

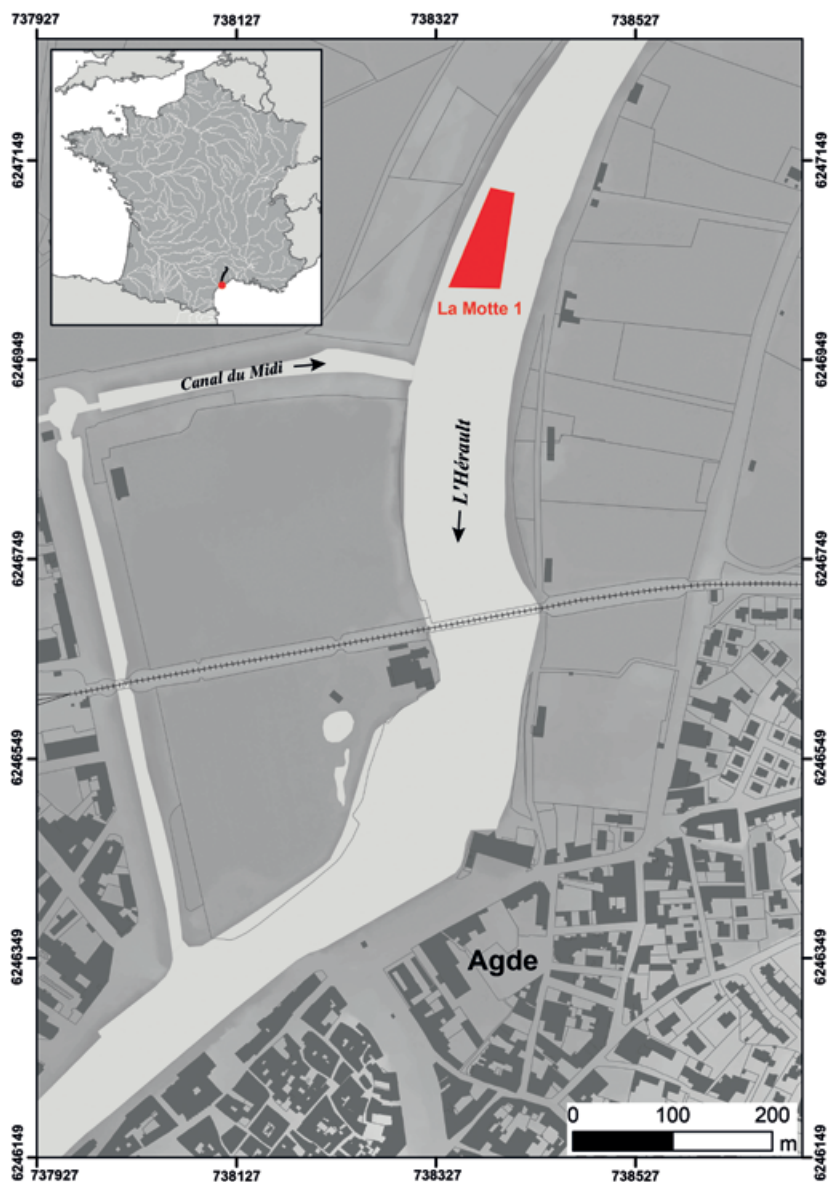
## ENTER THE MATRIX

### LATE BRONZE AGE CASTING MOULDS FROM »LA MOTTE« (AGDE, DÉP. HÉRAULT/F) IN THEIR CONTEXT

The La Motte 1 site (Agde, Hérault) (**fig. 1**) is known in particular for the discovery of a spectacular deposit of ornamental objects interpreted as an individual ceremonial costume with feminine connotations (Moyat et al. 2007; Verger et al. 2007). The find, dating to the 8<sup>th</sup> century BC, consists of some 330 pieces made for the most part from copper alloy, but also incorporating some amber and tin elements. Most of the neck and limb decorations belong to a local tradition, specific to western Languedoc and the Pyrenees, that is well illustrated in the grave goods of the cremation necropolises occupied in the 9<sup>th</sup> and 8<sup>th</sup> centuries BC. Other pieces, however, suggest more distant connections, with a composite belt and an articulated apron pointing to Liguria and the southern Alps and phalerae showing similarities to the Continental Hallstatt culture (Verger et al. 2007). This deposit, found submerged in the Hérault River, was made near a settlement, as evidenced by architectural elements (wooden piles) and remains of a domestic nature (ceramic, faunal, etc.) (Moyat et al. 2007). Subsequent underwater excavation campaigns carried out since 2011 have provided more details on the chronology of occupation, the size and the economy of the site (Gascó et al. 2014; 2015; Lachenal et al. 2020). They indicate that at the time of its occupation, the settlement at La Motte was located on the edge of a lagoon and near the mouth of the Hérault River (Devillers et al. 2019). It is characterised by almost 500 wooden piles divided into two main groups located in shallow areas, associated with numerous basalt blocks which may have been used in the structures of the site. The analysis of the ceramic corpora and radiocarbon dating indicate an occupation extending from at least the end of the 10<sup>th</sup> to the beginning of the 8<sup>th</sup> centuries BC, or mainly between the Late Bronze Age IIIB and the phase of transition between the Bronze Age and the Iron Age in the regional chronology, corresponding to Ha B2-3 and Ha C, respectively (Lachenal et al. 2020). Various analyses (anthracology, carpology, paleoentomology and zooarchaeology) support the characterisation of a permanent settlement occupied year-round, with an economy mainly based on farming and livestock (Lachenal et al. 2020; Bouby et al. 2016; Lespes et al. 2019). The La Motte site thus provides the context for a reference study of the settlements of the very end of the Bronze Age in Languedoc. Evidence of artisanal activities is also present, including a set of four fragments of casting moulds that form the subject of this article. This type of artefact, which provides precious evidence of the processes of production of objects made from copper alloy, and thus of the location of the workshops (Overbeck 2018, 20-21), is not commonly found at settlement sites. These objects therefore provide new information on metal production at the end of the Bronze Age in Mediterranean France, in particular on the organisation thereof and the ways in which bronze models were diffused.

#### LOCATION OF THE DISCOVERIES

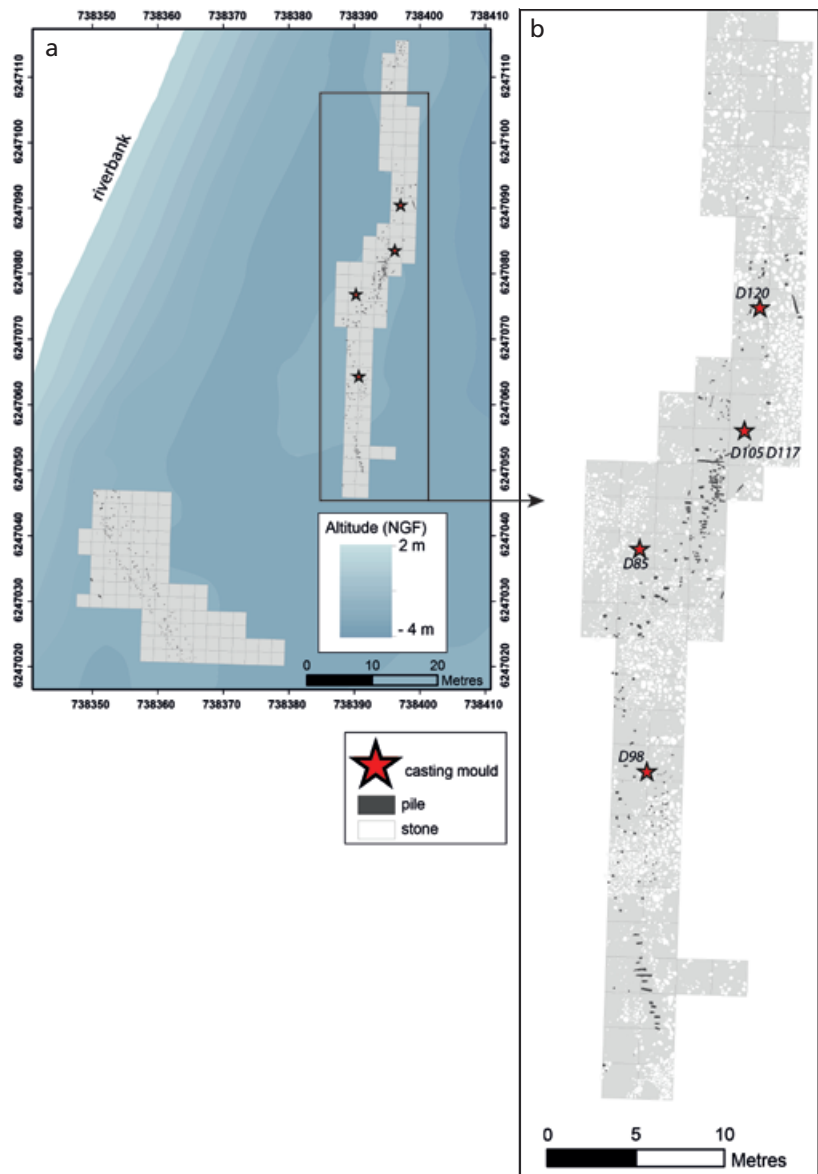
The La Motte site is characterised by two rows of wooden piles or stakes (**fig. 2a**), one oriented northeast-southwest, near the right bank of the river (to the west), the second oriented north-south, closer to the



**Fig. 1** Location of the site in the Hérault River, north of the town of Agde, on a cadastral base. – (GIS Th. Lachenal; data BDTOP0®).

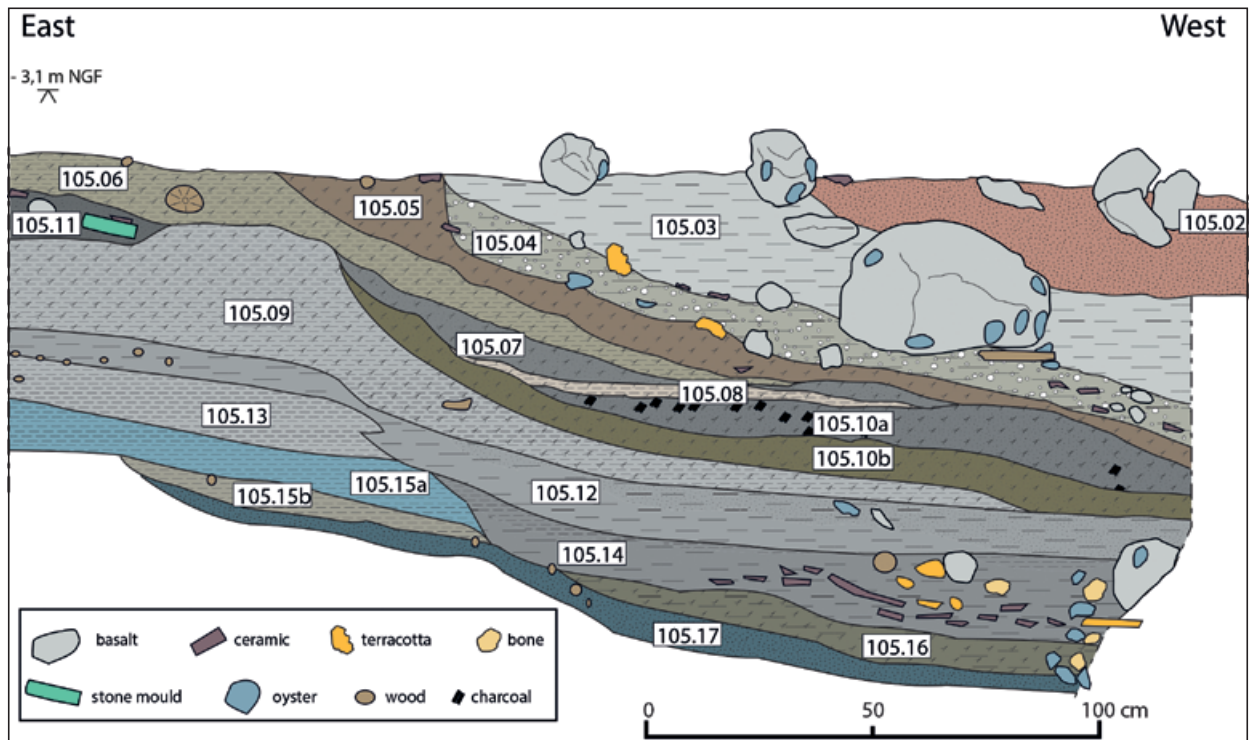
left bank (to the east). The analysis of the distribution of species of wood and radiocarbon dating indicate that these piles correspond to several coherent alignments, installed from south to north. The excavation trenches dug support their interpretation as systems for bank maintenance and protection that use different techniques: fascines and possible live stakes made of willow. They would have protected the edges of a settlement that has unfortunately been greatly eroded by the action of the river. The presence of several piles of larger diameter nearby indicates the existence of buildings removed from the banks. Likewise, the strata studied, over 2 m thick, contain significant domestic waste resulting from the activity of the settlement (Lachenal et al. 2020).

The mould fragments all come from the eastern part of the site (**fig. 2b**), towards the centre of the alignment of piles. They are concentrated in a zone of 56m<sup>2</sup> and separated by a distance of 7-12 m from each other. It is thus possible that the production of objects made from copper alloy only involved one sector of the settlement. The moulds are included in the levels of domestic waste present at the edge of the settlement. They were for the most part unearthed among the remains appearing on the surface of the archaeological layers preserved, after removal of the recent deposits of the river.



**Fig. 2** Location of the casting moulds on the overall map of the wooden piles at La Motte (a) and detail of the eastern sector of the site (b). – (GIS Th. Lachenal; bathymetry F. Yung).

In just one case, two adjoining fragments of the same mould were discovered in an excavation trench. The sequence preserved corresponds for the most part to a shore area, located at the edge of the protohistoric settlement (fig. 3). A red sandy layer (US 105.02) corresponds to a recent river deposit. Scatterings of ceramics and shellfish remains (US 105.04, 105.14 and 105.17) must, however, be interpreted as levels of waste from domestic activities, dumped in the lagoon at the edge of the settlement. As for the branches present, they must have been deposited on the bank. Other midden levels (US 105.05, 105.12 and 105.16) should also be noted. The greater presence of plants could correspond to waste from phases of construction of wooden structures. Layers of very pure clay associated with the accumulation of organic matter (US 105.06, 105.09, 105.10b and 105.15a) can be interpreted as the result of flood deposits, carrying fine sediments and organising the plants into floating bands deposited on the banks. This stratigraphy can be likened to those observed at the edge of the current lakeside settlement of Ganvié, on Lake Nokoué in Bénin (Pétrequin/Pétrequin 1984). It must therefore correspond to the time at which the protohistoric settlement was active. The level in which the mould was found, located at the eastern edge of the excavation trench (US 105.11), has a smaller slope and could thus correspond to a local level of occupation just behind the bank.



**Fig. 3** Stratigraphic diagram of the excavation trench D105-D117 and location of the casting mould. – (Graphic B. Debrand / Th. Lachenal).

## INVENTORY OF THE OBJECTS

### Square D85<sup>1</sup>

Valve of a permanent mould made of schist, rectangular in shape, 7.6 cm long, 5.3 cm wide and 1.5 cm thick. Two faces were prepared to be used as a matrix (**fig. 4**). The first (face A) has a pouring cup and three dowel holes, two of which are very close together. The hole located farthest to the outside led to a fracturing of the surface at the edge of the mould and was thus reproduced just above. The matrix corresponds to two circular cavities with a central perforation, around which a moulding in slight relief is noticeable. Dark spots on the surface indicate that other circular objects were made in the missing valve. They were connected to the first ones by runners extending from the pouring cup. Another mould from the Les Cayrols necropolis in Fleury (dép. Aude/F) is also characterised by two similar circular matrices (Louis/Taffanel/Taffanel 1958, fig. 51, 6). The same face was used to cast arrowheads with a flanged tang, a type of weapon that appears in the south of France in the Late Bronze Age IIIB and may have persisted into the beginning of the Early Iron Age (Beylier 2012, 96-98). These moulds were probably used to create circular appliqués with a central bulge, like those from the Vénat deposit in Saint-Yrieix-sur-Charente (dép. Charente/F) (Coffyn/Gomez/Mohen 1981, pl. 48, 40). They formed decorative elements for clothing or more probably for objects.

The second face (B) also has a dowel hole. However, the matrix is incomplete, which indicates that it is a reused fragment and that face A is more recent. It corresponds to the proximal end of a pin, the head of which consists of a bulb with a conical top. Nearby, there is also a recess in the shape of an arc of a circle, for which it is impossible to determine the intended use.

### Square D98

Valve of a permanent mould, parallelepipedic in shape, measuring 15.4 cm long, 9.5 cm wide and 4 cm thick (fig. 5). It was made from a block of fine grey sandstone with inclusions of mica and has a flat face used as a matrix and a worked contour, while the back was left in its raw state. A dowel hole is also visible on the surface, which has dark spots created by the casting of the metal. Although the object is broken at two ends, the artefacts that it was used to cast can be partially identified. On the left, a straight rod matrix extended by a pouring cup is visible. The right part of the object was used to produce spear-heads with a lozenge-shaped blade.

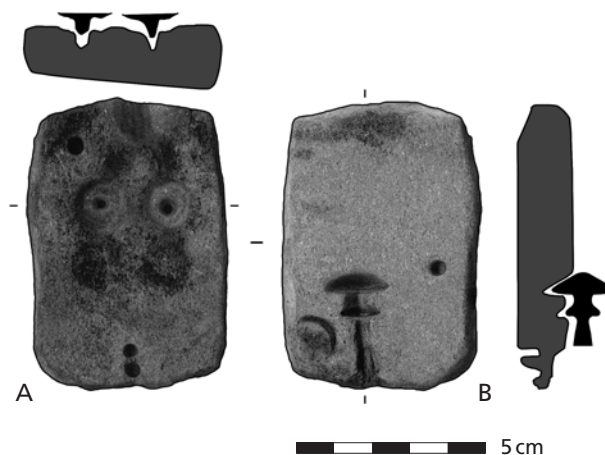


Fig. 4 Mould valve from square D85. – (DAO Th. Lachenal). – Scale 1:2.

### Square D120

Fragment of a mould valve, 6.1 cm long, 4.2 cm wide and 3.6 cm thick (fig. 6), made from a dark rock rich in muscovite (mica schist?). The three preserved faces were worked to be used as moulds. The best-preserved, face A, has a flat portion with three dowel holes. Despite its fragmentation, the matrix of a socketed axe with a flat blade can be identified. The opposite face (B) was used to cast objects of a non-identifiable nature. As for the preserved lateral face (C), it was used to create a subcircular object 1.3 cm wide. One of the ends flattens out and has a groove in the shape of an arc of a circle. This could therefore be a socketed chisel (Nicolardot/Gaucher 1975, 121-124).

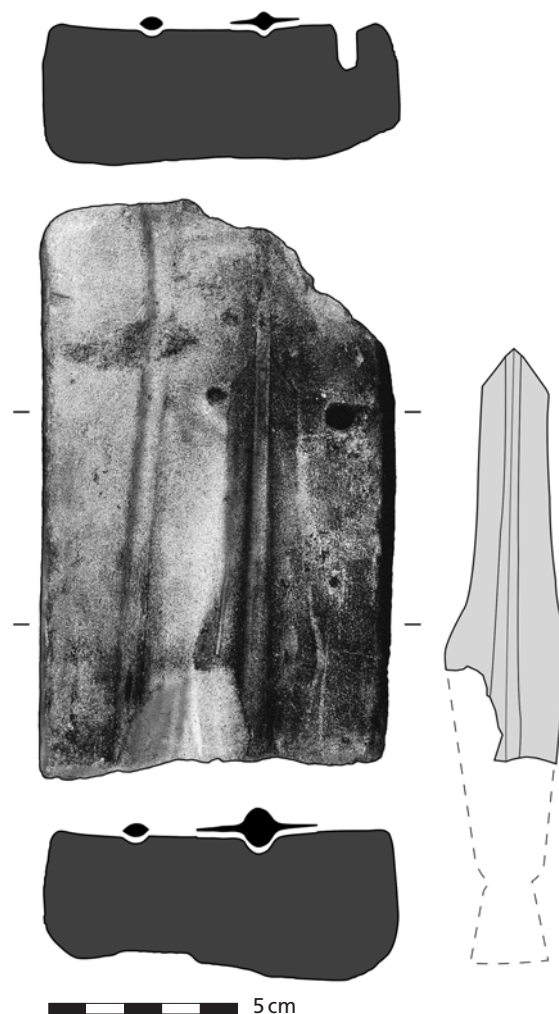
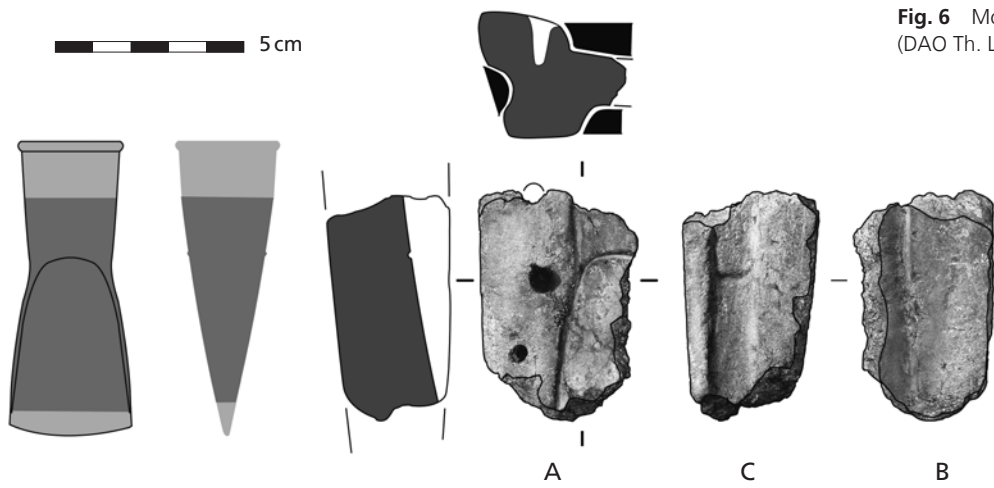


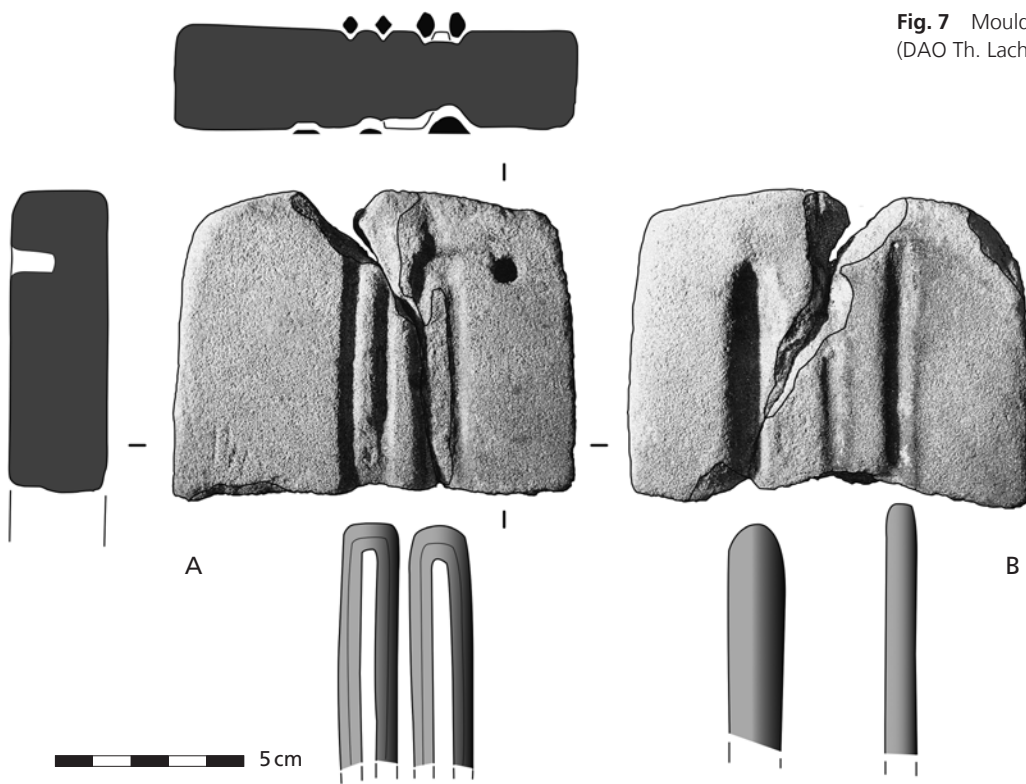
Fig. 5 Mould valve from square D98. – (DAO Th. Lachenal). – Scale 1:2.

### Square D105

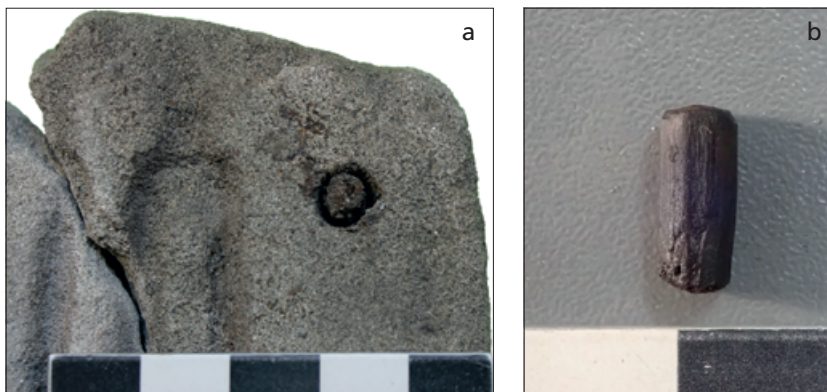
Fragment of a mould valve unearthed in US 105.11, broken into two parts, with only one surviving end. It measures 10.7 cm long, 8 cm wide and 2.6 cm thick (fig. 7). This object was made from a block of fine sandstone with inclusions of muscovite and has two flat faces used as a matrix and a worked contour. A dowel hole is visible on one face, with a preserved wooden dowel inside (fig. 8). This part of the mould (face A) was used to cast objects that have not yet been identified, with a lozenge-shaped cross-section, reminiscent of elongated links (fig. 7). The other face (B)



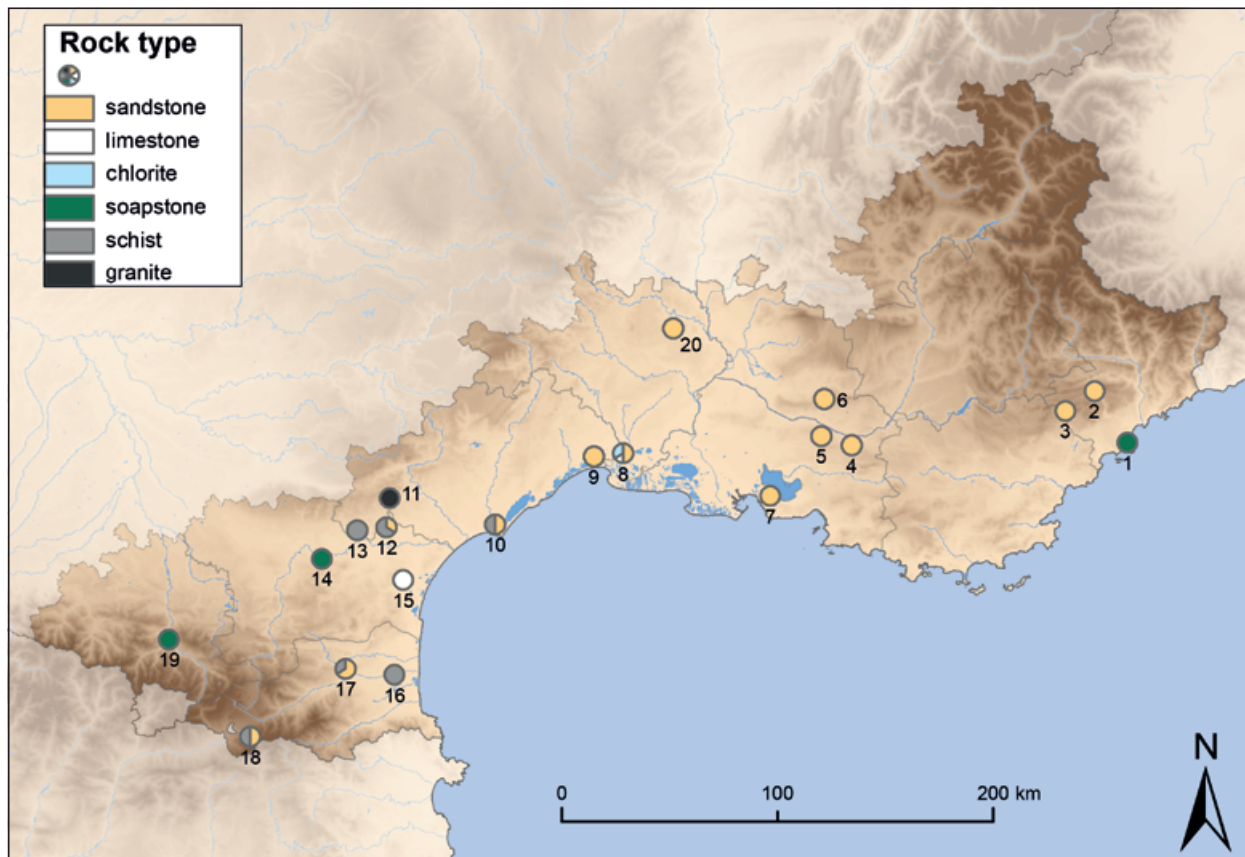
**Fig. 6** Mould valve from square D120. – (DAO Th. Lachenal). – Scale 1:2.



**Fig. 7** Mould valve from square D105. – (DAO Th. Lachenal). – Scale 1:2.



**Fig. 8** Mould valve from square D105. Detail of the dowel contained in the dowel hole (a) and photograph of the dowel (b). – (Photos Th. Lachenal).

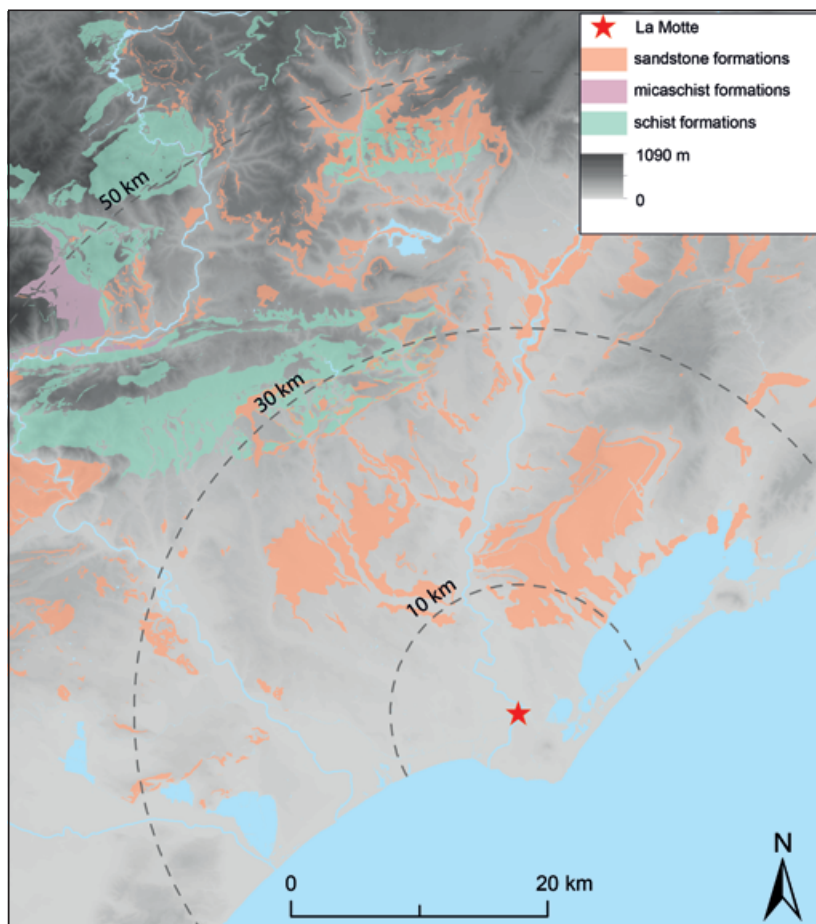


**Fig. 9** Map of the distribution of the stone moulds for which the type of rock has been identified in southern France: **1** Cave Biénès, Antibes. – **2** Baou dou Draï, Gréolières. – **3** Baumon de Briasq shelter, Escragnolles. – **4** L’Espougnac, Meyrargues. – **5** Pié-Fouquet, Rognes. – **6** Buoux. – **7** L’Abion, Martigues. – **8** Camp-Redon, Lansargues. – **9** Tonnerre I, Mauguio. – **10** La Motte, Agde. – **11** Baous de la Salle, Bize-Minervois. – **12** Le Cayla, Mailhac. – **13** Las Fados, Pépieux. – **14** Le Laouret, Floure. – **15** Baumel/Batiqueille, Peyriac-de-Mer. – **16** Mas Bruno, Perpignan. – **17** Caune de Bélesta. – **18** Lladre, Llo. – **19** Lombrives cave, Ussat. – **20** Cavillargues. – (GIS Th. Lachenal).

corresponds to the matrix of circular or rectangular metal bars with varied cross-sections and thicknesses. These were probably semi-finished products intended to be shaped by plastic deformation or remelted.

## THE RAW MATERIALS

The supports used to create the moulds are all soft rocks – sandstone, schist and in all likelihood mica schist – that are easy to work and resist thermal shocks well (Fleury 1991). In this, the nature of the rocks does not differ from those used for other Bronze Age moulds in Mediterranean France. Among the specimens for which the nature of the rock is known, there is indeed a majority of sandstones (26 specimens), which are almost exclusive east of the Rhône (fig. 9). In Languedoc and in the Pyrenees, the rocks used are more diverse. For example, there are nine matrices made from schistose rocks (schist, mica schist, lime schist) generally associated with other raw materials. The geographic position of La Motte between these two regions manifests itself in the use of both sandstone and schist to make the moulds. The use of limestones and carbonates (one specimen at Camp-Redon in Lansargues [dép. Hérault/F] and two at Peyriac-de-Mer [dép. Aude/F]), chloritite (also one at Camp-Redon), and granite (Baous de la Salle in Bize-Minervois [dép. Aude/F]) is rarer. Steatite, a material particularly well suited to the creation of this type of object (Gambari/Rubat-Borel/Campagnoni 2007, 132-133), is known in the Pyrenees, at Le Laouret in Floure



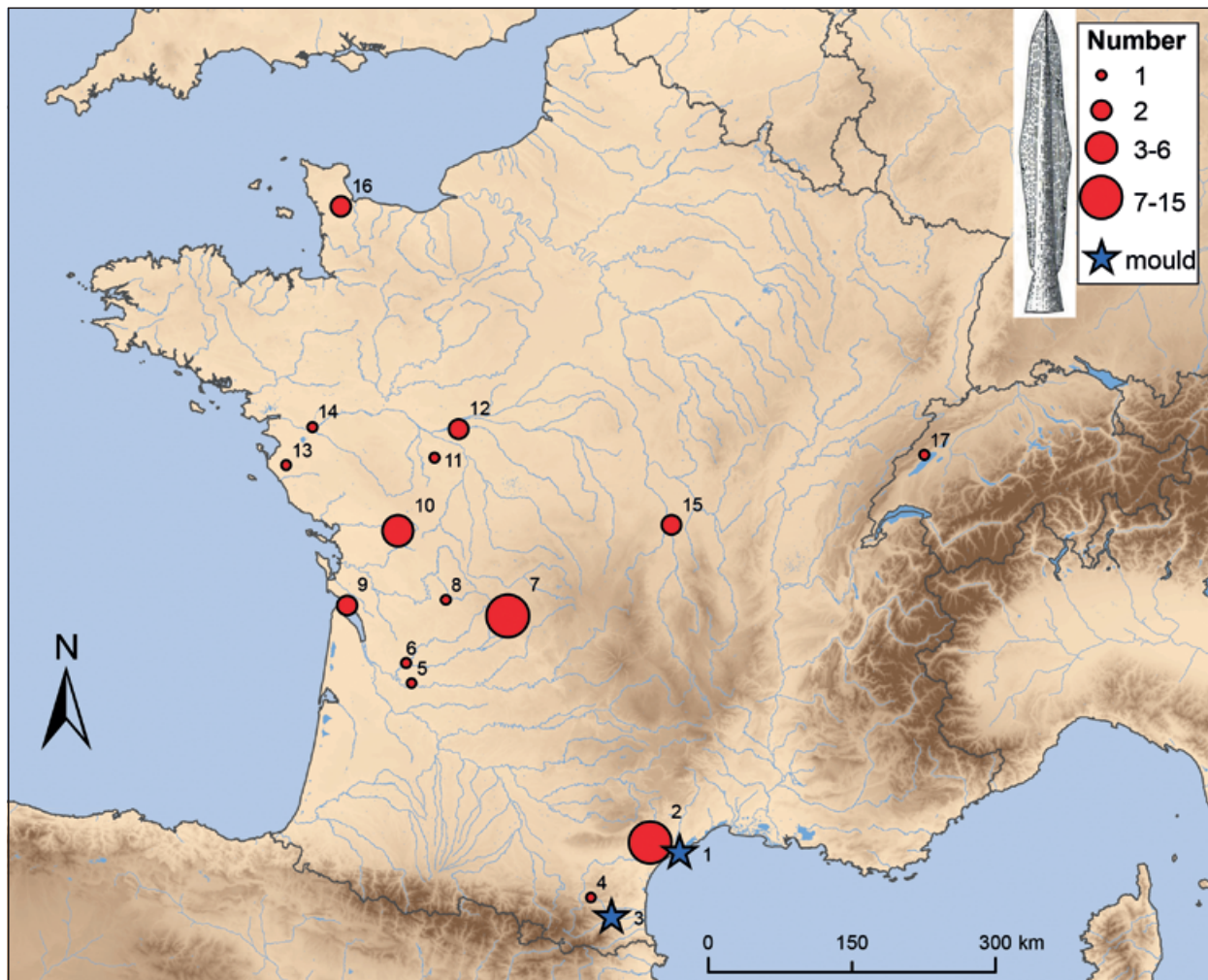
**Fig. 10** Map of the geological formations containing sandstone, schist or mica schist in central Languedoc. – (BRGM data; GIS Th. Lachenal).

(départ. Aude/F) (2), and at the Lombrives cave in Ussat (départ. Ariège/F) (3), as well in the Alpes-Maritimes at the Cave Biénès in Antibes (départ. Alpes-Maritimes/F) (Campolo 2013). The use of this rock thus seems to be limited to the sectors closest to the sources of raw material, present in the Queyras (Gambari/Rubat-Borel/Campagnoni 2007; Rigaud 2007) and in the Ariège at Luzenac (Boutin 2016).

The raw materials used to make the moulds from the south of France are most often supposed to be of local or regional origin (Simonnet 1970; Gascó 1996; Cert 1998). However, with regard to the specimens from Camp-Redon in Lansargues and Tonnerre I in Mauguio (départ. Hérault/F), M. Py notes that the observations by J.-L. Reille concluded that an alpine origin was »totally acceptable« for the chloritite and that »nothing seems to dispute« the same for the carbonaceous sandstone from which these specimens were made (Py 1990, 521-523).

As for the specimens from La Motte, a petrographic analysis would of course be useful to more precisely characterise the nature of the materials and identify their origin. It is possible, however, to note that the types of rock used are potentially present on the fringes of the Hérault valley (fig. 10). At its closest, sandstone can be found 10 km away, in the terraces of the Montblanc area, on the right bank and near Florensac on the left bank, in Pliocene strata associated with sand and conglomerates. It can also be found in the alluvium of the Hérault River. The schistose formations are located farther to the north, about 30 km away, near Cabrières. It should also be noted that schist pebbles are transported by the Hérault River, with some even being discovered in archaeological layers. Mica schist is less common in the region, but can still be found near Lamalou-les-Bains, on the edge of the Mont Caroux, 40 km from La Motte.



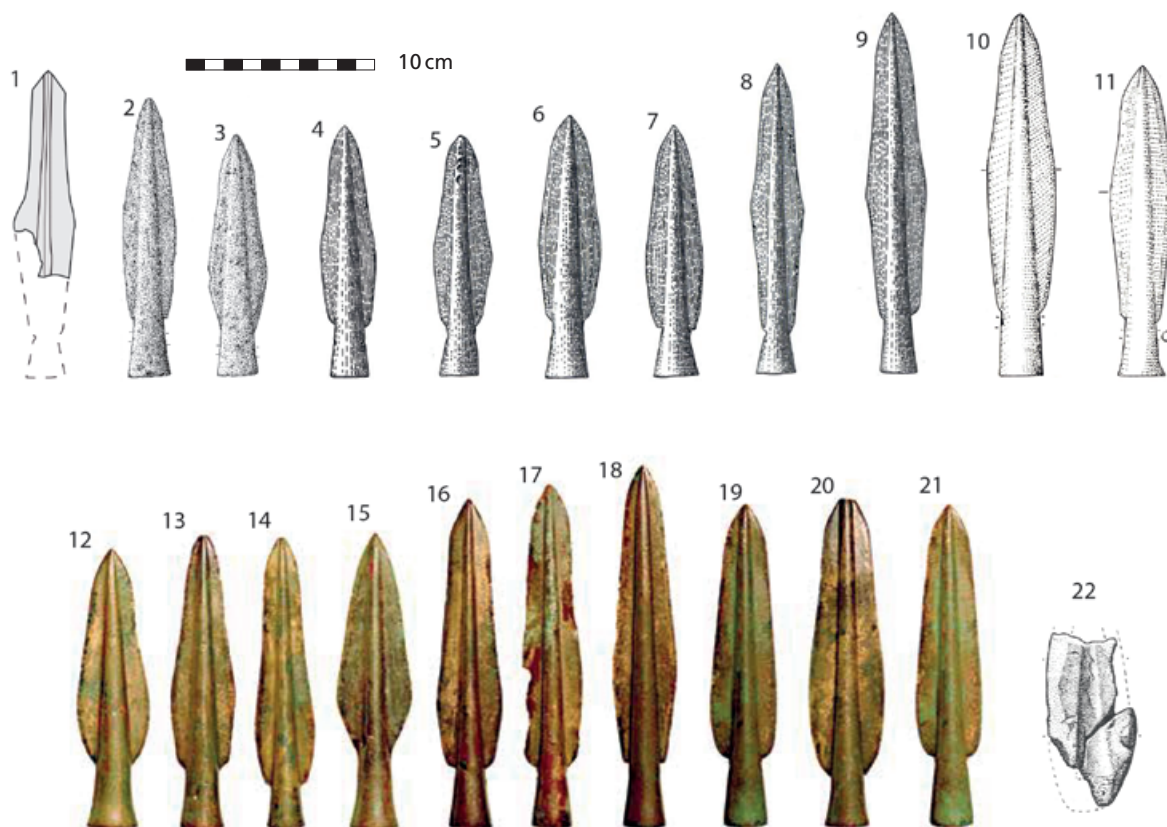


**Fig. 11** Distribution map of spearheads of the Vénat type: 1 La Motte, Agde. – 2 Rieu-Sec hoard, Cazouls-lès-Béziers. – 3 Caune de Bélesta. – 4 Les Fountelos. – 5 dredging of the Dordogne. – 6 dredging of the Isle. – 7 Vénat hoard, Saint-Yrieix-sur-Charente. – 8 Quéroy cave. – 9 Meschers hoard. – 10 Triou hoard. – 11 Rossay. – 12 Azay-le-Rideau hoard. – 13 Challans hoard. – 14 Prairie de Mauves hoard, Nantes. – 15 Champ de la Famine hoard, la Ferté-Hauterive. – 16 Auvers hoard. – 17 Auvernier. – (GIS Th. Lachenal, after Coffyn/Gomez/Mohen 1981, map 3, modified).

## THE OBJECTS PRODUCED

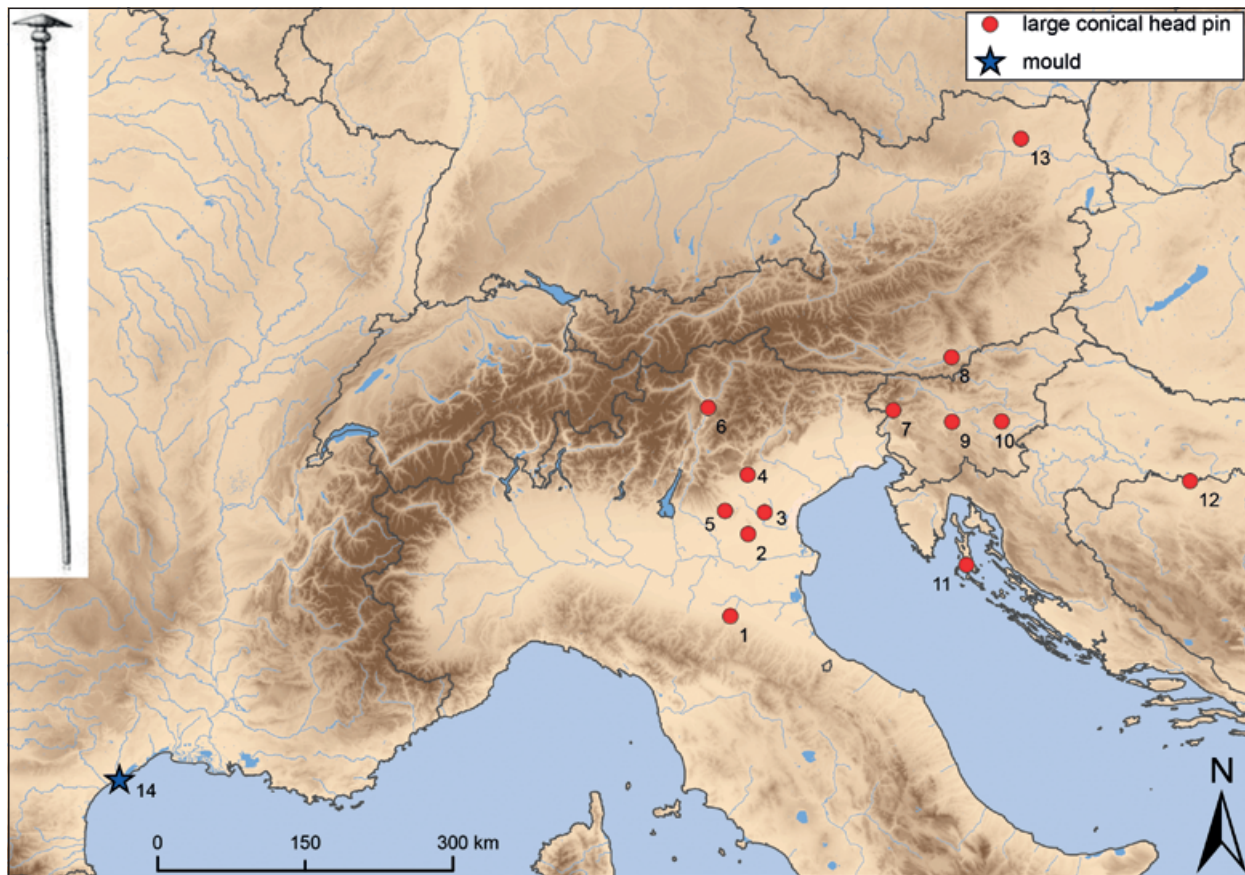
### Spearhead of the Vénat Type

The mould from D98 (fig. 5) was used to produce a spearhead with a lozenge-shaped blade that is close to the specimens of the Vénat type. According to their definition, the latter have »a short, flared socket, blade edges incurvate near the middle and ending in a pointed tip, while the base is connected to the socket by a slight notch« (Coffyn 1985, 48). Despite the absence of the lower part of the matrix, the shape of the blade edges and of the tip clearly points to this type of object. This weapon is characteristic of the horizon of the latter part of the Atlantic Late Bronze Age 3 (Milcent 2012, 139), contemporary to the Late Bronze Age III B in the south of France. It is distributed mainly over the French Atlantic coast, with a concentration in the centre-west between the Loire and the Gironde (figs 11-12). A. Coffyn's initial inven-



**Fig. 12** Comparison of the matrix of the mould of D98 (1) to whole spearheads belonging to the Vénat type (2-21) and to the mould fragment from Bélesta (22). – 2-3 Meschers. – 4-9 Triou. – 10-11 Vénat. – 12-21 Cazouls-lès-Béziers. – (1 see fig. 5; 2-3 after Gachina et al. 2008; 4-9 after Cordier 2009; 10-11 after Coffyn/Gomez/Mohen 1981; 12-21 after Dedet/Marchand 2015; 22 after Cert 2000). – Scale 1:4.

tory integrated specimens from Great Britain and the Iberian Peninsula into this type, but this attribution was questioned by C. Burgess and B. O'Connor (2008). It is clear that these blades differ from the model as defined by Coffyn himself. The same is true for the loam mould of Peña Negra (prov. Alicante/E), the matrix of which has sometimes been likened to the spearheads of the Vénat type, something that has also been called into question (Burgess/O'Connor 2008, 55). This type of weapon is, however, also known in Languedoc, in the Rieu-Sec hoard in Cazouls-lès-Béziers (dép. Hérault/F), as well as at Les Fountelos in Bugarach (dép. Aude/F) (Guilaine 1972, figs 111, 4; 113, 1; Dedet/Marchand 2015, fig. 5). Another element supports the association of the matrix from La Motte with this type of spearhead: another mould fragment, corresponding to the lower part this time, discovered in occupation levels from the end of the Bronze Age at the Bélesta cave (dép. Pyrénées-Orientales/F) (Cert 1998; 2000). The socket is short and the junction with the blade is marked by the characteristic notch of these weapons. The blade, although incomplete, has the lozenge shape of the spearheads of the Vénat type (Cert 2000, fig. 4 no. 2; fig. 12, 22). The metal objects closest to the La Motte matrix correspond to the largest known specimens in the eponymous hoard of Vénat and in those of Triou (dép. Deux-Sèvres/F) and Cazouls-lès-Béziers (Coffyn/Gomez/Mohen 1981, pl. 11, 7; Pautreau/Gendron/Bourhis 1984, figs 13-14; Dedet/Marchand 2015, fig. 5; fig. 12, 8-10, 17-18). They are distinguished in particular by the concavity and the slight dissymmetry of the distal part of the blade. Judging by the mould from La Motte, this feature is not due to wear on the objects.



**Fig. 13** Distribution map of large conical head pins: **1** Benacci, Bologna. – **2** Este. – **3** Via Tiepolo, Padova-S. Massimo. – **4** San Giorgio di Angarano. – **5** Montebello Vicentino. – **6** Vadena. – **7** Tolmin. – **8** Grabelsdorf. – **9** Ljubljana. – **10** Mokronog-Slepšek e Oostrožnik. – **11** Osor. – **12** Donja dolina. – **13** Großweikersdorf. – **14** La Motte, Agde. – (GIS Th. Lachenal; after Škvor Jernejčič 2014, fig. 5, modified).

### Pin with a Large Conical Head

The fragmented matrix visible on face B of the mould of D85 (**fig. 4**) can be interpreted as that of a pin with a large conical head, sometimes also called a pin with an »umbrella-shaped head<sup>2</sup>«. It differs, however, from the specimens discovered in alpine lakeside settlements (Audouze/Courtois 1970, 47-48), characteristic of the Late Ha B3, from the end of the 9<sup>th</sup> century BC (David-Elbiali 2013), which have a smaller head. A parallel also exists with some specimens of the Limberg type described by J. Říhový (1979, pls 62, 1714; 63, 1727). But the closest comparisons can be made in the contexts of the Early Iron Age in the Caput Adriae, in northeast Italy, Slovenia and Croatia. The Italian specimens were classified by G. L. Carancini into various types (Angarano, Porto Sant’Elpidio, San Costanzo, Caprara) dating to the 8<sup>th</sup> century BC (Carancini 1975, 268-276 pl. 62). This dating, confirmed by Ch. Pare (1998), was nevertheless moved back to the 9<sup>th</sup> century BC for certain specimens (Peroni/Vanzetti 2005; Dore 2005). More recently, B. Škvor Jernejčič proposed a distinction between the true pins with an umbrella-shaped head of the Porto Sant’Elpidio type, with a rounded, hollow end, and those with a solid conical head. The latter can be divided into two types according to the size of the disc on the end (Škvor Jernejčič 2014). The matrix of the La Motte mould is close to the type with a large conical head that is found in the necropolises of Bologna and Este (prov. Padova/I), as well as in Slovenia and Croatia (**fig. 13**). The most precise dating contexts are provided by tomb 581 in the Bologna-Benacci necropolis, dating to the IIA phase around 820-800 BC

and the Großweikersdorff hoard (Bez. Tulln/A), attributed to the Ha B2-3 (Škvor Jernejčič 2014, 144) or the 9<sup>th</sup> century BC.

### Bar-shaped Ingots

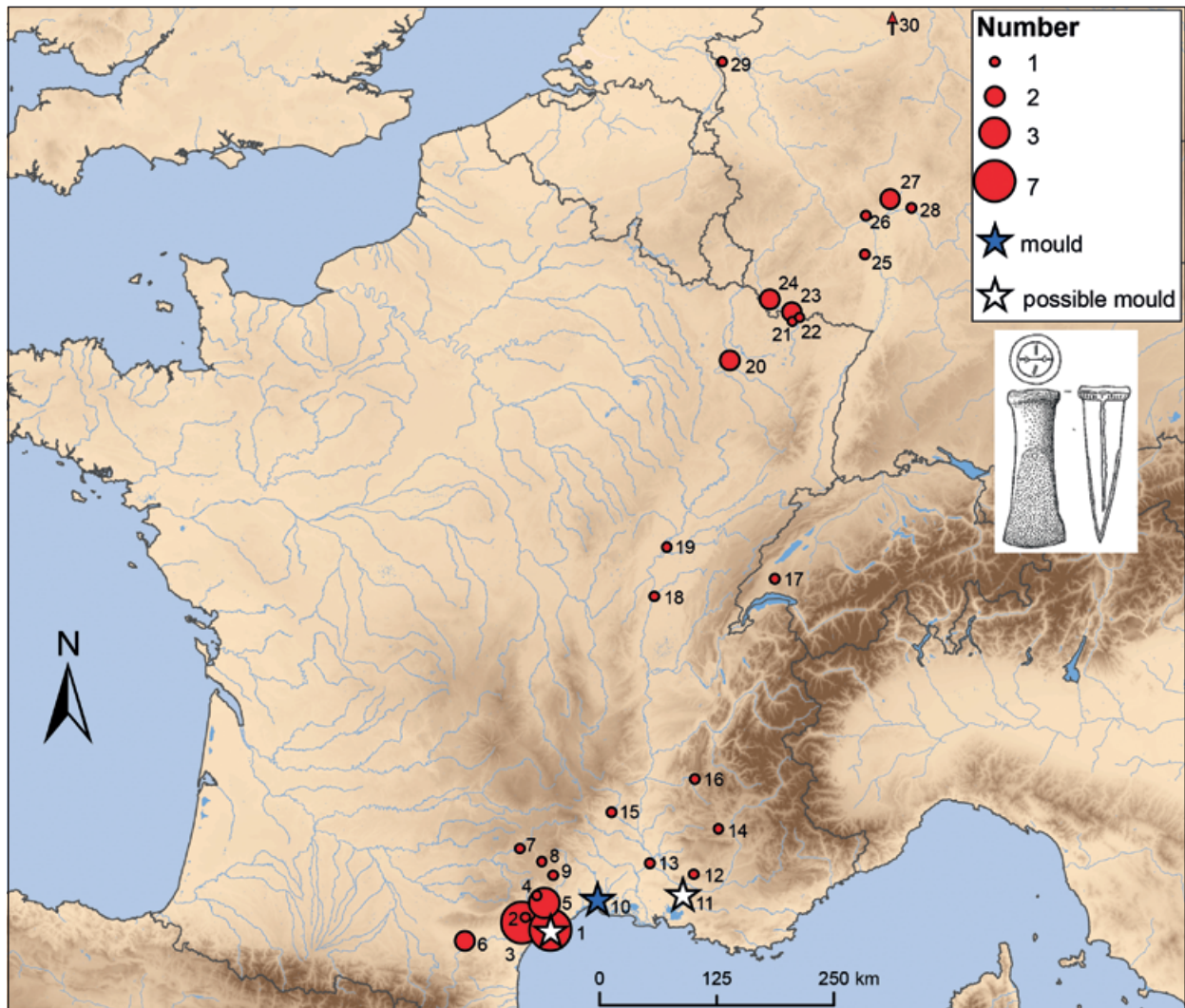
Face B of the mould of D105 (**fig. 7**) was used to produce elongated bars with a trapezoidal or semi-circular cross-section. Given the absence of a dowel hole, unlike face A of the same object, it is probable that this face was used as a single valve. It is thus possible to interpret these objects as bar-shaped ingots. Elements of this type but with a bulkier shape were discovered in the Terra-Fort hoard in Octon (dép. Hérault/F) (Garcia 1993, fig. 37, 5-6), which can be attributed to the middle phase of the Late Bronze Age (Beylier 2011, 123). Similar semi-finished products also come from the Les Châtelliers hoard in Amboise (dép. Indre-et-Loire/F) (Cordier 2002a, fig. 8, 26-28), which dates to the latter part of the Atlantic Late Bronze Age 2, around 1050-950 BC (Milcent 2012). The Unadingen hoard in Baden-Württemberg (Lkr. Breisgau-Hochschwarzwald/D) also contained two such specimens. This context can be attributed to the Ha B3 by the presence of bracelets of the Homburg type (Müller-Karpe 1959, pl. 177C, 1-2). The bar-shaped ingots from the hoards of Santa Marinella (città metropolitana di Roma/I) in Latium and Goluzzo (prov. Siena/I) in Toscana also date to the end of the Bronze Age (Fugazzola Delpino/Pellegrini 2009/2010, figs 18, 1-4; 47, 11). In the south of France, this type of object was still present in the Early Iron Age, in the Launacian hoards of the 6<sup>th</sup> century BC (Guilaine et al. 2017, fig. 4). Elemental analyses revealed that the bar-shaped ingots from these hoards were all the result of an alloy, of copper and tin or of copper and lead, but their composition is not comparable to that of the manufactured objects from the same contexts. This means that they cannot be considered to be the result of the remelting of these objects or even blanks. The hypothesis was put forward that the metallurgist used them to adjust the alloys in order to control the desired concentration of copper, tin and lead (Guilaine et al. 2017, 136. 159). Finally, it should be noted that the Bélesta cave site, already mentioned with regard to the mould for a spearhead of the Vénat type, also contained a matrix that could have produced bar-shaped ingots (Cert 1998, pl. 12, 1).

### Axe of the Frouard Type, Hanau Variety

Face A of the mould of D120 (**fig. 6**) can be attributed to a matrix for a socketed axe with a flat blade of the Frouard type (Briard/Verron 1976, 71-72; Chardenoux/Courtois 1979). By analogy to four metal objects discovered at the site itself, we propose the interpretation of a variant without a loop (**fig. 14**), of the Hanau variety, for which K. Kibbert distinguished a variant specific to southern France (Kibbert 1984). Moreover, one of the axes from La Motte could have been produced using this mould. This type is particularly well represented regionally in the Late Bronze Age IIIB Rieu-Sec hoard in Cazouls-lès-Béziers (Guilaine 1972, fig. 112, 2; Chardenoux/Courtois 1979, pls 50, 891-896; 51, 897). In the La Motte mould, like in the metal specimens, the bevel of the blade is underlined by a slight groove that can also be found in Die (dép. Drôme/F) and at Buoux (dép. Vaucluse/F) (Chardenoux/Courtois 1979, pl. 55, 899. 906). This shape persisted into the Early Iron Age, as evidenced by the Launacian hoards in Carcassonne (dép. Aude/F) and at Butarès in Péret (dép. Hérault/F) (Guilaine et al. 2017, fig. 5, 1-2), but seems to have shrunk slightly. As far as it's known for the moment, the distribution of this type is concentrated in two areas. The first in southern Germany (Kibbert 1984) and eastern France, and the second in southern France (**fig. 15**). Moreover, in this region, local production is attested by the presence of other moulds at Camp-Redon in Lansargues (Dedet/Py 1985, fig. 53) and in the tumulus at



**Fig. 14** Fragment of the mould from square D120 and examples of socketed axes with a flat blade from La Motte. – (Photo Th. Lachenal).



**Fig. 15** Distribution map of the socketed axes with a flat blade of the Frouard type, without a loop (Hanau variety): **1** La Motte, Agde. – **2** La Croix de Mus hoard, Murviel-lès-Béziers. – **3** Rieu-Sec hoard, Cazouls-lès-Béziers. – **4** Terra-Fort, Octon. – **5** Bautarès hoard, Péret. – **6** Carcassonne hoard. – **7** La Clapade cave, Millau. – **8** Camp of Los Goïnos, Sauclières. – **9** Soulagets cave, Saint-Maurice-Nava-celles. – **10** Camp-Redon, Lansargues. – **11** Moullard sud, Lambesc. – **12** Buoux. – **13** Avignon. – **14** Barret-sur-Méouge. – **15** dolmen of Labeaume. – **16** Abbaye de Valcroissant, Die. – **17** Echallens hoard. – **18** La Truchère. – **19** Saône Valley. – **20** Frouard hoard. – **21** Saar area. – **22** Reinheim. – **23** Brembach, Saarbrücken. – **24** Saarlouis-Roden. – **25** Hangen-Weisheim. – **26** Wiesbaden. – **27** Bad Homburg. – **28** Hanau. – **29** Niers bei Weeze. – **30** Øster Løgum. – (GIS Th. Lachenal; after Guilaine et al. 2017, map 4; Jockenhövel 1981, fig. 7, modified).

Moullard sud in Lambesc (dép. Bouches-du-Rhône/F), dating to the 8<sup>th</sup> century BC (Cordier 2002b, fig. 6, 3). The latter is fragmented, however, so it is not possible to determine whether it was used to cast axes of the Frouard type with or without a side loop. Furthermore, it was reused to create bracelets with moulded decoration of the Lauzières type (Lachenal 2017). In the present state of knowledge, it is difficult to say whether a relationship exists between the axes of this type from southern France and the other specimens.

## CHRONOLOGY

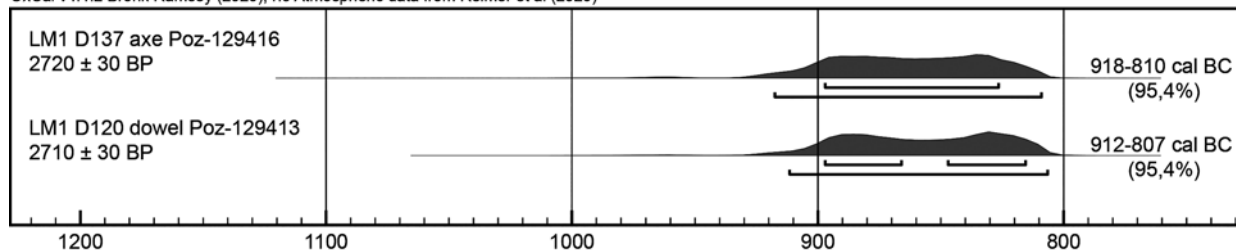
The various identified objects produced using the moulds from La Motte exhibit coherent dating to the end of the Bronze Age. The spearheads of the Vénat type are found exclusively in the hoards from the Atlantic Late Bronze Age 3 of the chronology of P.-Y. Milcent (2012). When a more precise date is possible, the result is systematically the latter part of the Atlantic Late Bronze Age 3, like for the eponymous hoard, but also those of Auvers (dép. Manche/F), the Prairie de Mauves in Nantes (dép. Loire-Atlantique/F), Challans (dép. Vendée/F), Azay-le-Rideau (dép. Indre-et-Loire/F), and Triou. This period can be synchronised with the Ha B3 of the Central European chronology, corresponding to the 9<sup>th</sup> century BC (Milcent 2012, 170). One instance of the Vénat type is suggested, however, in the earlier part of the Atlantic Late Bronze Age 3 by its presence in the Rieu-Sec hoard in Cazouls-lès-Béziers (Milcent 2012, 125). Although this hoard was indeed ascribed to an older phase of the Late Bronze Age III (Guilaine 1972, 295-296), following P. Schauer (1975), its date should be moved up to the Late Bronze Age IIIB.

As we have seen, the pins with a large conical head can also be dated to the 9<sup>th</sup> century BC. With regard to the axes with a flat blade of the Frouard type without a side loop, their association with spearheads of the Vénat type in Cazouls-lès-Béziers also indicates production in the Late Bronze Age IIIB, which is confirmed by radiocarbon dating carried out on wood present inside the socket of a specimen from La Motte, centred on the 9<sup>th</sup> century BC. Additionally, a similar date was obtained for the wooden dowel of the mould from square D105 (fig. 16).

The casting moulds from La Motte must therefore be generally dated to the 9<sup>th</sup> century BC. This period, corresponding to the Late Bronze Age IIIB of the Mailhac style of the regional chronology, matches the main phase of occupation of the site (Lachenal et al. 2020).

## LOCAL AND EXOTIC OBJECTS

In addition to providing some of the most direct evidence for the identification of bronze-casting workshops, moulds are some of the most relevant remains for identifying the areas of production of types of metal objects. Nevertheless, the answer to this type of question is most often sought out in the zones of distribution of the finished objects. However, cases in which the location of the matrices does not overlap with that of the manufactured products are not rare. The moulds from La Motte are rather representative of this problem: some of the objects that they were used to produce are frequent in the region, but others are much rarer or even unknown. The first case relates to the socketed axes with flat blades without a side loop (fig. 15). This type, very well represented in the southeast of France and in particular in Languedoc, undoubtedly appears to be produced locally, which the presence of three potential moulds does not contradict. The presence of a matrix and metal axes of the same type at La Motte also supports this hypothesis. But what about the presence of this type in the valley of the Saar and the upper Rhine? Is this the consequence of an independent centre of development of this form of tool, or is it evidence of relations between



**Fig. 16** Radiocarbon dating of the wooden dowel of the mould from square D105 and of the wood contained in the socketed axe with a flat blade. – (OxCal v4.4.2 Bronk Ramsey [2020]; atmospheric data from Reimer et al. 2013; illustration Th. Lachenal).

the two regions? The pieces that could attest to a relay point are rare but perhaps underestimated. Some examples show a superposition of the area of diffusion of a metal type and the evidence of its production. This is the case for the mould from the tumulus at Moullard sud in Lambesc: before being used to produce socketed axes of the type mentioned above, it was used to create bracelets with moulded decoration of the Lauzières type. In this case, the matrix occupies a central position in the very limited area of diffusion of these ornaments (Lachenal 2017, fig. 14).

This configuration might be considered a textbook case, but in reality, it is far from the norm. Indeed, in many situations, the moulds are actually on the fringes or even outside of the known area of diffusion of the metal objects that they were used to produce. A good example is provided by the bivalve sword mould of Piverone (città metropolitana di Torino/I) in Piedmont. Its three faces allowed the production of swords of the Erbenheim type, from the Late Bronze Age IIB, distributed mainly in the basin of the Rhine, the Seine and the Saône. Although some examples are also known in England, northern Germany, and the Danube basin, no metal sword of this type has been found in Italy (Gambari/Rubat-Borel/Campagnoni 2007, 135 fig. 8). At Toceno (prov. Verbano-Cusio-Ossola/I), also in Piedmont, there was a mould for a razor with an open-work handle decorated with a Saint Andrew's Cross, the metal shape of which is likewise not documented south of the Alps (Gambari/Rubat-Borel/Campagnoni 2007). These two moulds were, however, made from soapstone, the local origin of which is highly probable. The deposit of moulds at Simiane-Collongue (départ. Bouches-du-Rhône/F), dating to the end of the Middle Bronze Age (BA C2), evokes a similar situation (Vital 1999). One of the matrices was thus used to create pins with mobile flanges of the Vers-Vernaison type, mainly diffused to the north of the discovery, along the Saône-Rhône axis (Vital 1999; 2002, fig. 49). Another mould from the same deposit, intended to produce a dagger of the Veruno type, points in the opposite direction: this type is mainly documented in the plain of the Po and the northwest Alps<sup>3</sup> (David-Elbiali 2000, map 4). Another mould for a dagger of this type comes from Capificu (départ. Haute-Corse/F) and is made from steatite, which is available 30 km from the site (Peche-Quilichini et al. 2014, fig. 5 no. 1). The mould from Plumieux (départ. Côtes-d'Armor/F), intended for the production of pins with a large annular head that are characteristic of the Middle Bronze Age in the south of England, is also representative of this disconnect between the place of production and the area of diffusion of a metal type (Nordez 2019, fig. 27). The case of the *tintinnabula* from the end of the Bronze Age is likewise suggestive. A mould for an object of this type comes from Offenthal (Lkr. Offenbach/D), in the Rhine and Main region. While the whole specimens were discovered near this matrix, in Lorraine and in southwest Germany, fragments attest to the presence of this type of object in other regions of France and in particular in the centre-west (Gachina et al. 2008, 173 fig. 5). This example suggests that the models, if not the products of metallurgy, are not necessarily diffused concentrically from their place of development. They can, however, travel along axes that may correspond to networks of exchange or diplomatic relations.

This configuration can be likened to the distribution of the spearheads of the Vénat type (**fig. 11**). The latter are especially documented in the centre-west, but they are also present in the south of France, in particular, if the number of known objects and their state are taken into consideration. Thus, after the eponymous hoard, the next-largest quantity comes from the Rieu-Sec hoard in Cazouls-lès-Béziers, with eight spearheads corresponding to the canonical type and two others possibly forming variants thereof, without a notch at the base (Dedet/Marchand 2015, fig. 5; **fig. 12, 12. 15**). Then comes the Triou hoard, with six whole spearheads, and those at Meschers (dép. Charente-Maritime/F) and La Ferté-Hauterive (dép. Allier/F), which contained two each (Pautreau/Gendron/Bourhis 1984, figs 13-16; Gachina et al. 2008, fig. 1, 1-2; Gauthier 2003, fig. 23; **fig. 12**). Another whole object comes from the Quéroy cave in Chazelles (dép. Charente/F), but belongs more to the variant also known in Cazouls-lès-Béziers (Gomez de Soto et al. 1991, fig. 15, 1). In the other Atlantic contexts, the spearheads of the Vénat type are mainly found in fragments, in the hoards of Auvers, the Prairie de Mauves, Challans and Azay-le-Rideau (Germond et al. 1988, fig. 2, 14. 22; Briard 1966, no. 418; Verney 1990, no. 31; Cordier/Millotte/Riquet 1959, pl. 3, 30-31).

However, the fact that the only two known moulds for the production of these weapons come from near the Gulf of Lion poses the question of their geographic origin. The spearheads of the Vénat type have traditionally been interpreted as Atlantic products (Coffyn/Gomez/Mohen 1981; Briard/Mohen 1983, 134; Milcent 2012, 139), and those discovered in Cazouls-lès-Béziers and Bugarach as resulting from imports of objects or at least of a model (Gomez de Soto/Milcent 2000, 351). The presence of moulds in La Motte and Bélesta allows at least for the conclusion that there was local manufacturing of this type of weapon. Moreover, no detail allows the southern products to be distinguished from the Atlantic ones; the same variability in form can be found in both regions. Should it not therefore be possible to reverse the direction of exchanges initially proposed? The lesser representation of these objects in Languedoc could thus be explained by the small number of hoards known in the region. Besides that of Cazouls-lès-Béziers, the only hoard from the Late Bronze Age III B is the one of axes at Ornaisons (dép. Aude/F) (Guilaine 1972). The absence of moulds in the Atlantic domain can, however, be the result of a technological choice, since the use of non-permanent loam moulds seems to have been preferred in this province at the end of the Bronze Age (Fleury 1991; Gomez de Soto 2020). This technique is much rarer in the south of France, with the only examples mentioned being at the Baumon de Briasq cave (dép. Alpes-Maritimes/F) (Vindry 1978). Too much remains unknown for this question to be resolved entirely. Nevertheless, the possibly somewhat iconoclastic proposition of situating the zone of production of the spearheads of the Vénat type in the Gulf of Lion sector can be seriously considered. In addition, a spear butt of the Cazouls type was discovered in the hoard at Triou, even though these objects are interpreted more as a product of the south (Pautreau/Gendron/Bourhis 1984, fig. 23 no. 20; Gomez de Soto/Milcent 2000, 353-354). Could they not have been associated with spearheads of the Vénat type on the same shaft?

With regard to the pins with a large conical head, the problem is yet again different. The type, especially common in the north Adriatic, is not documented in the southeast of France, and the closest specimens are more than 600 km away. This might be the effect of a lack of documentation. For example, similar specimens with a small head are known in the French Alps (David-Elbiali/Dunning 2005). Moreover, in their eastern distribution, certain pins with a large conical head are quite far from their area of concentration (**fig. 13**). It should also not be forgotten that the moulds could represent objects that are not known archaeologically, like the dagger of the matrix from the Perrats cave in Agris (dép. Charente/F) (Gomez de Soto 2018). The similarities between the mould from La Motte and the Adriatic specimens allow the existence of contacts between this region and the south of France at the end of the 9<sup>th</sup>-beginning of the 8<sup>th</sup> centuries BC to be supposed. With regard to the belt with conical buttons from the La Motte deposit, it was possible to establish parallels with artefacts from the necropolises of Chiavari (città metropolitana di Genova/I) in coastal



Liguria and Sorbo at Cerveteri (città metropolitana di Roma/I), in Latium (Verger et al. 2007, 137). They point to the existence of elite exchange networks which, although sporadic, can stretch over long distances.

### **ITINERANT CRAFTSMEN?**

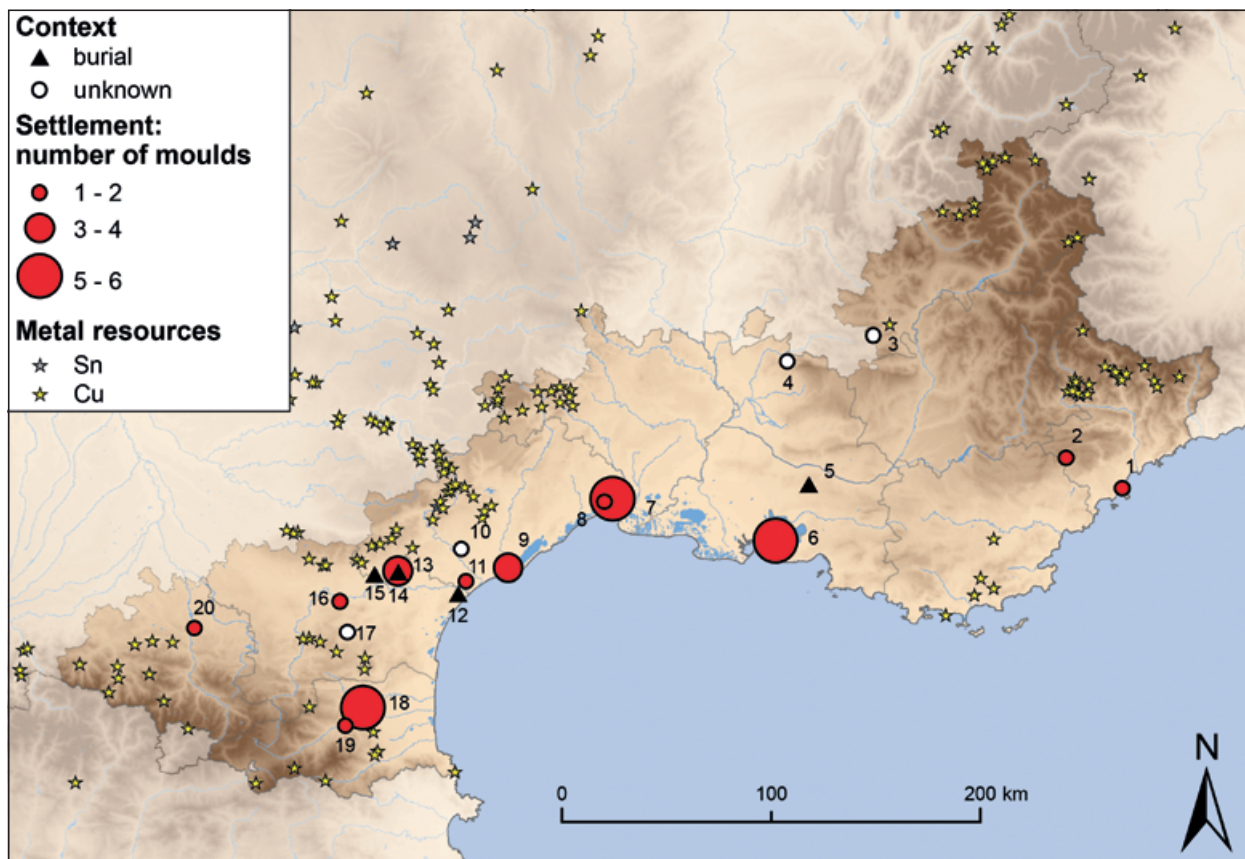
The presence of moulds intended to create objects considered to be exotic for the region can pose the question of them being brought to the site by itinerant craftsmen. This is the conclusion reached by O. Dietrich regarding the matrices for casting socketed axes discovered at the Mediaş site (jud. Sibiu/RO), on the basis of which he proposed reconstructing the travels of an individual from the south of the Carpathian Basin (Dietrich 2012). The debate is not new: the proposition of seeing the metallurgists as specialists moving from one site to another had been introduced by V. G. Childe (1930, 3-5; 1936, 9). This is also the hypothesis of M. Py with regard to the cultural groups of the Late Bronze Age III B in the south of France. Based on a possible Alpine origin of the materials of the casting moulds discovered at the sites of Camp-Redon and Tonnerre I, he put forward the hypothesis that metallurgy was reserved for travelling craftsmen and was not a part of the manufacturing economy of villages (Py 1990). Childe's concept was subject to sharp criticism in the 1970s by M. J. Rowlands<sup>4</sup> on the basis of ethnographic comparisons. The latter does, however, acknowledge the existence of situations in which craftsmen specialised in metalwork would travel around, but this would occur most often in a nearby environment and cultural context (Rowlands 1971, 214). Successive works introduced an intermediate notion, with semi-specialised village craftsmen and others who were more qualified, producing prestige goods intended for the elites (Burgess 1980) and being potentially more prone to travel in relation to specific commissions. This »self-organised« operating mode (Kienlin 2008; 2013) seems to best take into account the archaeological data of the European Bronze Age (Molloy/Mödlinger 2020). Metal productions can show different degrees of expertise, as opposed to an activity organised only by craftsmen with a high level of skill (Kuijpers 2018). In the case of La Motte, the objects produced and the technique used (casting in a permanent mould) do not seem to signal the presence of highly skilled craftsmen<sup>5</sup>. The hypothesis that should be preferred here seems to be that of metallurgical production wholly integrated into the site's economy. Is this arrangement representative of all the settlements of the end of the Bronze Age in Mediterranean France, or does it denote a particular status for La Motte?

### **THE MOULDS FROM THE END OF THE BRONZE AGE IN MEDITERRANEAN FRANCE**

The resolution of this question involves an assessment of the knowledge of casting moulds from the south of France, which was in large part established by C. Cert for Languedoc and the Pyrenees (Cert 1998; 2000). Here, we address only those objects with a date that could be contemporary to the occupation of the La Motte site, between the 10<sup>th</sup> and 8<sup>th</sup> centuries BC. The contexts in which these objects were discovered that are known are burial sites or settlements (fig. 17).

#### **The Moulds in the Funerary Space**

Three objects come from cremation necropolises in western Languedoc. For two of them, Les Cayrols in Fleury and Las Fados in Pépieux (départ. Aude/F), the precise context of the moulds is not known (Louis/Taffanel/Taf-



**Fig. 17** Map of the findings of casting moulds from the end of the Bronze Age (10<sup>th</sup>-8<sup>th</sup> century BC) in Mediterranean France: **1** Cave Biènès, Antibes. – **2** Abri du Baumon de Briasq, Escragnolles. – **3** Sainte-Colombe. – **4** Grotte du Levant, Malaucène. – **5** tumulus du Mouillard sud, Lambesc. – **6** Abion, Martigues. – **7** Tonnerre I, Mauguio. – **8** Camp-Redon, Lansargues. – **9** La Motte, Agde. – **10** Corneilhan. – **11** Portal-Vielh, Vendres. – **12** Les Cayrols, Fleury. – **13** Le Cayla, Mailhac. – **14** Le Moulin, Mailhac. – **15** Las Fados, Pépieux. – **16** Le Laouret, Floure. – **17** Mayronnes. – **18** Caune de Bélesta. – **19** oppidum d’Arsa, Sournia. – **20** Carbon, Varilhes. – (GIS Th. Lachenal).

fanel 1958, 74 fig. 51, 6). The fragment discovered in the Le Moulin necropolis in Mailhac (départ. Aude/F) comes from a »deposit« that did not contain any bones. In the tumulus at Mouillard sud in Lambesc, four fragments of the same mould were dispersed around the edge of the burial mound, inside the circle of rock defining it, in three opposite sections (Cordier 2002b, 564). Therefore, it is not clear whether this metallurgical tool personifies the deceased and signals their function as metallurgist in the community. This discovery, along with that of Le Moulin, also indicates that the moulds were used in the context of symbolic activities occurring around the edge of the tomb rather than as accompanying goods. This situation does not differ from the rest of western Europe, where the burials that could be identified as those of metallurgists are rare (Jockenhövel 2018). This absence of personification of bronze workers in death is another argument for considering, after B. Nessel, that this activity is integrated into the community (Nessel 2013, 144).

### The Moulds in the Settlements

There are twelve sites recognised as settlements that contained moulds, but only five of them contained more than two specimens (fig. 17). Besides La Motte, these are L’Abion in Martigues (départ. Bouches-du-Rhône/F), Camp-Redon, Le Cayla in Mailhac (départ. Aude/F), and the Bélesta cave. These sites, 50-80 km

apart, may correspond to major centres of production and diffusion of metallurgy. Moreover, it should be noted that the coastal sites are particularly well represented in the corpus, with half of the occurrences. Their connection to maritime and fluvial communication routes provided an undeniable advantage for the organisation of the trade of products manufactured from bronze. With regard to the sites located farther inland, it can be noted that they are never far from copper deposits; in most cases, the distance from the closest one is less than 15 km. Consequently, there appear to be two main models for the establishment of production sites. Some are close to the areas of extraction and have direct access to the raw material, while others are set up on the coast and take advantage of natural exchange routes to transport the ore and trade in metal products.

### **The Types of Objects Produced**

The types of objects produced at the sites of southern France at the end of the Bronze Age are of a large variety, but some stand out. These include end-winged axes, for which nine moulds come from the Grotte du Levant in Malaucène (départ. Vaucluse/F) (Campolo/Garcia 2004, no. 259), Sainte-Colombe (départ. Hautes-Alpes/F) (Muller 1991, 106), Le Moulin and Le Cayla in Mailhac (Cert 2000, fig. 6), Carbon in Varilhes (départ. Ariège/F) (Simonnet 1970, fig. 33), Camp-Redon in Lansargues (Tendille 1985, figs 50, 52), and L'Abion in Martigues (unpublished). This form of axe is particularly common in the south of France (Charde-noux/Courtois 1979, 97-99), and the frequency of the moulds confirms its production between the Alps and the Pyrenees. Socketed axes, already discussed above, are another example of these southern products, attested here by four moulds. The arrowheads made using the matrices of the Les Cayrols necropolis in Fleury and the Arsa oppidum in Sournia (départ. Pyrénées-Orientales/F) also correspond to types that are frequent in Languedoc between the end of the Bronze Age and the beginning of the Iron Age (Beylier 2012, 96-98). Other elements such as rings are more omnipresent, while moulds for pins do not allow the type to be precisely identified, like at Camp-Redon or Le Cayla (Tendille 1985, fig. 51, 25; Cert 2000, fig. 6). The presence of exotic objects like at La Motte is thus relatively rare, with the exception of Bélesta with the other mould identified for the production of spearheads of the Vénat type. Moreover, the mould fragment from the Cave Biénès in Antibes allowed an end-winged axe to be produced; in this axe, the divergent shape of the edges, the rectilinear stop ridge and the ogee butt are comparable to Italian axes, maybe of the Gabbro, Teor, Monte Primo or Pertosa types, all belonging to the Late Bronze Age and distributed mainly along the Tyrrhenian and north Adriatic coast of the Italian peninsula (Peroni 1980). With the exception of these several examples, the objects made at the production sites are for the most part distributed in the south of France. The manufacturing of bar-shaped ingots is also attested; in addition to the specimen from La Motte, there are two at Camp-Redon and two others at Bélesta (Tendille 1985; Cert 1998). Semi-finished products made of copper or bronze were thus also made at the sites that produced metal objects.

The data for the south of France thus suggests that metal production was concentrated at several settlements located either close to the ore or on the coast. This configuration could be related to the mode of occupation of the land, which was largely dominated during the Bronze Age by the presence of scattered or very loosely clustered settlements. The end of the period witnessed the appearance of larger sites located on high ground or near lagoons (Lachenal 2014), and some contained moulds, like Le Cayla in Mailhac, Camp-Redon and Portal-Vielh in Vendres (départ. Hérault/F). These settlements may therefore have had a central role in the organisation of territories, but also in the concentration of certain manufacturing activities of the communities of the end of the Bronze Age. Several pieces of evidence point to a special status for the site of La Motte: the discovery of the deposit of ornamental objects suggesting a female individual of high rank

(Verger et al. 2007), but also the herd management, which indicates a search for high-quality meat through the slaughter of young animals, which supposes a privileged social environment (Lespes et al. 2019). We have already mentioned the integration of the site into a network of settlements regularly established along the Hérault valley (Lachenal et al. 2020, 250) up to the Cabrières sector, the copper deposits of which were exploited at the end of the Bronze Age (Bouquet et al. 2006; Ambert et al. 2009). The discovery of several casting moulds at La Motte thus suggests a central role for this settlement in the production and distribution of objects and semi-finished products made from copper alloys manufactured at least in part with the ore from the Cabrières district.

## CONCLUSION

The discovery of four casting moulds concentrated in one sector of the La Motte site shows the presence of foundry activities in this settlement, fully integrated into its economy. Although one of the matrices was used to create tools well-attested regionally and at the site itself – socketed axes of the Frouard type without a loop (mould of D120, face A) – others were used to create objects that are rarer or even unknown in the region. This is the case of the matrices present on face A of the moulds of D85 and D105, for which the objects produced – circular appliqués and elongated rectangular links – do not have any direct parallels. Other moulds were used for the production of metal goods with shapes considered to be exotic, since they are less frequent in the region than in other sectors, like the spearheads of the Vénat type (mould of D98), or even totally unknown, like the pin with a large conical head (face B of D85). However, the presence at La Motte of permanent moulds intended for casting these objects demonstrates that they were produced locally. This observation gives some perspective on the value of maps of distribution of metal objects in identifying their zone of production. Various factors can skew the relevance of this data, in particular the fact that the practice of voluntary deposits made in a funerary or another context can vary from one region to another (Gorgues/Milcent 2018, 269-270).

We have seen that the hypothesis supported by the archaeological and ethnographic data is that of resident metallurgists carrying out their craft within the settlement. In any case, regardless of the circumstances that led to the production of these forms of metal objects, whether through individual movements or the transmission of ideas or expertise, they attest to the existence of networks that broadly exceed the regional context, sometimes extending over very long distances.

The system of exchange connecting the centre-west and the Mediterranean through the Gallic isthmus has already been highlighted (Gomez de Soto/Milcent 2000). The moulds for spearheads of the Vénat type provide new evidence thereof and could also reverse the direction of certain exchanges. The intertwining relations along the Aude-Garonne axis are also suggested by the spread of characteristics of the Mailhac 1 style all the way to the northern Albigeois, although their presence progressively decreases farther from the coast (Carozza 1997, 314; Janin 2000, 170). Beyond the material culture, it is the grouping together of the dead in cremation necropolises that is common to the coast of western Languedoc and the valley of the Garonne starting in the Late Bronze Age IIIB, then even more markedly at the beginning of the Iron Age (Dedet 2004). The relations with the eastern plain of the Po suggested by the mould for a pin with a large conical head are less known. Links between the decorations of Proto-Villanovan ceramics and those of the Mailhac 1 style have already been pointed out (Guilaine 1972), and a (shared?) origin from the northern Alps, related to the Rhine-Switzerland-eastern France culture, is now favoured (Gomez de Soto 1993). A link to the eastern plain of the Po, namely the area around the Frattesina site (prov. Rovigo/I), has been established for the middle phase of the Late Bronze Age through the import of glass beads (Gratuze/Billaud 2014) and

potentially of pick ingots. It is therefore possible that these relations were maintained through the very end of the Bronze Age.

As for the socketed axes, they attest to a network of regional relations maintained by a variety of production sites. Still, links to the west of Germany cannot be totally excluded after reading the map of distribution of the type.

These moulds for casting objects made of bronze thus place the site of La Motte in a multiplicity of networks extending in different directions. This observation is in line with that made for the deposit of ornamental objects, the elements of which also point to different regions: not just southern France, but also northern Italy and central Europe (Vergier et al. 2007). The site is entangled in long-distance exchanges, which would be bolstered by its coastal position. This participation in multidirectional networks of relations thus prefigures the special place that the area around Agde would occupy in the exchange routes connecting the Mediterranean to the Celtic world in the Early Iron Age.

## Acknowledgements

This project is supported by LabEx ARCHIMEDE from »Investir L’Avenir« program ANR-11-LABX-0032-01.

## Notes

- 1) The numbers indicate the grid units, which measure 2 m × 2 m. They were numbered according to their location in the site grid (Moyat et al. 2007; Lachenal et al. 2020).
- 2) *Capocchia ad ombrellino* in Italian.
- 3) Although a dagger from Cartinet tumulus 1 in Cabris (dép. Alpes-Maritime/F) may also illustrate this type (Vindry 1978, fig. 10 no. 16).
- 4) And also more recently (Niepert 2003).
- 5) Unlike other types of production such as swords, but especially beaten bronze production (vases, defensive weapons, etc.).

## References

- Ambert et al. 2009: P. Ambert / M. Laroche / V. Figueroa Larre / V. Klemm / S. Rovira / J.-L. Guendon / M. Prange, Cabrières et la métallurgie de la transition de l’Age du bronze et du Premier Age du fer (Launacien pro parte): état de la question. *Bulletin du Musée d’Anthropologie préhistorique de Monaco* 49, 2009, 99-114.
- Audouze/Courtois 1970: F. Audouze / J.-C. Courtois, Les Epingles du Sud-Est de la France (Départements Drôme, Isère, Hautes-Alpes, Savoie et Haute-Savoie). *Prähistorische Bronzefunde XIII*, 1 (München 1970).
- Bartoloni/Delpino 2005: G. Bartoloni / F. Delpino (eds), Oriente e Occidente: metodi e discipline a confronto. *Riflessioni sulla cronologia dell’età del Ferro in Italia. Atti dell’Incontro di Studi Roma, 30-31 ottobre 2003. Mediterranea 1* (Pisa, Roma 2005).
- Beylier 2011: A. Beylier, Les épées de l’âge du bronze dans le midi de la France. In: D. Garcia (ed.), *L’âge du bronze en Méditerranée. Recherches récentes* (Paris 2011) 115-130.
- 2012: A. Beylier, *L’armement et le guerrier en Méditerranée nord-occidentale au premier âge du Fer. Monographies d’Archéologie Méditerranéenne* 31 (Lattes 2012).
- Bouby et al. 2016: L. Bouby / Ph. Ponel / V. Girard / T. C. Chia / L. Garnier / M. Tillier / B. Devillers / Th. Lachenal / Ch. Tourrette / J. Gascó, Premiers résultats carpologiques et entomologiques sur le site subaquatique Bronze final de la Motte (Agde, Hérault). In: M.-F. Dietsch-Sellami / C. Hallavant / L. Bouby / B. Pradat (eds), *Plantes, produits végétaux et ravageurs. Actes des X<sup>e</sup> Rencontres d’Archéobotanique, Les Eyzies-de-Tayac 2014. Aquitania Suppl. 36* (Bordeaux 2016) 65-87.
- Bouquet et al. 2006: L. Bouquet / V. Figueroa-Larre / M. Laroche / J.-L. Guendon / P. Ambert, Les Neuf-Bouches (district minier de Cabrières-Péret), la plus ancienne exploitation minière de cuivre de France: travaux récents, conséquences. *Bulletin de la Société préhistorique française* 103/1, 2006, 143-159.
- Boutin 2016: A. Boutin, *Etude des conditions de formations du gisement de talc-chlorite de Trimouns (Ariège, France)* [PhD thesis Univ. Paul Sabatier – Toulouse III 2016]. <https://tel.archives-ouvertes.fr/tel-01578145/document> (17.1.2022).
- Briard 1966: J. Briard, *Dépôts de l’âge du bronze de Bretagne. La Prairie de Mauves à Nantes* (Rennes 1966).
- Briard/Mohen 1983: J. Briard / J.-P. Mohen, *Typologie des objets de l’Age du Bronze en France. 2: Poignards, hallebardes, pointes de lance, pointes de flèche, armement défensif* (Paris 1983).
- Briard/Verron 1976: J. Briard / G. Verron, *Typologie des objets de l’Age du Bronze en France. 3: Haches* (1) (Paris 1976).

- Burgess 1980: C. Burgess, *The Age of Stonehenge* (London 1980).
- Burgess/O'Connor 2008: C. Burgess / B. O'Connor, Iberia, the Atlantic Bronze Age and the Mediterranean. In: S. Celestino Pérez / N. Rafel i Fontanals / X.-L. Armada (eds), *Contacto cultural entre el Mediterráneo y el Atlántico* (siglos XII-VIII a. n. e.). La precolonización a debate (Madrid 2008) 41-58.
- Campolo 2013: S. Campolo, Moule fragmentaire, en pierre, de hache à ailerons (cave Biénès, Antibes). In: E. Delaval / R. Thernot (eds), *Aux origines d'Antibes. Antiquité et Haut Moyen Age* [exhibition catalogue Antibes] (Milan, Antibes 2013) 34.
- Campolo/Garcia 2004: S. Campolo / D. Garcia, Bronzes protohistoriques du Musée Calvet d'Avignon (Avignon 2004).
- Carancini 1975: G. L. Carancini, Die Nadeln in Italien / Gli spilloni nell'Italia continentale. *Prähistorische Bronzefunde* XIII, 2 (München 1975).
- Carozza 1997: L. Carozza, Habitats et cultures à la fin de l'âge du Bronze en Languedoc et sur la bordure sud-ouest du Massif central [PhD thesis EHESS Toulouse 1997].
- Cert 1998: C. Cert, Les moules de fondeurs de l'âge du Bronze dans les Pyrénées [master's thesis Univ. Toulouse II – Le Mirail 1998].
- 2000: C. Cert, Les moules de métallurgistes dans les Pyrénées. *Bulletin de la Société préhistorique française* 97/4, 2000, 595-608.
- Chardenoux/Courtois 1979: M.-B. Chardenoux / J.-C. Courtois, Les haches dans la France méridionale. *Prähistorische Bronzefunde* IX, 11 (München 1979).
- Childe 1930: V. G. Childe, *The Bronze Age* (Cambridge 1930).
- 1936: V. G. Childe, *Man Makes Himself* (London 1936).
- Coffyn 1985: A. Coffyn, Le Bronze final atlantique dans la Péninsule ibérique. *Publications du Centre Pierre Paris* 11 = Collection de la Maison des pays ibériques 20 (Paris 1985).
- Coffyn/Gomez/Mohen 1981: A. Coffyn / J. Gomez / J.-P. Mohen, L'apogée du bronze atlantique: le dépôt de Vénat. *L'âge du Bronze en France* 1 (Paris, 1981).
- Cordier 2002a: G. Cordier, Le dépôt de l'âge du Bronze final des Châtelliers à Amboise (Indre-et-Loire). *Revue archéologique du Centre de la France* 41, 2002, 5-34.
- 2002b: L. Cordier, Occupation du Bronze final IIIb dans un fond de vallon au Moullard (Lambesc). In: *Archéologie du TGV Méditerranée. Fiches de synthèse. 2: La Protohistoire. Monographies d'archéologie méditerranéenne* 9 (Lattes 2002) 561-566.
- 2009: G. Cordier, *L'Âge du Bronze dans les Pays de la Loire moyenne* (Joué-lès-Tours 2009).
- Cordier/Millotte/Riquet 1959: G. Cordier / J.-P. Millotte / R. Riquet, La cachette de bronze d'Azay-le-Rideau (Indre-et-Loire). *Gallia Préhistoire* 2, 1959, 57-71.
- David-Elbiali 2000: M. David-Elbiali, La Suisse occidentale au II<sup>e</sup> millénaire av.J.-C.: chronologie, culture, intégration européenne. *Cahiers d'archéologie romande* 80 (Lausanne 2000).
- 2013: M. David-Elbiali, La chronologie nord-alpine du Bronze final (1200-800 av. J.-C.): entre métal, céramique et dendrochronologie. In: W. Leclercq / E. Warmenbol (eds), *Échanges de bons procédés. La céramique du Bronze final dans le nord-ouest de l'Europe. Actes du colloque international organisé à l'Université libre de Bruxelles les 1<sup>er</sup> et 2 octobre 2010. Études d'archéologie* 6 (Bruxelles 2013) 181-197.
- David-Elbiali/Dunning 2005: M. David-Elbiali / C. Dunning, Le cadre chronologique relatif et absolu au nord-ouest des Alpes entre 1060 et 600 av. J.-C. In: Bartoloni/Delpino 2005, 145-195.
- Dedet 2004: B. Dedet, Variabilité des pratiques funéraires protohistoriques dans le sud de la France: défunts incinérés, défunts non brûlés. *Gallia* 61, 2004, 193-222.
- Dedet/Marchand 2015: B. Dedet / G. Marchand, Eau, arme et territoire aux âges du Bronze final et du Fer en Languedoc et en Provence. In: Olmer/Roure 2015, 595-620.
- Dedet/Py 1985: B. Dedet / M. Py, L'Occupation des rivages de l'étang de Mauguio (Hérault) au Bronze Final et au premier Age du Fer. 3: Synthèses et annexes. *Cahier de l'Association pour la Recherche Archéologique en Languedoc Oriental* 13 (Caveirac 1985).
- Devillers et al. 2019: B. Devillers / G. Bony / J.-P. Degeai / J. Gascó / Th. Lachenal / H. Bruneton / F. Yung / H. Oueslati / A. Thierry, Holocene Coastal Environmental Changes and Human Occupation of the Lower Hérault River, Southern France. *Quaternary Science Reviews* 222, 2019, 105912. DOI: 10.1016/j.quascirev.2019.105912.
- Dietrich 2012: O. Dietrich: Travelling or Not? Tracing Individual Mobility Patterns of Late Bronze Age Metalworkers in the Carpathian Basin. *Satu Mare. Studii și Comunicări. Ser. Arheologie* XXVIII/1, 2012, 211-229.
- Dore 2005: A. Dore, Il Villanoviano I-III di Bologna: problemi di cronologia relativa e assoluta. In: Bartoloni/Delpino 2005, 255-292.
- Fleury 1991: L. Fleury, Les moules de l'âge du Bronze en France atlantique et dans les îles britanniques: aspects technologiques et culturels. In C. Chevillot / A. Coffyn (eds), *L'âge du Bronze Atlantique: ses faciès, de l'Écosse à l'Andalousie, et leurs relations avec le Bronze continental et la Méditerranée. Actes du 1<sup>er</sup> colloque du Parc Archéologique de Beynac, Beynac-et-Cazenac 1990* (Beynac-et-Cazenac 1991) 267-276.
- Fugazzola Delpino/Pellegrini 2009/2010: M. A. Fugazzola Delpino / E. Pellegrini, Due ripostigli dell'Italia centrale tirrenica: Santa Marinella e Goluzzo. *Produzione e circolazione dei metalli in Italia centrale tra la fine dell'età del Bronzo e gli inizi dell'età del Ferro. Bollettino di Paletnologia Italiana* 98, 2009/2010, 25-172.
- Gachina et al. 2008: J. Gachina / J. Gomez de Soto / J.-R. Bourhis / C. Veber, Un dépôt de la fin de l'Âge du bronze à Meschers (Charente-Maritime). *Remarques sur les bracelets et tintinnabula du type de Vaudrevange en France de l'Ouest. Bulletin de la Société préhistorique française* 105/1, 2008, 159-185.
- Gambari/Rubat-Borel/Campagnoni 2007: F. M. Gambari / F. Rubat Borel / R. Campagnoni, Le forme di fusione e l'utilizzazione preromana della pietra ollare nella protostoria dell'Italia nordoccidentale. In: D. Daudry (ed.), *La pierre en milieu alpin. Actes du XI<sup>e</sup> colloque sur les Alpes dans l'Antiquité, Champsec 2006. Bulletin d'Études Préhistoriques et Archéologiques Alpines* 18, 2007, 131-151.
- Garcia 1993: D. Garcia, Entre Ibères et Ligures: Lodévois et moyenne vallée de l'Hérault protohistoriques. *Revue archéologique de Narbonnaise Suppl.* 26 (Paris 1993).
- Gascó 1996: J. Gascó, Les fragments de moules d'objets métalliques. In: J. Gascó (ed.), *Le Laouret et la montagne d'Alaric à la fin de l'Age du bronze. Un hameau abandonné entre Floure et Monze* (Aude) (Toulouse, Carcassonne 1996).

- Gascó et al. 2014: J. Gascó / G. Borja / C. Tourrette / J.-L. Verdier / L. Bouby / B. Devillers / S. Greck / F. Yung, Le site subaquatique de la Motte (Agde, Hérault) à la fin de l'âge du Bronze. In: Sénépart et al. 2014, 625-630.
- 2015: J. Gascó / G. Borja / C. Tourrette / F. Yung / J.-L. Verdier / L. Bouby / B. Devillers / S. Greck / F. Baisse / C. Barthélémy / J. Chabbert / D. Constant / B. Debrand / J. Dez / J.-C. Iché / F. Laurent / J.-P. Puech / P. Rouvet / C. Rolland / A. Sabastia, Une occupation lagunaire palafittique aux IX<sup>e</sup>-VIII<sup>e</sup> s. a.C.: La Motte (Agde) au fond du fleuve Hérault. In: Olmer/Roure 2015, 69-86.
- Gauthier 2003: E. Gauthier, Etude de la variabilité de la composition des dépôts de bronzes, en France Orientale, aux X<sup>e</sup> et IX<sup>e</sup> siècles avant notre ère. *Revue archéologique de l'Est* 52, 2003, 19-44.
- Germond et al. 1988: G. Germond / J. Gomez / G. Verron / J. R. Bourhis, Nouvelles recherches sur le dépôt d'Auvers, Manche (Bronze final III). *Bulletin de la Société préhistorique française* 85/1, 1988, 15-32.
- Gomez de Soto 1993: J. Gomez de Soto, »Pictogrammes«, figurations anthropomorphes et zoomorphes sur les céramiques de la fin de l'Age du Bronze: une révision. In: J. Briard / A. Duval (eds), *Les représentations humaines du Néolithique à l'âge du Fer. Actes du 115<sup>e</sup> Congrès national des Sociétés savantes, Avignon 1990 (Paris 1993)* 149-162.
- 2018: J. Gomez de Soto, Le moule multiple en pierre du Bronze moyen de la grotte des Perrats à Agris (Charente, France). In: S. Boulud-Gazo / M. Mélin (eds), *Contributions à l'archéologie de l'âge du Bronze dans les espaces atlantiques et Manche-Mer du Nord. 2: Actes des Séminaires archéologiques de l'ouest (2008, 2009 et 2010). Bulletin de l'APRAB Suppl. 4 (Dijon 2018)* 149-162.
- 2020: J. Gomez de Soto, Les moules de fondeur de bronze. In: Ch.-C. Besnard-Vauterin (ed.), *Évolution d'un terroir au cours de la protohistoire. Les fouilles préventives de lfs »ZAC object'ifs Sud« (Rennes 2020)* 122-136.
- Gomez de Soto/Milcent 2000: J. Gomez de Soto / P.-Y. Milcent, De la Méditerranée à l'Atlantique: Échanges et affinités culturelles entre le nord-ouest (Armorique, Centre-Ouest, Limousin) et le sud-ouest de la France (principalement Languedoc occidental) de la fin du X<sup>e</sup> au V<sup>e</sup> s. avant J.-C. In: Th. Janin (ed.), *Mailhac et le Premier Âge du Fer en Europe occidentale. Hommage à Odette et Jean Taffanel. Actes du colloque international de Carcassonne, 17-20 septembre 1997. Monographies d'Archéologie Méditerranéenne 7 (Lattes 2000)* 351-371.
- Gomez de Soto et al. 1991: J. Gomez de Soto / I. Kerouanton / B. Boulestin / J.-R. Bourhis, La grotte du Quéroy à Chazelles (Charente) – Le Bronze final IIIb. *Bulletin de la Société préhistorique française* 88/10-12, 1991, 341-392.
- Gorgues/Milcent 2018: A. Gorgues / P.-Y. Milcent, Circulations et modalités d'échanges à l'âge du Bronze en France. In: J. Guilaine / D. Garcia (eds), *La Protohistoire de la France (Paris 2018)* 265-282.
- Gratuze/Billaud 2014: B. Gratuze / Y. Billaud, Inventaire des perles en verre et en faïence de l'Age du Bronze originaires des ateliers de la région de Frattesina retrouvées en France. In: S. Ciappi / A. Larese / M. Ubaldi (ed.), *Il vetro in età protostorica in Italia. Atti delle XVI Giornate Nazionali di Studio sul Vetro, Adria (RO), 12-13 maggio 2012 (Cremona 2014)* 25-37.
- Guilaine 1972: J. Guilaine, *L'Âge du bronze en Languedoc occidental, Roussillon, Ariège. Mémoires de la Société préhistorique française* 9 (Paris 1972).
- Guilaine et al. 2017: J. Guilaine / L. Carozza / D. Garcia / J. Gascó / Th. Janin / B. Mille, Launac et le Launacien. *Dépôts de bronzes protohistoriques du sud de la Gaule (Montpellier 2017)*.
- Janin 2000: Th. Janin, Le groupe culturel Mailhac 1 en France méridionale: essai de définition et extension géographique d'après l'étude des nécropoles du Languedoc occidental. In: J. Gascó / F. Claustre (eds), *Habitats, économies et sociétés du Nord-Ouest méditerranéen de l'Âge du Bronze au Premier Âge du Fer. Actes du colloque international, Carcassonne, 26-30 septembre 1994. Congrès préhistorique de France* 24, 3 (Paris 2000) 167-174.
- Jockenhövel 1981: A. Jockenhövel, Zu einigen späturtenfelderzeitlichen Bronzen des Rhein-Main-Gebietes. In: H. Lorenz (ed.), *Studien zur Bronzezeit. Festschrift für Wilhelm Albert v. Brunn (Mainz 1981)* 131-149.
- 2018: A. Jockenhövel, Alteuropäische Gräber der Kupferzeit, Bronzezeit und älteren Eisenzeit mit Beigaben aus dem Gießereiwesen (Gießformen, Düsen, Tiegel). In: Overbeck 2018, 213-337.
- Kibbert 1984: K. Kibbert, Die Äxte und Beile im mittleren Westdeutschland II. *Prähistorische Bronzefunde* IX, 13 (München 1984).
- Kienlin 2008: T. Kienlin, Tradition and Innovation in Copper Age Metallurgy: Results of a Metallographic Examination of Flat Axes from Eastern Central Europe and the Carpathian Basin. *Proceedings of the Prehistoric Society* 74, 2008, 79-107.
- 2013: T. Kienlin, Copper and Bronze: Bronze Age Metalworking in Context. In: A. Harding / H. Fokkens (eds), *The Oxford Handbook of the European Bronze Age (Oxford 2013)* 414-436.
- Kuijpers 2018: M. H. G. Kuijpers, *An Archaeology of Skill. Metalworking Skill and Material Specialization in Early Bronze Age Central Europe (London, New York 2018)*.
- Lachenal 2014: Th. Lachenal, Le village évanescant. *Formes de l'habitat à l'âge du Bronze en France méditerranéenne. Archéopages* 40, 2014, 26-35. DOI: 10.4000/archeopages.590.
- 2017: Th. Lachenal, Parures et territoires à la fin de l'âge du Bronze. Les bracelets du groupe d'Orgon dans le Sud-Est de la France. *Bulletin de la Société préhistorique française* 114/3, 2017, 553-572.
- Lachenal et al. 2020: Th. Lachenal / J. Gascó / B. Devillers / L. Bouby / L. Chabal / V. Girard / S. Greck / F. Guibal / C. Lespes / L. Liottier / Ph. Ponel / Ch. Tourrette, Un habitat de la fin de l'âge du Bronze entre lagune et fleuve: le site immergé de la Motte à Agde (Hérault, France). In: Y. Billaud / Th. Lachenal (eds), *Entre terres et eaux. Les sites littoraux de l'âge du Bronze: spécificités et relations avec l'arrière-pays. Actes de la séance de la Société préhistorique française, Agde 2017. Séances de la Société préhistorique française* 14 (Paris 2020) 217-255.
- Lespes et al. 2019: C. Lespes / Th. Lachenal / A. Gardeisen / J. Gascó, New Perspectives on Late Bronze Age Lagoon Sites in the South of France Revealed by Animal Exploitation at the La Motte I Site (Hérault). *Journal of Archaeological Science: Reports* 25, 2019, 206-216.
- Louis/Taffanel/Taffanel 1958: M. Louis / O. Taffanel / J. Taffanel, *Le premier âge du Fer languedocien. 2: Les nécropoles à incinération (Bordighera, Montpellier 1958)*.

- Milcent 2012: P.-Y. Milcent, Le temps des élites en Gaule atlantique. Chronologie des mobiliers et rythmes de constitution des dépôts métalliques dans le contexte européen (XIII<sup>e</sup>-VII<sup>e</sup> s. av. J.-C.) (Rennes 2012).
- Molloy/Mödlinger 2020: B. Molloy / M. Mödlinger, The Organisation and Practice of Metal Smithing in Later Bronze Age Europe. *Journal of World Prehistory* 33, 2020, 169-232.
- Moyat et al. 2007: Ph. Moyat / A. Dumont / J.-F. Mariotti / Th. Janin / S. Greck / L. Bouby / Ph. Ponel / P. Verdin / S. Verger, Découverte d'un habitat et d'un dépôt métallique non funéraire du VIII<sup>e</sup> s. av. J.-C. dans le lit de l'Hérault à Agde, sur le site de la Motte. *Jahrbuch des RGZM* 54, 2007, 53-84.
- Muller 1991: A. Muller, L'Age du Bronze dans les Hautes-Alpes. In: A. Barruol (ed.), *Archéologie dans les Hautes-Alpes. Catalogue des collections du Musée Départementale de Gap* (Gap 1991) 103-112.
- Müller-Karpe 1959: H. Müller-Karpe, Beiträge zur Chronologie der Urnenfelderzeit nördlich und südlich der Alpen. *Römisch-Germanische Forschungen* 22 (Berlin 1959).
- Neipert 2006: M. Neipert, Der »Wanderhandwerker«. *Archäologisch-ethnographische Untersuchungen. Tübinger Texte: Materialien zur Ur- und Frühgeschichtlichen Archäologie* 6 (Rahden/Westf. 2006).
- Nessel 2013: B. Nessel, The »Absence« of Smiths and Founders: Why Tools Are Rare in Bronze Age Burials. In: B. Rezi / R. E. Németh / S. Berecki (eds), *Bronze Age Crafts and Craftsmen in the Carpathian Basin. Proceedings of the International Colloquium from Târgu Mureş, 5-7 October 2012. Bibliotheca Musei Marisiensis. Seria Archaeologica* 6 (Târgu Mureş 2013) 139-148.
- Nicolardot/Gaucher 1975: J.-P. Nicolardot / G. Gaucher, *Typologie des objets de l'Âge du Bronze en France. 5: Outils* (Paris 1975).
- Nordez 2019: M. Nordez, La parure en métal de l'âge du Bronze moyen atlantique. *Mémoires de la Société préhistorique française* 65 (Paris 2019).
- Olmer/Roure 2015: F. Olmer / R. Roure (eds), *Les Gaulois au fil de l'eau. Actes du 37<sup>e</sup> colloque international de l'Association Française pour l'Étude de l'Âge du Fer, Montpellier 2013. 1: Communications* (Bordeaux 2015).
- Overbeck 2018: M. Overbeck, Die Gießformen in West- und Süddeutschland (Saarland, Rheinland-Pfalz, Hessen, Baden-Württemberg, Bayern). *Prähistorische Bronzefunde* XIX, 3 (Stuttgart 2018).
- Pare 1998: Ch. Pare, Beiträge zum Übergang von der Bronze- zur Eisenzeit in Mitteleuropa. Teil I: Grundzüge der Chronologie im östlichen Mitteleuropa (11.-8. Jahrhundert v. Chr.). *Jahrbuch des Römisch-Germanischen Zentralmuseums* 45, 1998, 293-433.
- Pautreau/Gendron/Bourhis 1984: J.-P. Pautreau / Ch. Gendron / J.-R. Bourhis, L'Age du Bronze en Deux-Sèvres (2500-800 av. J.-C.). *La cachette de Triou* (Niort 1984).
- Peche-Quilichini et al. 2014: K. Peche-Quilichini / J. Graziani / G.-F. Antolini / M.-A. Gardella / M. Milletti, Les matrices de fusion protohistoriques de Corse: état de la recherche et découvertes récentes. In: Sénépart et al. 2014, 431-446.
- Peroni 1980: R. Peroni, *Il Bronzo finale in Italia* (Bari 1980).
- Peroni/Vanzetti 2005: R. Peroni / A. Vanzetti, Intorno alla cronologia della prima età del Ferro italiana, da H. Müller-Karpe a Chr. Pare. In: Bartoloni/Delpino 2005, 53-80.
- Pétrequin/Pétrequin 1984: A.-M. Pétrequin / P. Pétrequin, *Habitat lacustre du Bénin. Une approche ethnoarchéologique. Recherche sur les civilisations. Mémoire* 39 (Paris 1984).
- Py 1990: M. Py, *Culture, économie et société protohistoriques dans la région nîmoise. Collection de l'Ecole française de Rome* 131 (Rome 1990).
- Reimer et al. 2013: P. J. Reimer / E. Bard / A. Bayliss / J. W. Beck / P. G. Blackwell / Ch. Bronk Ramsey / C. E. Buck / H. Cheng / R. L. Edwards / M. Friedrich / P. M. Grootes / Th. P. Guilderson / H. Hafflidason / I. Hajdas / Ch. Hatté / T. J. Heaton / D. L. Hoffmann / A. G. Hogg / K. A. Hughen / K. F. Kaiser / B. Kromer / S. W. Manning / M. Niu / R. W. Reimer / D. A. Richards / E. M. Scott / J. R. Southon / R. A. Staff / Ch. S. M. Turney / J. van der Plicht, *IntCal13 and Marine13 Radiocarbon Age Calibration Curves 0-50,000 Years cal BP. Radiocarbon* 55/4, 2013, 1869-1887. DOI: 10.2458/azu\_js\_rc.55.16947.
- Rigaud 2007: J. Rigaud, Identification et échantillonnage d'une matière première: la stéatite (Parc naturel régional du Queyras). *ADLFI. Archéologie de la France – Informations*. <http://journals.openedition.org/adlfi/6564> (17.1.2022).
- Říhovský 1979: J. Říhovský, Die Nadeln in Mähren und im Ostalpengebiet (von der mittleren Bronzezeit bis zur älteren Eisenzeit). *Prähistorische Bronzefunde* XIII, 5 (München 1979).
- Rowlands 1971: M. Rowlands, The Archaeological Interpretation of Prehistoric Metalworking. *World Archaeology* 3, 1971, 210-223.
- Schauer 1975: P. Schauer, *Beginn und Dauer der Urnenfelderkultur in Südfrankreich. Germania* 53, 1975, 47-63.
- Sénépart et al. 2014: I. Sénépart / F. Leandri / J. Cauliez / Th. Perrin / E. Thirault (eds), *Chronologie de la Préhistoire récente dans le Sud de la France. Acquis 1992-2012. Actualité de la recherche. Actes des 10<sup>e</sup> Rencontres Méridionales de Préhistoire Récente. Porticcio, 18 au 20 octobre 2012* (Toulouse 2014).
- Simonnet 1970: R. Simonnet, *Habitat et fonderie protohistoriques à Carbon, commune de Varilhes (Ariège). Gallia Préhistoire* 13/1, 1970, 151-216.
- Škvor Jernejčič 2014: B. Škvor Jernejčič, Contributo alla conoscenza degli inizi dell'età del Ferro tra la penisola italiana e l'area alpina sud-orientale: analisi degli spilloni con capocchia conica e ad ombrellino nell'area del Caput Adriae. *Padusa* 50, 2014, 141-166.
- Tendille 1985: C. Tendille, Moules de fondeur en pierre et mobiliers métalliques. In: Dedet/Py 1985, 103-116.
- Verger et al. 2007: S. Verger / A. Dumont / Ph. Moyat / B. Mille, Le dépôt de bronzes du site fluvial de La Motte à Agde (Hérault). *Jahrbuch des RGZM* 54, 2017, 85-171.
- Verney 1990: A. Verney, *Le dépôt de Challans (Vendée). Bulletin de la Société préhistorique française* 87/10-12, 1990, 396-418.
- Vindry 1978: G. Vindry, *Un siècle de recherches préhistoriques et protohistoriques en Provence Orientale (1875-1975). Documents d'Archéologie méridionale* 1, 1978, 7-76.
- Vital 1999: J. Vital, Identification du Bronze moyen-récent en Provence et en Méditerranée nord-occidentale. *Documents d'Archéologie méridionale* 22, 1999, 7-115.
- 2002: J. Vital, La grotte des Epingles (Cheval-Blanc). In: J. Buisson-Catil / J. Vital (eds), *Agès du Bronze en Vaucluse. Notices d'Archéologie Vauclusienne* 5 = *Travaux du Centre d'Archéologie Préhistorique de Valence* 4 (Avignon 2002) 127-134.



**»Enter the Matrix«. Spätbronzezeitliche Gussformen aus »La Motte« (Agde, dép. Hérault/F) in ihrem Kontext**

Die Ausgrabungsstätte La Motte 1, derzeit unter Wasser im Fluss Hérault in Agde gelegen, ist vor allem wegen der Entdeckung eines spektakulären Depots von Schmuck- und Trachtelementen bekannt, die in Verbindung mit einer Siedlung stehen. Seitdem haben neue Kampagnen von Unterwasserausgrabungen weitere Details zu Chronologie, Größe und Wirtschaft der Fundstätte zutage gebracht, die in der späten Bronzezeit und zu Beginn der Eisenzeit besiedelt war. Unter den Zeugnissen für handwerkliche Aktivitäten liefern vier Fragmente von Gussformen neue Informationen zur spätbronzezeitlichen Metallproduktion im mediterranen Frankreich – besonders zu deren Organisation und zur Verbreitung der Bronzemodelle. Während eine dieser Gussformen zur Herstellung von Werkzeugen diente, die in der Region und am Fundort selbst gut belegt sind – Tüllenbeile ohne Öse des Typs Frouard –, wurden mit anderen Objekte geformt, die in der Region seltener oder sogar unbekannt sind. Einige wurden sogar bis vor Kurzem als exotisch angesehen. Dies ist der Fall bei einer Gussform für Speerspitzen des Typs Vénat, die hauptsächlich an der französischen Atlantikküste auftreten, und bei einer anderen für Nadeln mit einem großen konischen Kopf, die besonders im nördlichen Adriaum verbreitet sind. In Anbetracht der archäologischen und ethnographischen Daten ist die Hypothese vorzuziehen, dass Metallurgen ihr Handwerk vor Ort in der Siedlung ausübten. Die Entdeckung von mehreren Metallgussformen an einem Fundort ist selten im mediterranen Frankreich und legt nahe, dass diese Siedlung eine zentrale Rolle spielte in der Produktion und Distribution von Objekten und Halbfabrikaten aus Kupferlegierungen, die zumindest teilweise aus dem Erz des Cabrières-Gebiets hergestellt worden sein könnten. Die Form der hergestellten Objekte zeigt, dass die Siedlung in Netzwerke eingebunden war, die weit über den regionalen Rahmen hinausgingen, manchmal über sehr große Entfernungen. Dies deutet auf die prominente Rolle hin, die die Region um Agde im Austausch zwischen dem Mittelmeer und der keltischen Welt in der frühen Eisenzeit spielen sollte.

**Enter the Matrix. Late Bronze Age Casting Moulds from »La Motte« (Agde, Dép. Hérault/F) in their Context**

The La Motte 1 site, currently submerged under the River Hérault in Agde, is known in particular for the discovery of a spectacular deposit of ornamental objects associated with a settlement. Since then, other underwater excavation campaigns have brought to light more precise details on the chronology, size and economy of the site, occupied at the end of the Bronze Age and at the very beginning of the Iron Age. Among the evidence of artisanal activities, four fragments of casting moulds provide new information on metal production at the end of the Bronze Age in Mediterranean France, in particular on the organisation thereof and the diffusion of bronze models. While one of these moulds was used to manufacture tools that are well attested regionally and at the site itself – socketed axes of the Frouard type without a loop –, others were used to create objects that are rarer or even unknown in the region. Some of these have even previously been considered exotic. This is the case for a mould for spearheads of the Vénat type, which can be found mainly on the French Atlantic coast, and another used to produce pins with a large conical head, especially widespread in the northern Adriatic. Given the archaeological and ethnographic data, the hypothesis that should prevail here is that of on-site metallurgists carrying out their craft within the settlement. The discovery of multiple metallurgy moulds at the same site is rare in Mediterranean France and suggests a pivotal role of this settlement in the production and distribution of objects and semi-finished products made from copper alloys, which could have been made at least in part from the ore from the Cabrières district. The shapes of the objects produced indicate that the site was integrated into networks that extended well beyond the regional framework, sometimes over very long distances. This prefigures the prominent role that the region around Agde would play in the exchanges connecting the Mediterranean to the Celtic world in the Early Iron Age.

**»Enter the Matrix«. Les moules de métallurgistes de l'âge du Bronze final provenant de »La Motte« (Agde, dép. Hérault/F) dans leur contexte**

Le site de La Motte 1, actuellement immergé dans l'Hérault à Agde, est notamment connu pour avoir livré un spectaculaire dépôt d'objets de parure associé à un habitat. Depuis cette découverte, de nouvelles campagnes de fouilles subaquatiques ont permis de préciser la chronologie, l'extension et l'économie de ce site, occupé à la fin de l'âge du Bronze et au tout début de l'âge du Fer. Parmi les témoins d'activités artisanales, quatre fragments de moules de métallurgistes livrent des informations inédites sur la production métallique de la fin de l'âge du Bronze en France méditerranéenne, en particulier sur son organisation et sur les modalités de diffusion des modèles en bronze. Si l'un de ces moules servait à la réalisation d'outils très bien attestés régionalement et sur le site même, des haches à douille sans anneau du type de Frouard, d'autres ont été utilisés pour réaliser des objets plus rares, voire inconnus dans la région.

Certains étaient même jusque-là considérés comme exotiques. C'est le cas d'une matrice pour pointes de lance du type de Vénat, qui se retrouvent principalement sur la façade atlantique française, et d'un moule ayant servi à réaliser des épingles à grande tête conique surtout diffusées dans le nord de l'Adriatique. L'hypothèse devant être retenue au regard des données archéologiques et ethnographiques est pourtant celle de métallurgistes résidents effectuant leur artisanat au sein même de l'agglomération. La découverte de plusieurs moules de métallurgistes sur un même site n'est par ailleurs pas fréquente en France méditerranéenne et suggère un rôle moteur de cet habitat dans la production et la distribution d'objets et de demi-produits en alliages cuivreux qui pourraient avoir été réalisés, au moins en partie, avec le minerai du district de Cabrières. D'autre part, les formes d'objets produits témoignent de l'insertion du site dans des réseaux d'interrelations dépassant très largement le cadre régional, s'établissant parfois à très longue distance. Cela préfigure la place privilégiée qu'occupera la région agathoise dans les courants d'échanges reliant la Méditerranée au monde celtique au premier âge du Fer.

#### *Schlüsselwörter / Keywords / Mots-clés*

Südfrankreich / späte Bronzezeit / Gussform / Metallurgie / Speerspitze / Tüllenbeil / Nadel / Stabbarren  
Southern France / Late Bronze Age / casting moulds / metallurgy / spearhead / socketed axe / pin / bar-shaped ingot  
France méridionale / Bronze final / moules / métallurgie / pointe de lance / hache à douille / épingle / lingot-barre

#### **Thibault Lachenal**

CNRS / Université Paul-Valéry Montpellier III  
ASM – Archéologie des Sociétés Méditerranéennes, UMR5140  
Route de Mende  
F - 34000 Montpellier  
thibault.lachenal@cnrs.fr