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THE ADZE-HEADS FROM PLEMIĘTA, GRUDZIĄDZ DISTRICT (POLAND): ALPINE JADES, ARMORICAN PRODUCTS AND VERY LONG-DISTANCE EXCHANGES

ABSTRACT

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Discovered in the 19th century, the hoard from Plemięta (Chełmno county, Poland) consisted of three polished adze-heads, of which two are in the Museum in Grudziądz. Until now, this hoard had been assumed to be linked to Danubian farming communities. A petrographic approach coupled with an in-depth, Europe-wide typological study allows us to rethink this cultural attribution. In fact, the Plemięta adze-heads had very probably been made in the Armorican massif (France), produced by specialists directly influenced by the standards of the earliest adze-heads of Alpine jades from Mont Viso in the Italian Alps.

This proposition, which is supported by other examples of adze- and axeheads that had probably been imported into southern Scandinavia from France, re-invigorates the hypothesis that there had been western European influences on communities of the Eastern TRB Group, pertaining to the circulation of 'object-signs' and ideas over distances exceeding 1500 km as the crow flies.

Key words: Plemięta, Chełmno county, Alpine jades, Bégude type adze-head, the Funnel Beaker culture.
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There is no doubt that the second half of the nineteenth century was a period of vigorous development in archaeology in modern-day Poland (e.g. Kostrzewski 1949; Gąssowski 1970; Abramowicz 1991). Prominent in this process was research by groups of amateurs, active in the area of what is now Gdańsk Pomerania and Chełmno county (Grabarczyk 2014). Constantin Florkowski (1819-1894) – a painter and a restorer by profession and an archaeologist by hobby – was one of the important (albeit nowadays rather forgotten) members of this circle (Kurzyńska 2011). One of his minor discoveries was the hoard of adze-heads found at Plemięta, Gruta commune, Grudziadz district. The circumstances of this find were recorded by Abraham Lissauer who reported, on the basis of the personal information provided by Florkowski, that three 'wedges' made of coarse-grained diabase had been discovered during ploughing in Plemięta (Lissauer 1887, 32: '*hier wurden im Acker drei Stielkeile aus grobkörnigen Grünstein gefunden*'). Florkowski's collection was partly dispersed and today the museum in Grudziądz houses only two of the three adze-heads. Some time ago, Tadeusz Wiślański (1987) turned his attention to these finds. However, the time that has elapsed since that publication and the significant progress made in research fully justify a reconsideration of this hoard.

1. TYPOLOGICAL APPROACH

It is advisable to start with typological observations which are consistent with the scheme proposed in *Projets JADE* and *JADE 2* (Pétrequin, Croutsch *et al.* 1998; Pétrequin, Cassen *et al.* 2012b; Pétrequin, Sheridan *et al.* 2015).

Adze-head 1 (Fig. 1). Length: 21.9 cm, width: 6 cm, thickness: 3.8 cm, weight: 566 g. Surface: glassy polish, a few chips missing, no larger than 3 mm. Grudziądz Muzeum, stock no. 154.

Adze-head 2 (Fig. 2). Length: 27.5 cm, width: 5.8 cm, thickness: 4.1 cm, weight: 912 g. Surface: glassy polish, a few chips missing, no larger than 4 mm. Grudziądz Muzeum, stock no. 155.

These two polished adze-heads are practically identical: long and narrow, with a pointed butt, markedly convex blade and a thick oval cross-section (Figs. 1-2). They differ only in their length and in several minor details of their cross-section shape: the slight longitudinal facets along the long sides are slightly more pronounced on adze-head 1.

We are therefore dealing with standardised production by a single 'workshop' showing a high level of expertise in both flaking the roughouts and polishing the adze-heads. This respect for the norms of production implies that thousands of polished adze-heads of this type had been produced, allowing the development and stabilisation of specialised manufacturing techniques.

The shape of the transverse section, which becomes asymmetrical as it approaches the blade, is a specific characteristic of adze-heads that were designed to fit directly onto a bent-headed haft. As the various minor signs of damage to the blade demonstrate, these two

Fig. 1. Plemięta: polished adze-head No. 1. Photo S. Rzepecki. CAD design A.-M. Pétrequin

Fig. 2. Plemięta: polished adze-head No. 2. Photo S. Rzepecki. CAD design A.-M. Pétrequin

Fig. 3. Typological *comparanda* in the repertoire of large adze-heads made from Alpine jades: San Damiano d'Asti (Piedmont, Italy) (Museo di Antiquità, Torino) and La Bégude-de-Mazenc (Drôme, France) (in private collection). Photos and CAD design A.-M. and P. Pétrequin

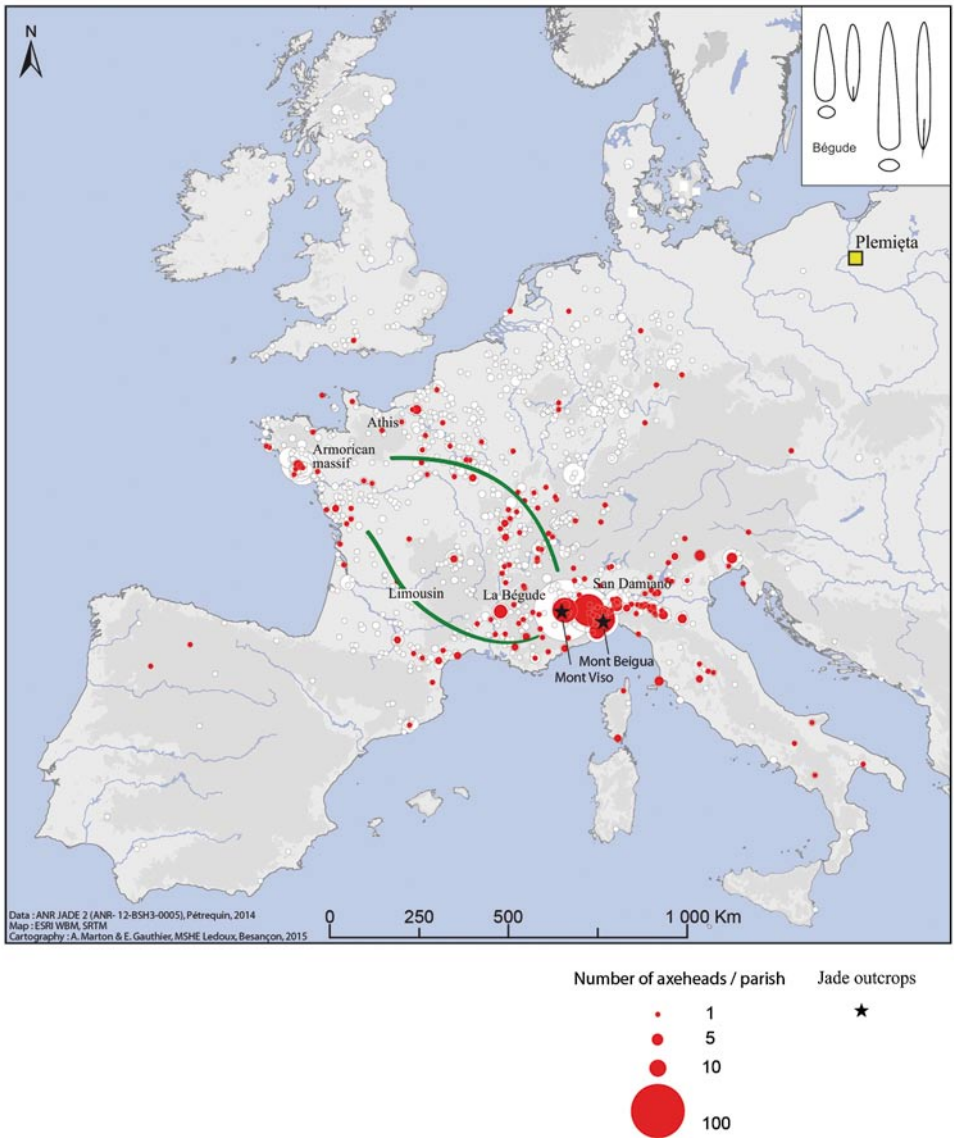

Fig. 4. Distribution of polished blades of Bégude type in Alpine jades, with a length in excess of 13.5 cm. First half of the 5th millennium. The white circles in the background represent the totality of Alpine jade adze- and axeheads of all types.
Cartography A. Marton and E. Gauthier. Data P. Pétrequin (JADE2, December 2014)

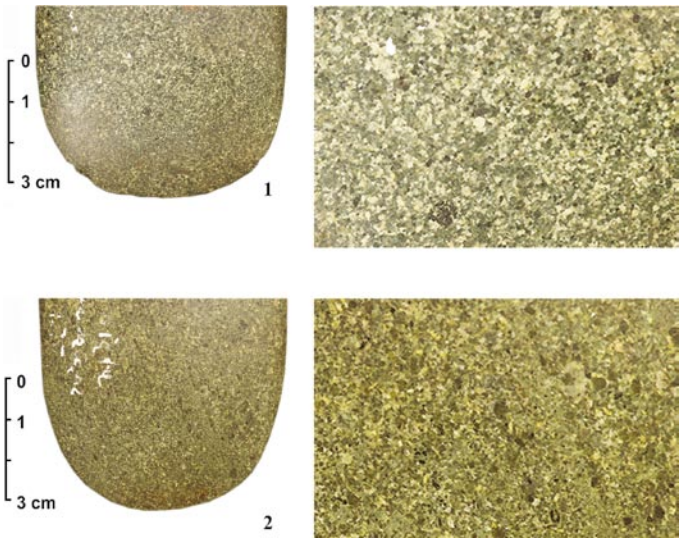

Fig. 5. Views of the raw material of the two Plemięta adze-heads.
Photo S. Rzepecki. CAD design A.-M. Pétrequin

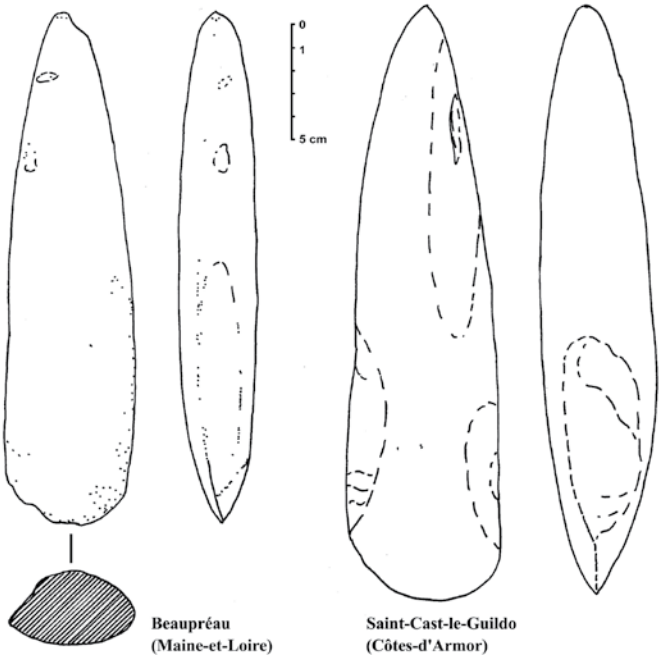

Fig. 6. Two polished adze-heads of Bégude type, in type A metadolerite.
After Le Roux 1999

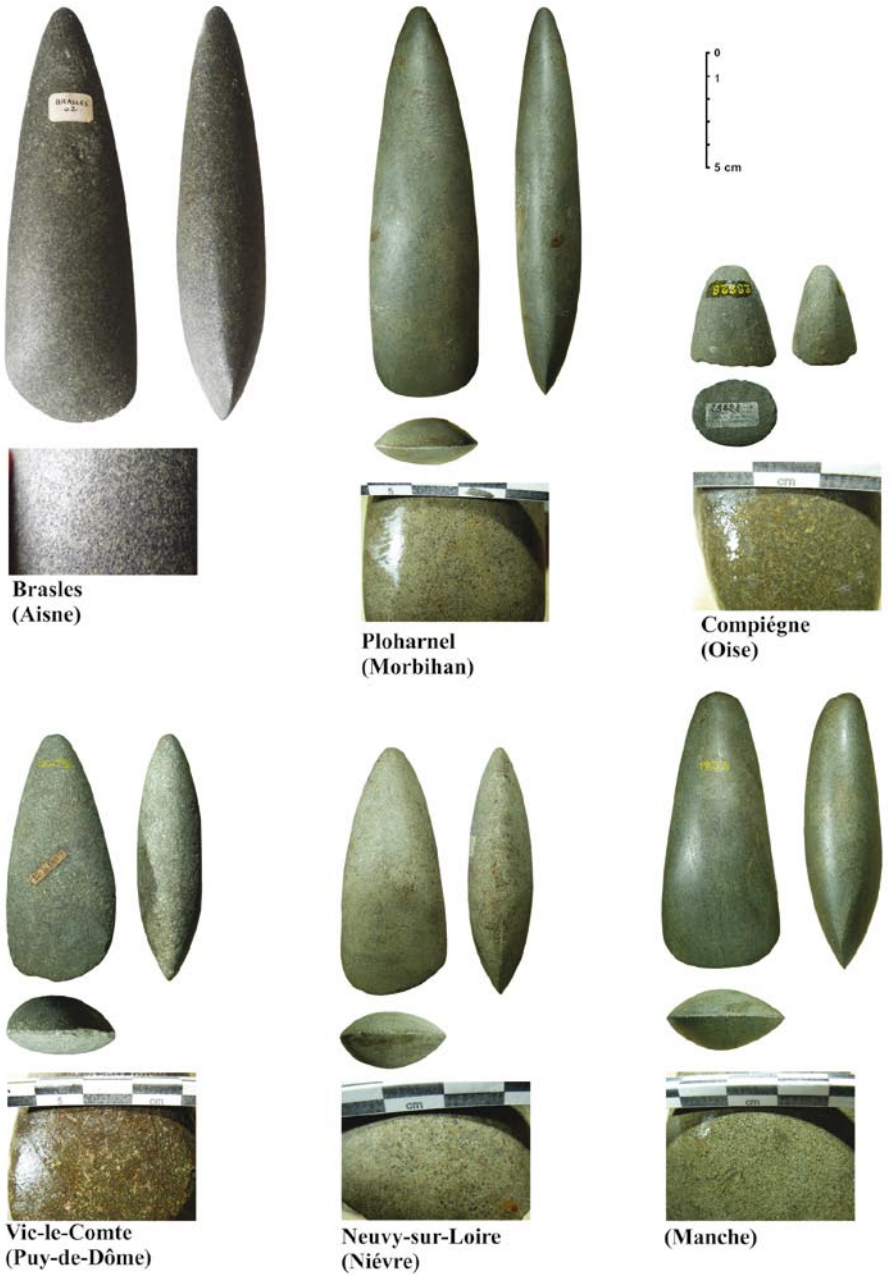

Fig. 7. Examples of adze- and axeheads of Bégude, Durrington and other types, made from diabases-dolérites; probably end of the 5th and beginning of the 4th millennium.
CAD and photos of objects in MAN, Saint-Germain-en-Laye: A.-M. Pétrequin; photos V. David, Brasles axe-head (in private collection)

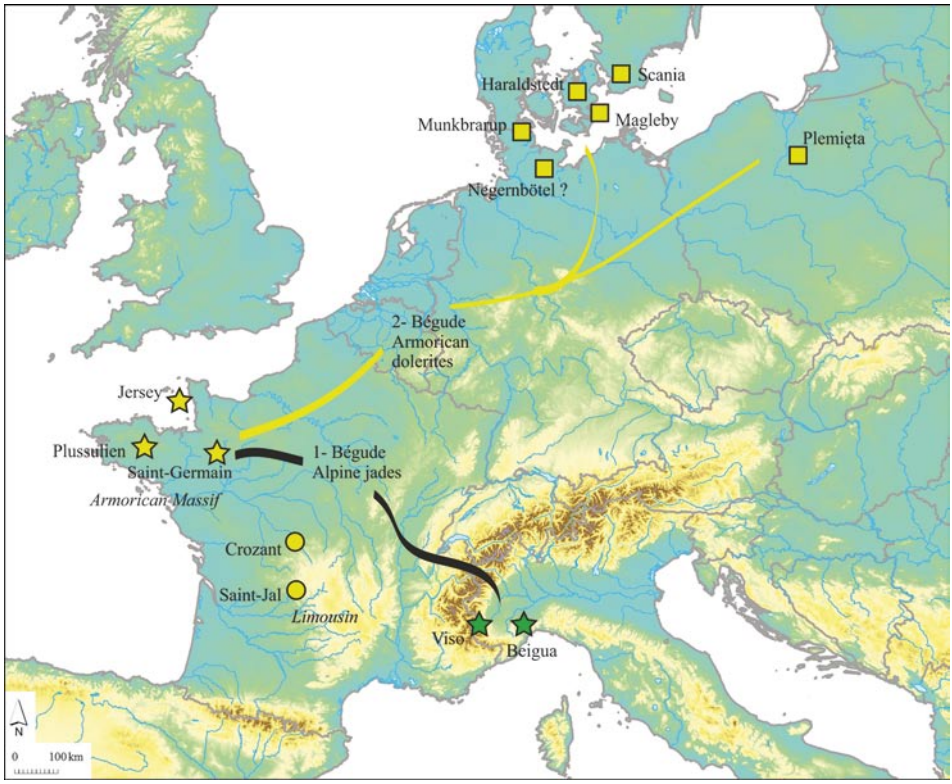

Fig. 8. According to our hypothesis, in response to imported polished blades of Alpine jades, the producers in the Armorican massif (and perhaps also in Bas Limousin) imitated the earliest 'object-signs' in jade using local diabases-dolérites. The adze-heads of the Plemięta hoard could therefore have been made in Brittany and exported to Poland over a long distance.

CAD F. Prodéo, using base map ESRI Data & Maps, under licence to MSHE Ledoux and NASA-SRTM

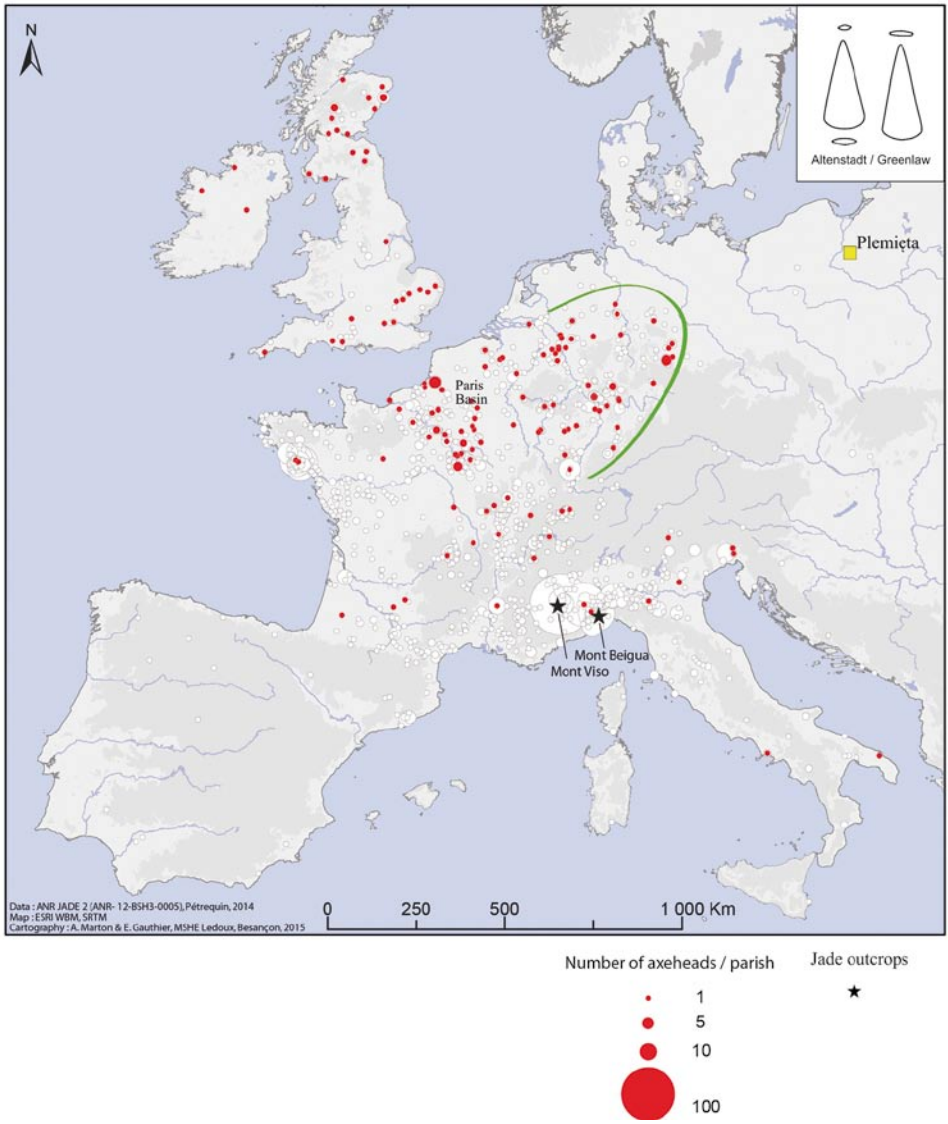

Fig. 9. Distribution of polished axeheads of Altenstadt-Greenlaw type in Alpine jades, with a length in excess of 13.5 cm. End of the 5th millennium–beginning of the 4th. Marked in green is the north-easterly expansion of the Michelsberg culture.
The white circles in the background represent the totality of Alpine jade adze- and axeheads of all types.
Cartography A. Marton and E. Gauthier. Data P. Pétrequin (JADE2, December 2014)

Fig. 10. The sole instance of association between jade and dolerite: the hoard of la Renaudie (Puy-de-Dôme). No. 1, jadeitite of Mont Viso; no. 2, dolerite.
Photos and CAD design A.-M. and P. Pétrequin. Objects in Clermont-Ferrand, Musée Bargoin

Fig. 11. French examples of objects made from diabases-dolerites, of types dating to the 4th and the beginning of the 3rd millennia. Photos and CAD design A.-M. and P. Pétrequin

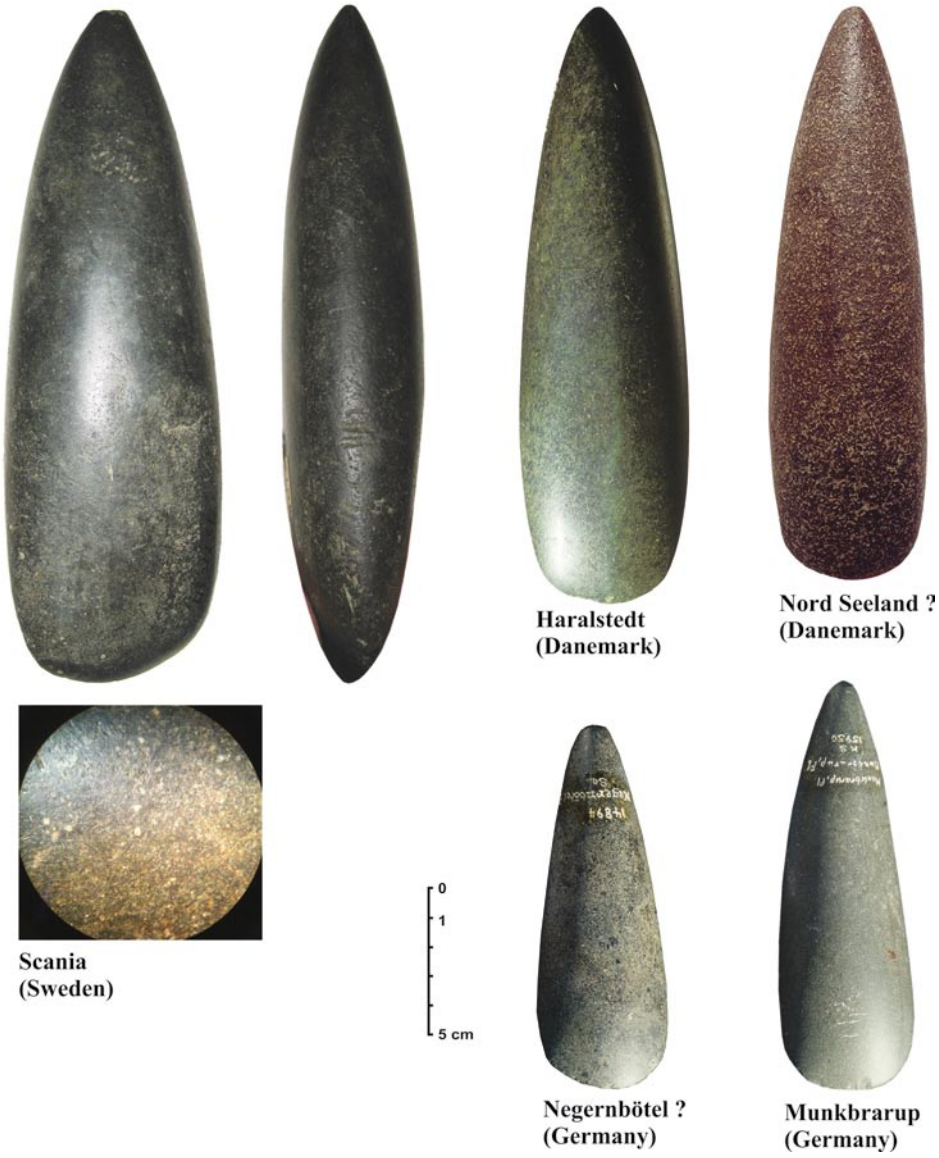

Fig. 12. Polished blades probably made of diabases-dolerites-amphibolites, found in Denmark, Germany and the south of Sweden.
Photos and CAD design A.-M. and P. Pétrequin. MAN, Saint-Germain-en-Laye

adze-heads had indeed been hafted, but they had not been used very much and might never have been re-sharpened. One might therefore regard them as 'object-signs' of high social value, rather than as sinple tools that fulfilled a technical function (Pétrequin *et al.* 2012a; Pétrequin *et al.* 2013). The high quality of the polishing, which had been done very carefully, is consistent with this view.

From a strictly typological perspective – that is to say, without taking into account their raw material – the two adze-heads from Plemięta are immediately comparable to Alpine examples of Bégude type (Pétrequin *et al.* 1998; Pétrequin *et al.* 2002). This type of adze-head was defined on the basis of eight out of 10 polished blades found together in a hoard at La Bégude-de-Mazenc/Le Gros Jean (Drôme, France), discovered as a result of deep earth-moving operations (Cordier and Bocquet 1998; Thirault 1999). All of the items in the hoard are of eclogite or jadeitite – Alpine jades exploited in the Mont Viso massif, on the Italian side of the Alps, 70 km south-west of Turin. Given the considerable distance between Poland and Italy, what is all the more remarkable is the near-perfect match between the two adze-heads from Plemięta and those from La Bégude-de-Mazenc (Fig. 3, right), except for the presence of the longitudinal faceting on the long sides of the former, a feature that is rare on Alpine examples.

The same degree of similarity appears to exist with the large Bégude-type adze-head found in the hoard from San Damiano d'Asti (Piedmont, Italy) (Fig. 3, left), which was associated with a chisel and four small axeheads (Ventura 1996). Three of those axeheads are of Collecchio type, which is a type well dated to the first half of the 5th millennium in Emilia Romagna (Bernabò Brea *et al.* 2012). Here, as at La Bégude-de-Mazenc, the raw materials are Alpine jades collected on the southern slopes of Mont Viso between 1700 and 2400 metres above sea level (Pétrequin and Pétrequin 2012).

Adze-heads of Bégude type made of Alpine jades were all produced in Piedmont (Italy), where roughouts for this type of object are especially abundant around the massifs of Mont Viso and Mont Beigua (Fig. 4; the raw material outcrops are shown by small black stars). These Bégude type adze-heads circulated over long distances, as far as Brittany, some 950 kilometres away as the crow flies, and southern Italy, 900 km away. However, their distribution remains essentially focused on south-west Europe (Fig. 4) – that is, to the south of a notional line between Trieste and Calais. To the north of the Alps, examples are rare and more erratic in their distribution. One from Kamegg (Austria) comes from an early Lengyel context (Pétrequin *et al.* 2010), while certain examples from Germany that have been known for a long time could be of more recent date.

In the production zone in Piedmont, Bégude type adze-heads of Alpine jades seem to have appeared at the end of the 6th millennium BC, then reached the peak of their production in the 5th millennium, during Phases 1 and 2 of the Square-Mouthed Pottery (VBQ) culture (Bernabò Brea *et al.* 2012) , disappearing at the latest around 4300 BC. However, in Brittany, on the Atlantic façade of Europe, the latest examples are not demonstrably later than c 4500 BC (Pétrequin *et al.* 2012b).

Elsewhere in Europe, there are fusiform adze-heads with a convex blade – made from various unremarkable rock types – but these are always shorter, and they have a rounded butt, rather than the pointed form seen in the examples from Plemięta. This is the case in Bulgaria and Romania (as noted by the authors in museums) and in the north-west of Turkey (Özbek 2007). Thus, the comparison between such items and the Polish adze-heads is not convincing.

Given the similarity between the two Plemięta adze-heads and those of Bégude type from the Alps, one might have expected the former to have been made of Alpine jades (jadéitites, omphacitites, very fine-grained eclogites), particularly since these 'object-signs' had been prized by the elites of the 5th and 4th millennia, and they circulated over a large part of the western 'Europe of jade' (which is in contrast to a central and Balkan 'Europe of copper': Pétrequin *et al.* 2002; Klassen 2004, Klassen *et al.* 2012; Pétrequin *et al.* 2012b).

But indeed, as we shall see, the two Plemięta adze-heads are not of jade.

2. PETROLOGICAL APPROACH

As recently as the 1980s, both artefacts from Plemięta were the subject of macroscopic petrographic analyses. It was concluded then that they were made of diabase (Skoczylas 1987).

In connection with the preparation of this article, the artefacts were also subjected to several non-invasive analyses. Compositional analysis using a scanning electron microscope (SEM) equipped with an EDS (Energy Dispersive Spectrometer; Michalska *et al.* 2015) was undertaken at the Institute of Geology, Adam Mickiewicz University in Poznań, while Raman spectroscopy (Kozanecki 2015) was carried out at the Department of Molecular Physics, Lodz University of Technology, and X-ray fluorescence spectroscopy (XRF) (Chebda and Rogulska 2016) was undertaken by the Heterogeneous Reactions Kinetics Group, Faculty of Chemistry, Jagiellonian University, Kraków.

The applied methods allow for a semi-quantitative (order of magnitude) identification of the elements present in the tested samples. For both objects, the results of the analyses are consistent. Although the analyses were performed at many points on the both artefacts, no significant deviations in their elemental composition were observed. Identification of the main groups of minerals revealed the predominance of the amphiboles and plagioclases, but less significant amounts of magnetite, titanomagnetite and pyroxene were also recorded (Michalska *et al.* 2015; Kozanecki 2015; Chebda and Rogulska 2016). It should be stressed that the rock was characterised by 'a lack of visible metamorphic foliation or clear lamination and segregation in composition or an erratic distribution of the magnetite grains. The rock structure is disordered and its composition is not differentiated, which might speak for its metamorphic origin' (Michalska *et al.* 2015: 1). These observations clearly indicate that the adze-heads can be identified conclusively as being of microdiabase with a plagioclase amphibolite composition (Fig. 5).

Diabase-group rocks occur only rarely in Quaternary deposits of the Polish Lowland. Based on his observations of 39,046 specimens of erratic boulders from the Lubuskie Lakeland and Kujavia, Piotr Chachlikowski (2013) stated that diabase generally amounted to just 0.16% (64 specimens) of all rock types. This obviously raises a question about the origin of the rocks from which the Plemięta adze-heads were made.

In order to discover the source of this raw material, we sought advice from several geological colleagues who are working on the sourcing of Neolithic axeheads in Europe. We asked them to comment on the macrophotos shown in Fig. 5 and on the results of the various compositional analyses.

For Antonin Přichystal (Brno), 'the rocks lack the ophitic texture which characterises the younger dykes of diabases, i.e. dolerites from the Bohemian Massif. In addition, the rocks show no trace of metamorphic foliation and probably all their three principal minerals (amphibole, plagioclase and magnetite-ilmenite) have no obvious signs of alteration. That is why we can probably exclude the Lower Palaeozoic (Ordovician, Silurian, Devonian) dolerites (diabases, microdolerites) from the Bohemian Massif including the part that outcrops in southern Poland. In contrast there are such unmetamorphosed dyke rocks of Upper Carboniferous age (postorogenetic from the point of view of the Hercynian orogenesis, and called diorites because of relatively acid plagioclase), and these were exploited during the Neolithic at their outcrops in southern Moravia. The workshops produced large polished tools especially during the Lengyel culture. The mineral composition is similar to those of the Plemięta adze-heads (amphibole, plagioclase, ilmenite, rarely a smaller amount of magnetite). But again they usually have an ophitic or almost ophitic texture and their plagioclases are altered (see Přichystal 2013, 219–220 and photos 300–304). At the moment, it seems to me that the raw material of the Plemięta adze-heads is probably not from the Bohemian Massif'. But 'to tell the truth, I would need a quality photo of the rock texture and to know the composition of the plagioclases'.

According to György Szakmany (Budapest), 'there are several possible sources of a raw material of dolerite-microdolerite-metadolerite type in east-central Europe (Starnini *et al.* 2007; Szakmány *et al.* 2011). For example, there are two outcrop localities that are known to have been exploited to make polished stone tools within the Carpathian Basin: the western part of the Bükk Mountains (around Szarvaskő in north-east Hungary) and the Maros valley in Romania. The only problem with Szarvaskő is that the opaque minerals are mainly ilmenite and not a magnetite-Ti-magnetite, but the main components are the same. So it would be necessary to undertake chemical and mineral chemical analyses of the stone tools to narrow the possible provenances'.

Federico Bernardini (Trieste) states that 'the best way of defining the origin of the raw material is to undertake a chemical analysis of the artefacts. There are, in fact, several dolerite outcrops from Germany to the Carpathians (Bernardini *et al.* 2014). Since the axes cannot be sampled, a non-destructive approach through Prompt Gamma Activation Analysis (PGAA) would be necessary to define at least the major elements'.

Commenting on the results of the analyses undertaken in Poland, Guy Cornen stated that it was a 'rock of magmatic origin (lacking the recrystallization associated with a deformation). The texture is not typically intersertal (more commonly known as 'doleritic'); the rock resembles a microgabbro. This microgabbro had been hydrothermalised (or spilitised) – that is to say, its primary ferromagnesian minerals (pyroxenes, olivine?, Ti-magnetite, calcic plagioclase formed at high temperature) had been transformed by the infiltration of water into a green amphibole; also present are chlorite and more sodic plagioclase or else potassic feldspar formed at low temperatures. The Ti-magnetites are mixed with magnetite and with ilmenite laths. This spilitisation is widespread in the dolerites and associated rocks in the Armorican massif, but it is equally present in other massifs elsewhere'.

Guy Cornen added that he had inspected 'several thin sections of rocks collected in Plussulien (Côtes-du-Nord, France) (Le Roux 1999; 2002) and in Saint-Germain-le-Guillaume/Beulin (Mayenne, France) (Kerdivel *et al.* 2011; forthcoming), both areas where the rock had been used during the Neolithic to make axeheads. The dolerites (or microgabbros) of the Beulin sector have a granulometry and a texture that could be compatible with that of the Polish adze-heads; this is evidently not the case with the Plussulien dolerites. But these rocks from Beulin that had been exploited during the Neolithic have a grain that is finer and more hydrothermalised than elsewhere: the plagioclases and the primary oxides are degraded and much epidote and secondary quartz had developed. In their current state and because of their fine texture, these rocks are not equivalent to the rock used for the Polish adze-heads.'

Nicolas Fromont (Rennes) has remarked: 'visually, the very fresh facies of the two Polish adze-heads may find several correspondences among axeheads in Normandy, but to my knowledge, the latter are generally patinated. As for the results of the analyses, I cannot pronounce on this because the analyses that had been carried out on the Armorican dolerites are not of the same type. Furthermore, in measuring only the major elements, we have only an idea of the rock (...) which is the same as all dolerites, diorites etc. Variations do exist, but their significance in terms of provenance is difficult to establish: sometimes there are important variations in the major elements within an individual vein. It is only the rare earths that can provide further information as these indicate the composition of the magmatic stock that lies behind the origin of the dolerites. Thus, for Lower Normandy, it is possible to distinguish between the dolerites of the north of the Cotentin peninsula from those of l'Orne-Mayenne-Sarthe using this criterion'.

Finally, according to Nicolas Le Maux (Paris), the hypothesis for these two Polish adze-heads is 'a fibrous dolerite formed on a brecciated rock. This accounts for the alternation between the stone's doleritic facies, the sub-feldspathic facies and the rare breccic veins (...). Axeheads of similar but not identical dolerites exist in Lower Normandy, but the source of their raw material has not yet been identified.'

To summarise, then, we must accept that the group of metagabbros that includes diabases (an ancient term still used in the USA) or dolerites (the current European term) is

widely distributed in Europe, being found and often exploited during the Neolithic in Spain (Gallello *et al.* 2016), in the Armorican massif (Le Gall 1999) and the Limousin in France (Santallier *et al.* 1986; Vuaillat *et al.* 1995), in the Channel Islands (Lees *et al.* 1989), in Great Britain (Clough 1988), Norway (Nyland 2015), central Sweden (Olausson 1983), Thuringia (Germany), the central Alps (Bernadini *et al.* 2014), the Bohemian massif (Přichystal 2013), Serbia (Antonovic *et al.* 2005), the Carpathians, etc. However, there does not seem to be an association between adze-heads of Bégude type and this family of rocks, since in the production zone in Piedmont where such adze-heads were made, the diabases-dolerites are only represented by small outcrops that do not seem to have been exploited (cf. the examples at Chenaillet (Hautes-Alpes, France) and those in the Levanto in Tuscany (Italy) and on the isles of Elba and Sardinia). Thus, in Italy, all the Bégude type axeheads that we have been able to study have been made exclusively of Alpine metaophiolites. The same observation had previously been made by Claudio D'Amico (D'Amico *et al.* 1997; 2000; 2012; D'Amico and Starnini 2012).

The variability of this family of rocks needs to be emphasised, as much in the scale of the outcrops, such as in the Armorican massif (Le Gall 1999) and in Limousin (Santallier *et al.* 1995) as in the axeheads that have been studied in smaller regions such as Brittany (Cognié and Giot 1952), the Loire Valley (Le Roux and Cordier 1974; Le Roux e*t al.* 1980) and the Vendée (France) (Gachina 1979). This creates the impression that:

– people had exploited numerous different outcrops, each with specific or variable petrographic characteristics;

– the absence of raw material reference samples and of polished axeheads of these rocks at a Europe-wide scale makes it impossible to source an individual axehead on the basis of petrographic or mineralogical characteristics on their own. A further difficulty is the variability in the modes of describing and studying these rocks, over time and from one geological tradition to another, with each worker seeking only to resolve regional problems. In the absence of these essential raw material reference samples, previous researchers tended to look for the closest source that could have been used to make an axehead. While this approach may generally be valid as far as the important series of specimens comprising roughouts and, more generally, specimens showing all the stages in the production of an axehead is concerned, it can be completely wrong when applied to polished axeheads, which could have circulated over long distances.

3. THE «FRENCH» HYPOTHESIS

Therefore, we are forced to concede that it is not yet possible to attribute the two adze-heads found at Plemięta to a specific source of the raw material; indeed, because there are virtually no good quality colour photos of the candidate rock types in question, in either geological or archaeological publications, it is not possible to make even initial comparisons. Nevertheless, we should not regard the task as insuperable, given the number and

the diversity of the metagabbros-diabases-dolerites in Europe. In effect, one could envisage a more archaeological and typological approach to the question – even though such an approach is only rarely taken into account in the archaeometric studies on the subject of sourcing.

The adze-head of Bégude type – a name given to polished adze-heads with a pointed butt, whose distribution lies in western Europe – is of a very specific form that is difficult to imitate, because it requires a high degree of expertise to achieve its shape through flaking with a hammerstone. This specificity of form and the difficulty of its manufacture makes it improbable that people in different regions of Europe could have invented this type of adze-head independently. Moreover, Bégude type adze-heads are absolutely unknown outside Europe, either in archaeological or in ethnographic contexts. In this respect, it contrasts with the regional imitations that were made of Alpine axeheads in local rocks, such as the Cangas-type axeheads of fibrolite in Spain (Pétrequin *et al.* 2012c), the Zug-type axeheads of serpentinite (Pétrequin *et al.* 2002) and the Glis-type axeheads of flint (Pétrequin *et al.* 2010), the last two types being found in the north-west of the Alps. The prototypes for these axeheads were the polished jade axeheads of high social value that were circulating over very long distances during the second half of the 5th millennium. The characteristic feature of these imitations of 'object-signs' is their irregularity of form and the fact that they are often quite roughly made – aspects that suggest the application of typological (and thus ideological) standards that were far less strict than those pertaining to the 'eponymous' models.

The two polished adze-heads from Plemięta appear to combine an Italian artefact form that is linked to the earliest implement types to be made of Alpine jades with a raw material (in the microgabbro-diabase-dolerite family) that is not found in the western high Alps. In attempting to account for this, we propose a three-stage scenario, based on the hypothe-sis that Bégude-type adze-heads will have represented a unique innovation in south-east Europe at the end of the 5th millennium, standing in opposition to the Danubian type of adze-head found further north in Europe (Pétrequin *et al.* 2012b, 637, fig. 66).

3.1. Bégude-type adze-heads and their circulation towards Brittany around 4700 BC

As observed above in section 1, the earliest Bégude-type adze-heads made of Alpine jades appeared in northern Italy before the end of the 6th millennium, as shown by the well-contexted examples found at Pozzuolo del Friuli/Sammardenchia (Venezia Giulia, Italy) (Pessina and D'Amico 1999; Bernabò Brea *et al.* 2012). Two centres of production

are known: the Mont Viso massif, where high altitude working sites have been found in zones only accessible during the summer, due to snow cover at other times of the year (Pétrequin and Pétrequin 2012), and the massif of Mont Beigua, north of Genoa, from where fewer items were exported due to the poorer quality of the raw materials.

To judge from the large number of broken and discarded adze-heads of Bégude type that have been found in settlements in northern Italy (and in particular at Alba in Piedmont), we are dealing there with an everyday tool used to fell trees, at least among the people who produced these objects. However, certain especially long examples that are oversized in terms of the technical requirements for an adze-head, and which were made from high quality jades, moved beyond the Alps (Fig. 4) and circulated in the direction of Brittany, as 'object-signs' that were frequently carefully polished, sometimes to a glassy finish. Once they had travelled beyond the Alps, these Bégude-type 'object-signs' are not found in villages. They had left the everyday sphere, to be consecrated to supernatural beings, either as hoards (such as the eponymous hoard from La Bégude-de-Mazenc, Drôme) or else planted in the ground in pairs, their blades uppermost, in particular locations in the landscape, in front of a rock-shelter or (in the case of one pair found at Lurs (Hautes-Alpes) at the top of a waterfall (Pétrequin *et al.* 2012a). Thus these 'object-signs', made from exotic stone that was particularly rare, tough and unalterable, were reserved for the domain of religion and rituals (Pétrequin *et al.* 2012a; Pétrequin *et al.* 2015). Once they had finally arrived in Brittany – this western end of the European world – certain large Bégude-type adze-heads were deposited, along with disc-rings of serpentinite, in the earliest monumental tombs of the Gulf of Morbihan (as at Quiberon: Cassen and Pétrequin 1999), around 4700–4500 BC. These first monumental tombs fore-shadowed the development of the giant Carnac-type mounds, which were reserved for the interment of exceptional individuals (Cassen *et al.* 2011) whose royal and religious functions are beyond doubt (Pétrequin *et al.* 2012a).

The Gulf of Morbihan, with its markedly inegalitarian social structure around the middle of the fifth millennium, represents one of the epicentres of the Neolithic world in western Europe (Cassen *et al.* 2012; Klassen *et al.* 2011), attracting exotic, highly-prized goods such as beads of variscite and axeheads made from fibrolite from the Iberian peninsula and from Alpine jades – the latter being very difficult and time-consuming to produce (Pétrequin *et al.* 2012). In this context, in which powerful mythological representations played a major role, jade axe- and adze-heads were considered to be, and manipulated as, 'object-signs' destined for the gods and for the powerful members of society (Cassen *et al.* 2010).

This underlines the importance and the social value of Bégude-type adze-heads once they reached Brittany, 900 km as the crow flies from the jade-working sites on Mont Viso, the highest point in the Italian Alps.

3.2. The rise of the production of objects made from diabase-dolerites in Armorica during the second half of the fifth millennium

Over the entire area where Alpine jade adze-heads of Bégude type circulated (Fig. 4), it was only in Brittany (or, more precisely, the Armorican massif and its edges, in geological terms) and Limousin that there are outcrops of diabase-dolerites (Le Gall 1999; Vuaillat *et al.* 1995). In places these outcrops are numerous and sizeable. It is not only the geology that is particularly important; there have been several discoveries of Neolithic diabase-dolerite exploitation sites, and of these the best known is the quarry at Plussulien (Côtes-du-Nord) (Le Roux 1999, 2002). The quarry at Le Pinacle on Jersey in the Channel Islands (Patton 1991) deserves to be mentioned, as does the recently-discovered site of Saint-Germain-le-Guillaume/Beulin (Mayenne) (Kerdivel *et al.* 2011; Kerdivel *et al.* forthcoming). Other probable exploitation sites are known in Bas Limousin, in the south east of the Massif central (Santallier *et al.* 1986; Vuaillat *et al.* 1995).

At Plussulien, the metadolerite of type A (Le Roux 1999) was extracted by means of fire-setting followed by knocking off thermal flakes, along a surface extending over several dozen metres (personal observation, P.P.). Roughing out using hammerstones was undertaken at the quarry. The initial- and later-stage roughouts display a remarkable degree of skill, given that the rock is tough and difficult to flake – as was shown by the preliminary experiments by Claude Sestier (pers. comm. and in Le Roux 1999, 87). This high level of know-how is equally demonstrated by the number and (often oversized) length of the roughouts and of finished products that were exported.

In and around the Armorican massif, and perhaps also in Limousin, a relatively short distance (75 km to 160 km) from the centre of power represented by Carnac and the Gulf of Morbihan in the fifth millennium BC, evidence has been found for the large-scale production of large adze-heads made from rocks in the diabase-dolerite family. This proximity between a large-scale exploitation area and a major epicentre for social intensification is not, in our opinion, simply due to geological chance. On the contrary: we suggest that at this particular point in time, these two complexes – the one technological, the other social – were linked in one way or another.

The presence of at least two long, partly-polished flaked adze-heads unquestionably of Bégude type (Fig. 6) among the objects of type A metadolerite that were exported from the source area (probably Plussulien) is likewise not due to chance. (The items in question had previously been wrongly identified as being axe/chisel blades.) Moreover, this phenomenon is not limited, either to Brittany or to the rock type used. In Lower Normandy, the Bégude type of adze-head features among the earliest axe- and adze-heads to be made from hornfels from the massif of Athis (Orne) (see Fig. 4; Le Maux 2014). One such example made from Norman hornfels was discovered in grave 416 at Buthiers-Boulancourt (Seine-et-Marne), dated to 4906-4709 BC and thus contemporary with the Villeneuve-Saint-Ger-

main culture (Samzun *et al.* 2012). Moreover, among the objects made from Île-de-France quartzite, the presence of a flaked roughout, very close in shape to those of Bégude type (Le Maux and Griselin 2013, 182, fig. 3, no.1), could similarly indicate an early regional production of adze-heads typologically close to the earliest examples made from Alpine jades.

However, there remains the question of the chronological position of these regional episodes of production which – to some extent, and over a short time – seem to have been copying the Bégude-type adze-heads that were circulating in the Paris Basin and as far as the Morbihan between c 4700 and 4500 BC. The aforementioned date for Buthiers-Boulancourt accords well with the beginning of these regional 'industries'.

What about the chronology of Bégude-type adze-heads of dolerite in the Armorican massif?

At Plussulien none of the radiocarbon dates that have been determined from charcoal (which probably derived from the use of fire-setting) is earlier than Gif 1877: 5270±140 BP, 4369-3770 cal BC at 95.4% probability (Le Roux 1999, 220). This date, with its admittedly large standard deviation, could provide a *terminus ante quem* for the beginning of exploitation there, since it cannot be assumed that the dated charcoal relates to the earliest episode of extraction. Thus a 'phase 0' can be proposed, predating this earliest radiocarbon date (which relates to a time when the extraction of stone at various points along the outcrop was well advanced). On the basis of long-distance exports of objects made from type A metadolerite that have been found at Jonquières/Le Mont d'Huette (Oise), Liévin (Pas-de-Calais) and Kemmel/Kemmelsberg (Belgique) in cultural contexts belonging respectively to the Chasséen, the early Michelsberg and the Epirössen, Charles-Tanguy Le Roux proposed a date of c 4300 BC for the beginning of exploitation at Plussulien.

This proposition is perfectly compatible with the presence of polished tools of type A metadolerite at Locmariaquer/La Table des Marchands (Morbihan) in the monument's Castellic level (Pailler 2009). The items in question are a pointed butt (Pailler 2009, 616, fig. 3, no. 2) and a body fragment of thick oval section (Pailler 2009, 616, fig. 3, no. 9). Yvan Pailler has also pointed out that in these levels, dating to between 4500 BC and 4000 BC (Cassen *et al.* 2009, fig. 5, chronological table), the proportion of metadolerite is in the minority during the Castellic (as are objects of fibrolite), whereas during the succeeding Auzay-Sandun period, the majority of stone tools are of metadolerite. On the basis of this evidence one could argue for a rise in the production of metadolerite objects at Plussulien, probably occurring during the second half of the fifth millennium BC.

In this chronological panorama, the most important fact would seem to be that the production of Bégude-type adze-heads of type A metadolerite at Plussulien post-dated the importation of this type of adze-head made from Alpine jades (i.e. the 'object-signs', reserved for an elite) and took the place of those Alpine examples. From being an importer of adze- and axeheads of Alpine jade, the Armorican massif and its edges (and possibly also Bas Limousin) became an exporter – well before the end of the fifth millennium – of large adze- and axeheads, made not only of metadolerites such as those from Plussulien and

Saint-Germain-le-Guillaume but also of diabase-dolerites that came from various exploitation sites that are currently poorly documented.

3.3. The north-easterly diffusion of Armorican 'Alpine-style' polished adze- and axeheads from 4300 BC

When adze- and axeheads made from west French diabase-dolerites (Fig. 7) began to be exported, at least some of them will thus have been influenced directly by one of the 'object-signs' of Alpine jade that were characteristic of phases I and II of the VBQ culture (Fig. 8), centred on northern Italy. One question naturally springs from this. With both the working of jades in Piedmont and the working of dolerites in the Armorican massif, the level of skill that is implied by the flaking of Bégude-type adze-head roughouts is remarkable; does this therefore mean that there had been a direct transfer of the high levels of savoir-faire that had been invested in the exploitation of jades in the Mont Viso massif? Or had there been an independent development of these high levels of skill in both the Alps and in the Armorican massif ? In the absence of unambiguous evidence for direct contacts between the VBQ and Castellic cultures (other than jade adze- and axeheads and certain Alpine disc-rings), we are inclined to favour the second hypothesis. But caution is needed, because we still lack a fine-grained chronology for the evolution of flaking techniques in western France.

We can, however, take as read that the ideal model of the 'Bégude object-sign' made its transition from jade to dolerites without losing its meaning. Bégude-type adze-heads were indeed tools, but in certain cases they were highly-charged symbolic objects that were for giving, for receiving, for placing into circulation, for treasuring or for consecrating. In effect, the Alpine jade examples and those of dolerite are often found in the same kind of findspot context, deposited as hoards (Cordier and Bocquet 1998). As with the Alpine jades, it could therefore be this social 'charge' that gave meaning to the 'object-signs' made of dolerite, especially those that travelled long distances. The Plemięta adze-heads are the perfect illustration of this, having travelled some 1400 km as the crow flies from the edges of the Armorican massif (Fig. 8, yellow arrows).The distance was considerable, but not as considerable as that travelled by some Alpine jade objects, which travelled 1700 km as the crow flies. If we find ourselves surprised by this, it is above all because the idea is new.

Moreover, during the period in question (that is, the second half of the fifth millennium and the beginning of the fourth), polished axeheads made from Alpine jades circulated in large numbers, travelling out from the Paris Basin in a north-easterly direction towards Germany (as shown in Fig. 9, the distribution of the Altenstadt-Greenlaw type of jade axehead). Two very large axeheads of Puy type (respectively 23.7 and 36 cm long) made of Mont Viso jades reached the island of Zealand in Denmark (Klassen 2004; Pétrequin *et al.* 2012b) and the distance travelled by these axeheads from the Paris Basin is the same as that between the Paris Basin and Plemięta, as the crow flies. Therefore, the long

distance travelled by the Plemięta axeheads cannot in any way be an argument for doubting their provenance.

We can add a persuasive consideration to the arguments that we have been proposing here – arguments that are based on fine-grained typological comparisons and on the evidence for chronological succession in north Italy and in the Armorican massif. From around 4300 BC, the Michelsberg culture, whose forerunners and earliest manifestation are situated in the north of the Paris Basin, extended rapidly as far as north-east Germany (Jeunesse 1998, 2010), and this expansion is certainly linked with that of polished axeheads of Alpine jades (Fig. 9) (Pétrequin *et al.* 2010b). These axeheads are sometimes found as hoards, as with that from Mainz/Gonsenheim (Jacobs and Löhr 2003), and some – according to our hypothesis, at least – will have been deposited alongside other axeheads made from diabase-dolerites.

However, we also need to note that, unless there is a hidden chronological problem of which we are unaware, it seems that the circulation of Alpine jade objects occurred independently of that of dolerite objects. We know of only one hoard – that of La Renaudie/Pierre Ronde (Puy-de-Dôme) – where a large axehead of Alpine jade has been found associated with one of dolerite (Fig. 10). In contrast, in all the other hoards of the second half of the fifth millennium and the first half of the fourth, jades are never associated with dolerites, whether it be in grave good assemblages such as those of the giant Carnac tumuli or in more classic consecrated hoards. This may imply independent circulation of objects of different materials, perhaps touching on different levels of Neolithic society.

4. OTHER PROBABLE IMPORTATIONS IN NORTHERN EUROPE

The hoard of Plemięta, which contained Bégude-type adze-heads that were practically identical and new when deposited, and that conform closely to the standards of Italian manufacture dating to the first half of the 5th millennium, could therefore have been made according to typological canons that had been transmitted to the producers of adze- and axeheads in the Armorican massif. In that region, the production of Bégude-type adze-heads can be situated at the beginning of a long technical evolution, which started with the strict imitation of the Italian tool types (ie the Bégude-type and, to a certain extent, Durrington-type axeheads) (Figs. 6-7). In view of the small number of these Bégude-type adze-heads made of dolerite – both in the zone of production and at a medium distance away – we are led to suppose that this initial episode was probably of short duration. A series of approximations (outlined above in section 3.2) allows us to situate this between 4500 BC and 4200 BC. The Plemięta hoard definitely post-dates 4300 BC and the expansion of the Michelsberg culture; its attribution to the end of the 5th millennium or the beginning of the 4th seems to be a reasonable hypothesis.

From the end of the fifth millennium, the production of adze- and axeheads made from the dolerite family of rocks underwent a technical evolution that is still not well known. The Bégude type of adze-head disappeared, or rather was modified in response to a new regional standard, namely the adze- or axehead with a circular section and a blade that was narrower than the body (Fig. 11, no. 1). This type, with its epicentre in north-east France, has been called the 'fusiform axehead'. A single example, found at Ernes (Calvados), was found among stones in a long barrow covering a small megalithic chamber with a short passage. This monument belongs to a phase, towards the end of the fifth millennium (Cassen and Pétrequin 1999), that is associated with the use of pedestalled cups and of goblets with internal lugs (Le Gall and Chancerel unpublished). It is likely that the production of these fusiform dolerite axeheads continued into the fourth millennium, as far as one can judge from several assemblages of low contextual and chronological reliability.

A rapid review of the polished adze- and axeheads of probable Danish, southern Swedish or north German origin that are considered to be possible imitations of Alpine examples (Klassen 2004) would seem to bear out that the Plemięta hoard is not isolated along the Baltic coast. Among the five polished axeheads whose raw material macroscopically resembles the diabase-dolerites of the west of France (Fig. 12), at least three belong to the fusiform type as described above: those from Scania (Sweden), Haraldstedt and Nord-Seeland (Denmark). It could naturally be argued that the origin of these old finds may be uncertain. That does not seem to be the case, however, for the Bégude-type adze-head from Munkrarup (Kr. Schleswig-Flensburg, Germany), kept in the Landesmuseum Schloss-Gottorf in Schleswig (Inventory no. 15950).

It would be straightforward to undertake systematic research in German museums to identify other importations; these would help to fill the gap in the distribution map (Fig. 8). Now is also the time to undertake a more systematic study of the Scandinavian axeheads that were exported to other parts of Europe, as far as the south west – as shown by the fragment of a Danish flint axehead found at Huelva in Andausia, Spain (Morgado, Lozano *et al.* 2014), which would have travelled around 2000 km as the crow flies from its area of production.

5. DISCUSSION

The distribution of Bégude-type adze-heads (Fig. 4) clearly divides Europe into two parts, with its hypothetical dividing line running across the continent from Friuli in Italy to Pas-de-Calais in France (Pétrequin *et al.* 2010). Only a few artefacts of Bégude type appear beyond this imaginary dividing line. So today, as discussed in the preceding section, the best hypothesis – even if not definitively demonstrated from a mineralogical point of view – is to consider the Plemięta adze-heads as imports, produced in France around the middle of the 5th millenium and circulating in the direction of Poland during the expansion of the Michelsberg culture. This hypothesis is strengthened by other indisputable

imports from France arriving in Denmark and Northern Germany at the turn of the fifth and fourth millennia.

We would now like to compare our hypothesis with those currently espoused in the Polish literature, which associate the adze-heads from Plemięta with the late Danubian communities (Wiślański 1987).

Wiślański based his concept on the similarities between the adze-heads from Plemięta with those from two neighbouring sites, recognized as being 'Danubian': Kazimierz (JADE 2008_0321) and Piła (JADE 2008_0322). It should be noted that the raw material from which they were made is still not definitively identified, being either a jade or a diabase-dolerite. It should also be noted that both artefacts belong among the uncontexted finds as described in Łucja Smoczyńska's publication (1953). It is worth noting that although Smoczyńska (1953, 73-74) pointed to their relationship with the Brześć Kujawski culture, she also emphasized the general western European character of the finds. Lech Czerniak came to a similar conclusion (1979). He compared the polished blade from Piła to the tools from the hoard of Żalęcino (German: Sallentin) (Dorka 1939) which were supposed to be imports or imitations of tools from the Rössen culture (Czerniak 1979, 127; 1980, 85). In that perspective, they would form part of a wide range of Rössen culture characteristics in the Polish Lowland (Czerniak 2012; Sznajdrowska 2012; Bigos 2014: 16).

If one accepts that the Plemięta adze-heads were probably produced from raw materials quarried in France, the western origin of those artefacts is not in doubt. As pointed out above, the typological affiliation of the adze- and axeheads from Plemięta, Kazimierz and Piła with examples made of Alpine jadeitite seems equally evident. It is worth noting that the Piła axehead is classified as being of Durrington type and the one from Kazimierz as Chelles type (Pétrequin *et al.* 2012b); this has far-reaching consequences. First of all, and as noted above, it must be emphasized that the appearance of the listed types of polished Alpine jade adze- and axehead in Germany is connected with the very beginning (c. 4300 BC) of the process of expansion of the Michelsberg culture (Jeunesse 1998, 42; 2010; Pétrequin *et al.*, 2010, 290; Ramminger 2010; Pétrequin *et al.* 2012b; Pétrequin *et al.* 2015, 71); moreover it is not just a case of a mere exchange of goods. The depositional practices of the Paris Basin were also transferred to the Michelsberg culture, as can be seen in the hoard of five jadeitite axeheads from Mainz/Gonsenheim (Jacobs and Löhr 2003). Against this background, it seems unlikely that the 'customers' for these imported objects in central and northern Europe represented the 'Danubian' communities. The natural supplier to the populations of the TRB culture came from the Michelsberg community zone; from this zone came elements borrowed from western Europe. This conclusion applies to both the Eastern (Rzepecki 2004, 2011) and the Northern TRB (Klassen 2004).

We should underline the fact that we interpret the presence of a hoard of adze-heads in the area to the west of the Odder as reflecting the adoption of religious and cultural norms associated with the West. Moreover, this conclusion does not only concern the adze-head types analysed here: Bégude, Chelles and Durrington. If we look carefully at the hoard

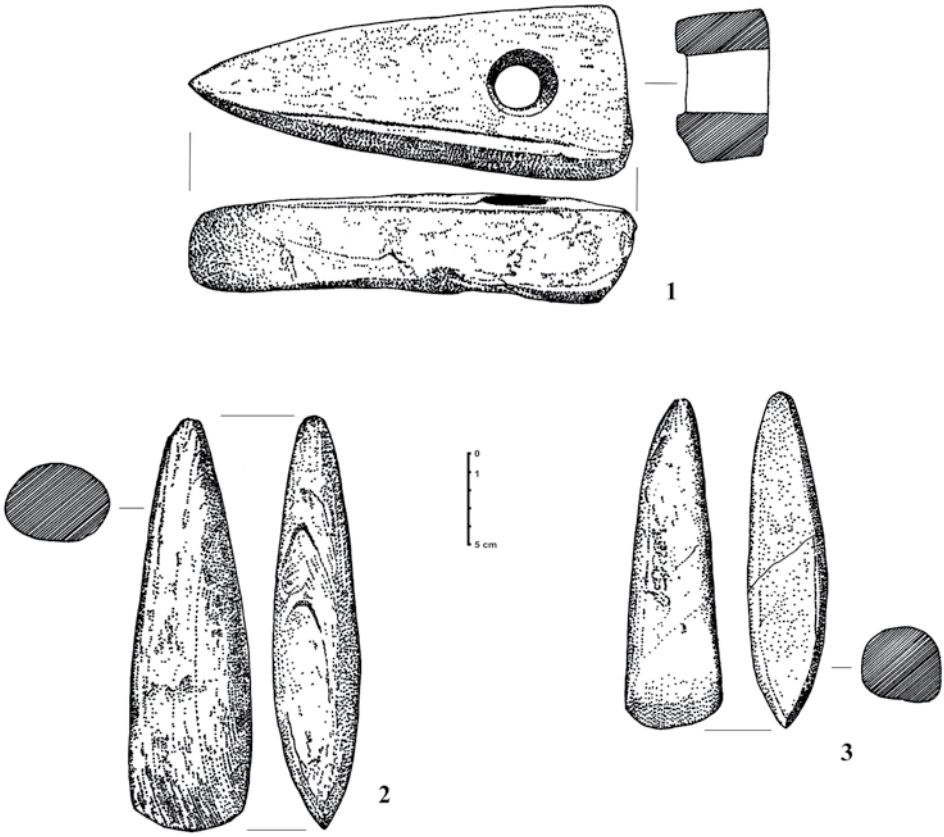

Fig. 13. The hoard from Żalęcino, Dolice commune, West Pomeranian Voivodeship, Poland. After Dorka 1939

from Żalęcino (Fig. 13), we will notice the features which are well-known from axehead hoards in western Europe. The Żalęcino objects were reportedly found under a large flat stone which was covered with earth, situated on a slight elevation of the terrain ('*Hortfund unter einem großem, flachem Steine, der über 4 Fuß mit Erde bedeckt war, auf einer sanft ansteigenden erhöhten Fläche*'; Dorka 1939, 187).

The dating of this hoard to the period following the decline of the Rössen culture is justified by its typological characteristics. Lutz Klassen (2004, 45) classified the perforated shoe-last adze (*durchborte Schuhleistenkeil*) from Żalęcino as being of the Lendershagen variant, contemporary with the Gatersleben culture. Also, the point-butted shape of the two polished blades (*spitznackige Beile*) has no good analogies in the Rössen culture,

while it is characteristic of the early Michelsberg culture in the area of Lower Saxony. All this allows us to date this assemblage to the end of 5th millennium BC (Klassen 2004, 65-66).

The integrity of the ritual deposits of polished adze- and axeheads, and the association of these deposits with a host of features inspired by interactions with the Michelsberg culture such as the use of ceramic plates (*Tonscheiben*), beakers, Niedźwiedź type tombs and the practice of supine burials (Rzepecki 2004; 2011), seems to be well founded. As noted above, in essence they are components of the ideological 'superstructure' related to the adoption and adaptation of the idea of using megalithic monuments. The recognition of this relationship might allow us to date the deposition of the hoard from Plemięta as being contemporary with the development of the Eastern TRB.

We can conclude that the significance of the Plemięta hoard cannot be overstated. After all, it is not just about placing another point on the map showing the distribution of Bégude-type adze-heads. The inclusion of the Eastern TRB within the long-distance exchange system for Alpine adze- and axeheads encourages us to pose several more questions about the relationship of that phenomenon to megaliths and to bog deposits.

Finally, last but not least, implementation of a large-scale research programme in Polish museums to look for axeheads made of Alpine jades should be treated as a particularly urgent task.

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