularly for the middle levels of the regional fluvial terrace sequence (T3 terrace at +21-29 m and T4 terrace at +30-39 m). There is currently no conclusive data in support of older human activity in the basin.

The main archaeological sites of the Miño River basin, such as Porto Maior, Arbo and Gándaras de Budiño, exhibit clear features of the LFA of African affinity, with extensive assemblages of handaxes and cleavers made on large flakes detached from giant cores. This pattern is consistent with those observed in other large basins of the western Iberian Peninsula and defines an extensive geographic area with cultural and chronological concomitances. However, the restrictive presence of LFA assemblages beyond the Iberian Peninsula and elsewhere across Europe raises important questions regarding the process of human expansion across the continent and its connection to African populations.

Future research in the region will be aimed at accurate the age of sedimentary formations and analysing the limits of human presence, in the pre and post Acheulean stage. We will also intensify research on already known sites (Porto Maior or Gándaras de Budiño, for example) and extend it to other promising sites.

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