REINHARD JUNG · MATHIAS MEHOFER

MYCENAEAN GREECE AND BRONZE AGE ITALY: COOPERATION, TRADE OR WAR?

»I continue to believe it probable that the occasion for the first introduction of Type II swords to the Aegean was military necessity that drove Mycenaean princes to hire warriors from outside Greece. These warriors brought their own armouries with them. Their swords in particular were greatly admired by their employers, who set their own swordsmiths to copy and adapt them.« [1]

Since the publication of Hector Catling's paper, which contains the above interpretation of Late Bronze Age relations between Mycenaean Greece and its north-western neighbours, various researchers have decisively contributed to a better understanding of the processes that lead 1) to the adoption of new types of weapons, armour, dress accessories and implements (often referred to as metallurgical *koiné* or »urnfield bronzes«) at the end of the Aegean Bronze Age and 2) to the local production of *impasto* pottery of Italian Recent and Final Bronze Age type in the Aegean and beyond. Thanks to the results of recent studies, we are provided with detailed typological arguments [2] that support the theory that the origin of those bronze and pottery types has to be traced back to Italy (figs 1-2). Other schools of research argued that the majority of the types forming the metallurgical *koiné* was invented in the regions of

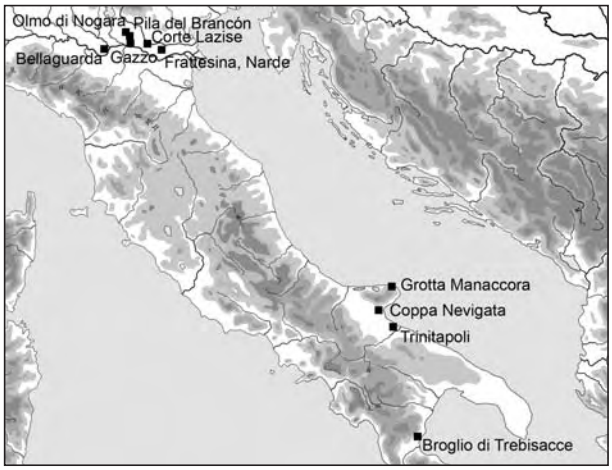

Fig. 1 Sites of the studied objects in Italy. – (Map R. Jung / M. Mehofer).

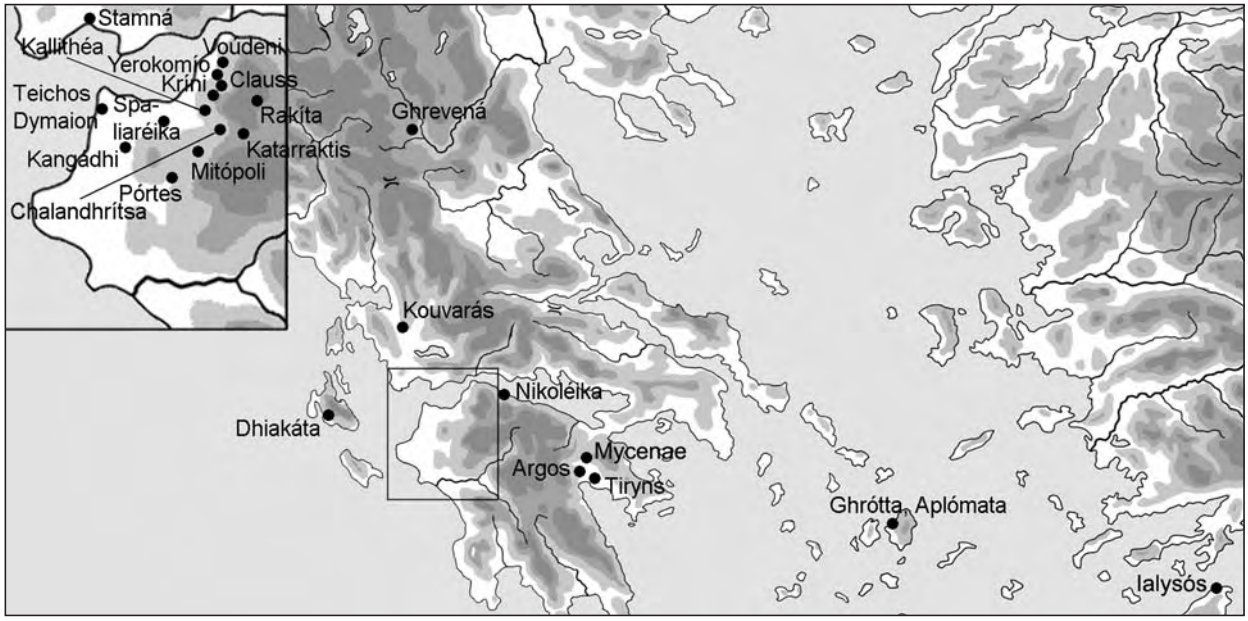

Fig. 2 Sites of the studied objects in Greece. – (Map R. Jung / M. Mehofer).

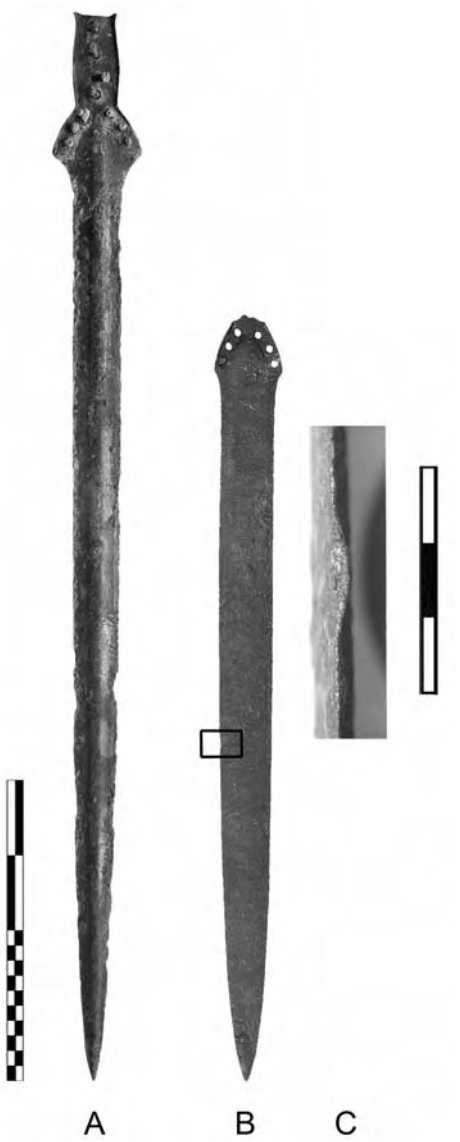

Fig. 3 **A** Olmo di Nogara, tomb 41, Naue II sword, type Cetona (scale 1:5). – **B** Tsountas hoard I, inv. no. E.A.M. 2539, Naue II sword, unknown type (scale 1:5). – **C** The detail shows a damage at the cutting edge of the sword from the Tsountas hoard I, which proves that it was used for fighting (scale 1:1). – (Photos R. Jung / M. Mehofer).

the Balkans and/or Central Europe and reached the Aegean via a Balkan route[3], whereas still others proposed to ascribe at least specific types to a Central European/Balkan origin[4]. However, statements are often very cautious and diverse options are regarded as possible. Undoubtedly, this is due to the close similarities between bronzes from many different regions in Europe – the very reason for the coining of the term »metallurgical *koiné*«.
These insights, now, inevitable pose the following fundamental question: from which region, when and why were new types of artefacts introduced to the Aegean? Given their typological homogeneity over wide geographical areas, only metal analyses of a larger number of weapons, parts of armour, implements and dress accessories forming this metallurgical *koiné* can help to determine the spatial origin of production.

EARLY »URNFIELD BRONZES« IN THE MEDITERRANEAN REGION

As is well known, in the Aegean the earliest artefacts, which represent types of the metallurgical *koiné*, are a pair of ivory hilt plates for a Naue II sword and a mould for a winged axe, both found at Mycenae in contexts dating to LH IIIB Middle (contemporary with part of Recent Bronze Age 1 [RBA 1] in Italy)[5]. Due to the mould, it is plausible to assume that winged axes of Italian type were produced at Mycenae during the Palatial period, but one cannot fully ascertain whether the mould was cut in Italy or in the Aegean. At Mycenae two bronze swords of the Naue II group have been found. The first one was excavated by Heinrich Schliemann and cannot be dated by context[6]. The second one was discovered by Christos Tsountas and forms part of a large hoard assemblage (Tsountas hoard I) from the Northwest Quarter of the citadel. That quarter was not inhabited after LH IIIB Final[7], and the hoard assemblage does not contain any type that would point to a more recent date of its deposition. These are strong indications that plausibly locate the various bronzes' date of production during the Palatial period – or in Italian terms before RBA 2. This further means that the Naue II sword is one of the earliest of its type known from the Aegean. Moreover, it is also morphologically early in the series of that typological group because the blade has a rather thin, lentoid section and the cutting edges of its distal part (about one third of the blade length) converge towards the tip. In Italy it can be best compared to the sword of tomb 41 at Olmo di Nogara (prov. Verona; **fig. 3A**), which is dated to RBA 1 on stratigraphical grounds[8] and is thus the oldest datable sword of type Cetona[9] from Italy and roughly contemporary to the sword and the ivory hilt plates from Mycenae. Besides the Naue II sword (**fig. 3B**), the Tsountas hoard I contained five more swords, but these are of Mycenaean type. Therefore, this hoard functions as a snap-shot of a transitional time at the end of the Palatial period, when the first new Italian swords

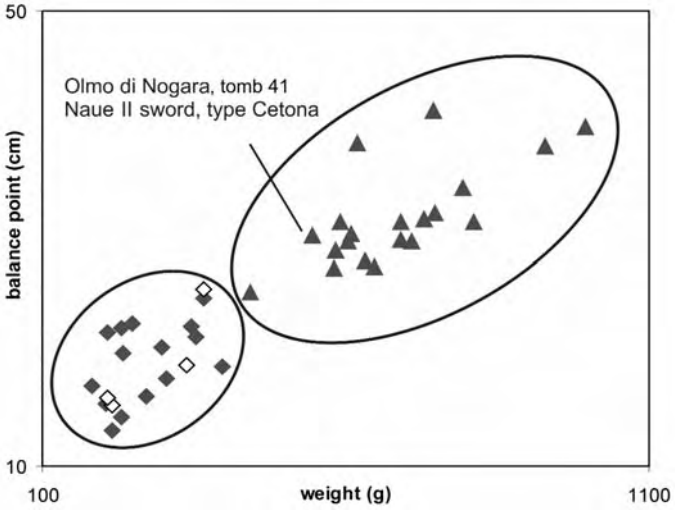

Fig. 4 The diagram shows a ratio of balance point and weight of swords from Italy and Greece. The measurements prove that the Myceanean-type swords (◆ Sanders' types A, C, D, F and G; ◇ Tsountas hoard I, Mycenaean types) are cleary set apart from the Naue II swords (▲ types A-C/Ceto-na-Allerona). These differences depend on their construction and reveal their intended uses as thrusting or slashing swords. – (Illustration R. Jung / M. Mehofer).

were used by the Mycenaean armies. The Mycenaean-type swords of the Tsountas hoard I belong to two typological groups[10]. Two swords are characterised by a long and flat blade with a narrow midrib. They belong to type G in Sandars' typology. The remaining three swords from the Tsountas hoard I are square-shouldered, have a flat blade and pertain to Sandars' type F.

COMBAT TECHNOLOGY AND USE-WEAR ANALYSES

In order to evaluate the different use patterns of the late Mycenaean-type swords and the newly introduced Naue II swords, we thoroughly examined available objects from Italy and Greece. Specifically, the factors weight, balance point and length were measured in order to describe the construction features related to the use of the weapons in a quantitative way with numeric parameters[11]. These measurements show that the swords studied in our project can be divided into one group with the balance point near to the hilt, and another group with the balance point further away from the hilt[12]. The first group comprises all measured swords of late Mycenaean types, whereas the second group is formed by Naue II swords (**fig. 4**). If the balance point and, as a consequence, most of the weight is situated closer to the hilt, the sword will feel well-balanced in the hand[13], which is important for a quick movement to hit a precise spot of the enemy's body by thrusting. If, however, the balance point is closer to the tip, a slashing movement from above increases the level of kinetic energy. The measurements confirm that the Naue II sword was indeed a functional novelty in Aegean sword combat (as opposed to B. Molloy[14]). Its type is clearly to be set apart by function from the thrusting and stabbing swords of Mycenaean tradition. Regarding the exemplar from Olmo di Nogara, tomb 41, the results of the measurements correlate with its date to the beginning of the production period of Naue II swords in Italy. In the diagrams it plots at the margin of the Naue II group, not far from the Mycenaean thrusting and stabbing swords (**fig. 4**).

In a further step each weapon was closely examined concerning its state of preservation and technological features in order to document possible traces of combat use. In several cases we were able to identify damages and repairs of the cutting edges[15]. This proves that these swords were not only used for ceremonial purposes but also as weapons in battle. These observations fit in very well with those made by Kristian Kristiansen in his studies on Central European swords over the last 20 years[16]. The Naue II sword from the

Tsountas hoard I can be regarded as an example in case. It has a damage of the cutting edge in the middle part of the blade, which attests to its usage not only for thrusting, but also for slashing (**fig. 3C**). This is especially interesting, as this artefact does not yet possess all the characteristics of a developed slashing sword. Additionally, it strongly suggests that already during the early stages of the development of the Cetona slashing sword, this weapon – which we might label as an »experimental piece« – was used in the Aegean and, moreover, most likely in slashing movements. Later, during LH IIIC, certain Mycenaean swords were produced whose blades display morphological influences of the Naue II type and were thus adapted to the fighting style with slashing and cutting movements, which now dominated the Aegean[17].

PROVENANCE ANALYSES

In the last decades, diverse research groups have carried out several large-scale analytical programs (using chemical as well as lead isotope analyses) in the Mediterranean and especially in the Aegean[18]. They focused on both copper ore deposits and bronze artefacts[19]. However, the end of the Bronze Age and especially the periods from LH IIIB to Submycenaean were not in the centre of that research. Our project focuses precisely on these spaces of time and on the contemporaneous RBA and FBA (Final Bronze Age) periods in Italy. To date, 49 artefacts from Italy and 19 slag samples from the Trentino region, 89 artefacts from Greece and a few more from the wider Mediterranean area have been analysed in the Curt-Engelhorn-Zentrum Archäometrie, Mannheim. Interestingly, the objects from Italy form a quite homogeneous group regarding both their chemical composition and their lead isotope ratios. A comparison with published analyses of copper ores allows us to exclude the northern Alpine, the Sardinian and the Tuscan ore deposits[20] (**fig. 5**). At the same time, there is analytical evidence for a southern Alpine origin of the copper used in Italian bronze production. The majority of the studied objects from Italy are characterised by lead isotope ratios, which coincide with those of contemporaneous copper smelting slags from various workshop sites in the Trentino[21].

Most of the finds from Greece provide evidence that they were produced with Cypriot copper[22], whereas a few pieces are grouped with the Italian artefacts. Those few Aegean objects, which show the same characteristics as the artefacts found in Italy, are all of Italian type. One may therefore conclude that these exemplars are imports from Italy. For a cross-check, our analyses include a number of contemporaneous artefacts of Mycenaean type, which in many cases derive from the same closed contexts as the analysed Italian-type objects from Greece. None of these Mycenaean bronzes contains the Italian copper, which characterises the exemplars found in Italy. We would therefore claim that one could exclude the possibility of Italian copper being imported to the Aegean and being used in Mycenaean weapon workshops.

The analytical results of the Naue II sword from the Tsountas hoard I coincides with the Italian artefacts from the Veneto and Lombardy regarding both trace element pattern and lead isotope ratios (**figs 5-6**). Hence, it can be classified as an import from Italy to Greece. Does this mean, however, that the sword of Mycenae was produced in a workshop in the Veneto? This question concerns the debate that centres on the circulation of either finished products or raw metal in the Italian-Adriatic area. 27 of the Italian objects sampled in our project were found in the regions Veneto and Lombardy, another 16 artefacts come from Calabria and Apulia, while six analysed pieces were discovered in south-eastern Sicily. Analytical results including minor and trace element percentages and lead isotope ratios are available for seven objects from southern continental Italy. The determination of the lead isotope ratios of the remaining nine south Italian exemplars is still in progress. According to the analyses, six of those seven objects are grouped with the artefacts from northern Italy. They include two swords with triangular hilt of type Pertosa, one of whose

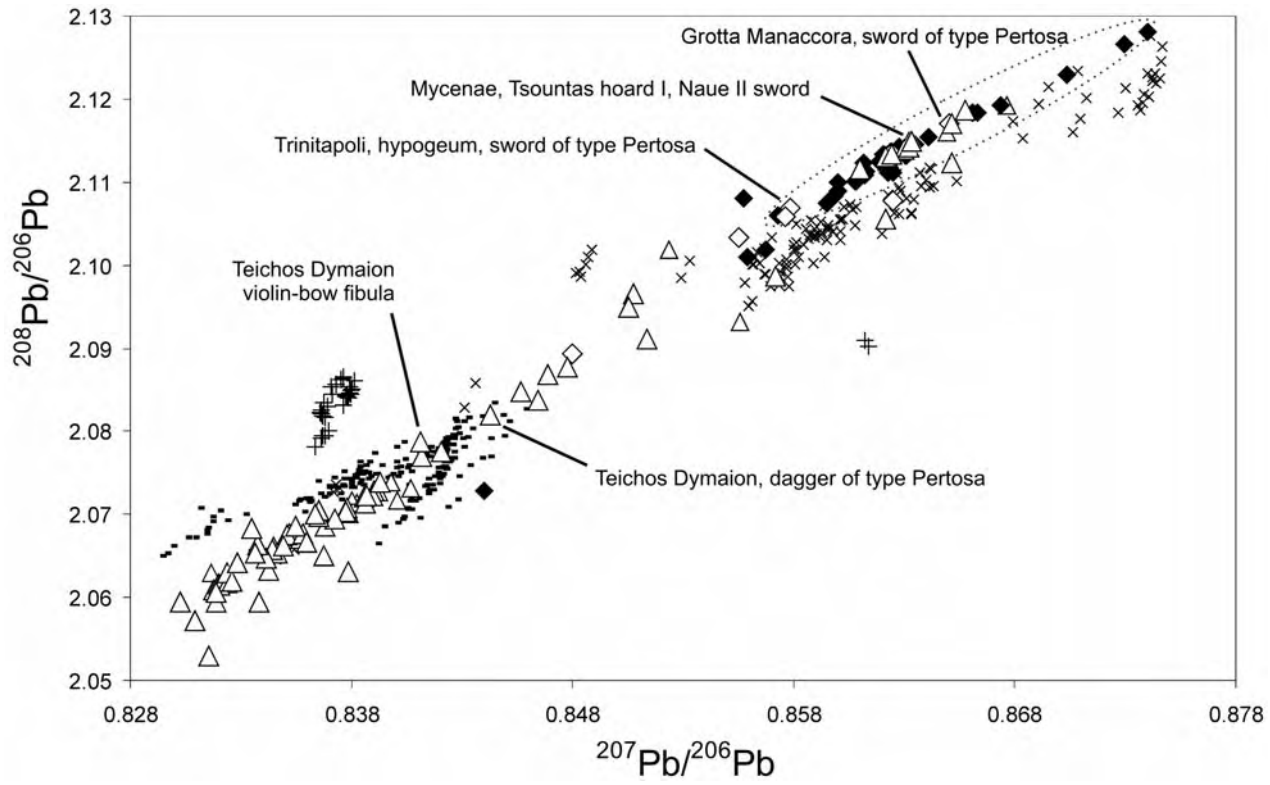

Fig. 5 The diagram presents the lead isotope ratios of the objects studied compared to published lead isotope ratios of copper and lead ores from Sardinia, Tuscany and Cyprus. It illustrates that several »Italian-type« artefacts from various Greek sites (△) have lead isotopes that are closely comparable with those of objects found in northern Italy (◆) and in southern Italy (◇). The dotted ellipse circumscribes the lead isotope ratios of 19 copper slags from Trentino. – Lead isotope data of ores (+ Tuscany; ▪ Cyprus; × Sardinia) after Stos-Gale et al. 1995, 413 tab. 1; Stos-Gale / Gale / Annetts 1996, 384 tab. 2.; Gale et al. 1997, 241 tabs 2, 242; 3, 243; 4, 246; 6. – (Illustration R. Jung / M. Mehofer).

being found in the Grotta Manaccora (prov. Foggia)[23] and the other in the so-called Hypogeum of the Bronzes at Trinitapoli (prov. Barletta-Andria-Trani)[24]. These two swords are dated to MBA 3 (Middle Bronze Age) by their stratigraphic contexts[25]. The Pertosa type is characteristic of southern and central Italy and does not occur further north than Lazio[26]. It follows then that the sampled specimens cannot be classified as imported objects that were produced in northern Italy. This leads to the conclusion that southern Italian bronze workshops had access to copper or bronze, which was shipped from northern Italy southwards along the Adriatic coasts[27]. This, in turn, adds to the picture of an intensification of the relationships between the Po Valley region and southern Italy during the period in question. Up to now that intensification was only deduced by typological reasoning[28].

Later on, during the RBA, copper export from northern Italy continued. We can say that the metal reached the Marche region, a conclusion that is suggested by the comparison of trace element data of artefacts from the Veneto analysed in our project with published data of artefacts from Moscosi di Cingoli (prov. Macerata) and Cisterna di Tolentino (prov. Macerata)[29]. Regarding the FBA, the excavations at Rocavecchia (prov. Lecce) brought to light a large bronze/copper hoard find (hoard 2 of the FBA 2 phase of the settlement) containing several ingot fragments with a total weight of 11.25 kg[30]. They may be imports from the north, as has been supposed for various bronze implements in the same hoard[31]. Current metal analyses are already aiming to find out if this raw metal has the same provenance as that of the copper ingots in the contemporaneous hoard 2 of Frattesina (prov. Rovigo)[32], which form part of the north Italian group in the lead isotope diagram (fig. 5)[33].

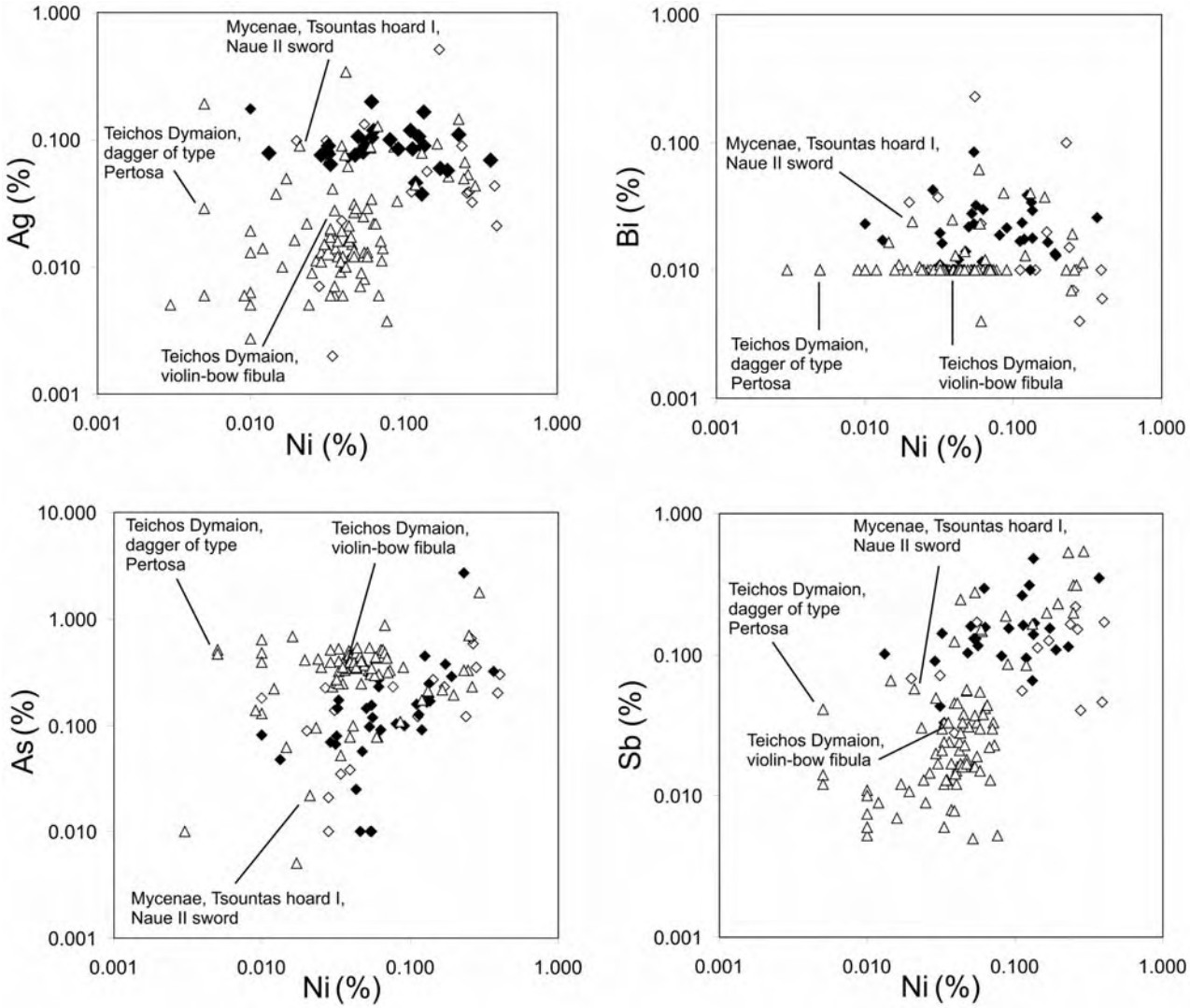

Fig. 6 Logarithmic plot of different trace element concentrations in the analysed objects. One can observe a separation of the artefacts found in Italy (◆ northern Italy; ◇ southern Italy) from those found in Greece (△). The trace element signatures of a few objects found in Greece lie within the »Italian field«. These are the same specimens, which plot with the Italian artefacts in **figure 5**. – (Illustration R. Jung / M. Mehofer).

This set of mentioned arguments open up the possibility that a sword made of north Italian copper and which was discovered in Greece, is in fact a southern Italian product. Nevertheless, it is possible that not only raw copper was shipped from the north to the south of Italy. Finished bronze products (like swords) and other goods might also have found their way to Apulia and the neighbouring regions via these connections. Some observations argue in favour of an intermediary role of southern Italy in the transfer of weapon technology from the Adriatic coasts to Greece:

1. Mycenaean pottery of the Palatial period (LH IIIA-IIIB) is found concentrated in the southern part of the Apennine peninsula, whereas it appears only sporadically in the central Italian regions[34]. According to petrographic and chemical analyses, most of the few sherds found in the Po Valley seem to be Italo-Mycenaean products and not imports from the Aegean[35]. In Italy the only larger concentrations of imported palatial Mycenaean pottery seem to be Thapsos (prov. Siracusa) in Sicily[36], Scoglio del Tonno (prov. Taranto)[37] and perhaps Rocavecchia in Apulia[38].

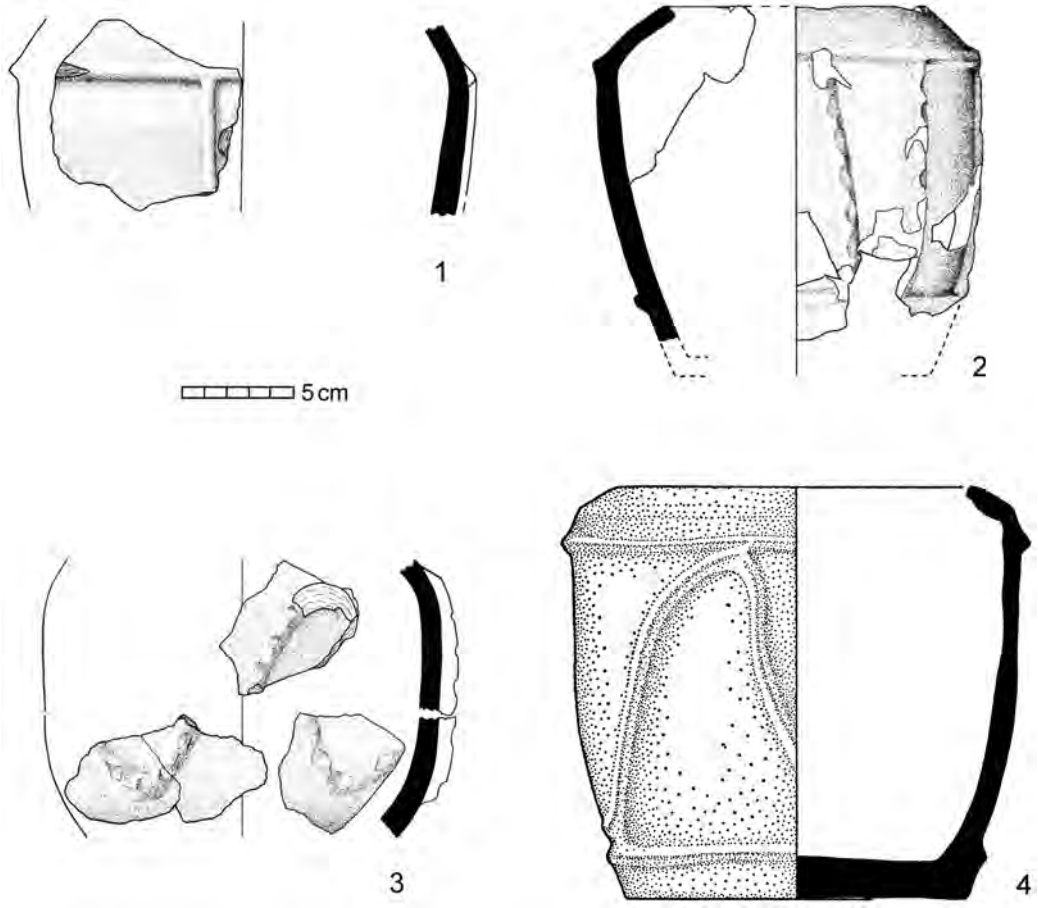

Fig. 7 Barrel-shaped jars of *impasto* pottery from Tiryns (**1** LH IIIC Early; **3** LH IIIC Late), Rocavecchia (**2** FBA 1) and Korakou (**4** LH IIIC Early). – (1 after Kilian 2007, pl. 22, 278; 2 after T. Scarano in: Pagliara et al. 2007, 338 fig. 13, IV.32; 341; 3 after Kilian 2007, pl. 23, 288; 4 after Rutter 1975, 18 illustration 1). – Scale 1:3.

2. Among the Italian-type Handmade Burnished Ware in the Aegean[39], types that are exclusive to northern Italian pottery manufacture are not present. Those types, which show relationships to more circumscribed regions, point to southern and central Italy[40]. One example is the horned handle with a nose-like protrusion belonging to a large *impasto* cup from Teichos Dymaion (nomos Achaea)[41]. This type is characteristic of southern to central Italy and was specifically common in the Adriatic regions[42]. Barrel-shaped jars with a strongly incurving rim and plastic ribs from Korákou (nomos Corinth)[43] and Tiryns (nomos Argolid)[44] once again have their strongest parallels in southern to central Adriatic Italy[45], e. g. at Rocavecchia[46] (**fig. 7**).
3. Wheelmade Grey Ware is a pottery class present in small quantities in LH IIIB and IIIC levels at several Mycenaean sites[47], but also in RBA contexts in southern continental Italy. Whereas some of the Grey Ware vessel shapes are Mycenaean in origin, others are derived from Italian pottery shapes. Grey Ware vessels were found at Dhimíni (nomos Magnesia) in Thessaly and at Tell Kazel in Syria, which clearly reproduced Grey Ware and *impasto* pottery types from Italy[48]. Wheelmade Grey Ware has a very circumscribed distribution area in southern Italy, along the Ionian coasts of Calabria and in Apulia[49]. Therefore, the occurrence of those vessel types in the Aegean and further east must be explained with direct or indirect contacts to the mentioned regions in the south of Italy.

4. Bronze weapons of Mycenaean type or showing Mycenaean typological elements appeared only in the south of Italy. These are the well-known sword of type F from the Surbo hoard (prov. Lecce) in Apulia, a Naue II sword with a semicircular hilt of Mycenaean shape from the Grotta Manaccora again in Apulia [50] and miniature type F swords from south-eastern Sicily [51]. Other examples from earlier (MBA) contexts could be added, e. g. the Aegean-type dagger from Rocavecchia in Apulia [52].

The arguments outlined above confirm the existence of a transfer of military know-how from Italy – and probably southern Italy – to the Aegean. As an example in case we can refer to the citadel of Teichos Dymaion in north-western Achaea. It is located on Cape Áraxos, which offered the first landfall for a ship coming from the Ionian Sea and directed towards the Corinthian Gulf or the western coast of Peloponnese. Most probably, a principal function of the citadel was to control those important sea routes [53]. In a destruction layer dated to the beginning of LH IIIC Early a dagger of type Pertosa with an ivory hilt cover was found [54]. Italian-type *impasto* pottery came to light in various Mycenaean contexts at the site – thus probably indicating the presence of some immigrants from the southern Italian mainland. The dagger is a local product as its chemical composition coincides with the majority of the bronzes from Greece, whereas its lead isotope ratios are compatible with those of Cypriot copper ores. In addition, a violin-bow fibula with good Italian parallels was found at Teichos Dymaion [55]. It also contains Cypriot copper and can thus be classified as a local Mycenaean product. The Pertosa dagger and the fibula demonstrate that bronze weapons and dress accessories foreign to the Mycenaean traditions and with exact parallels in Italy were produced at least since the beginning of the Post-palatial period in the Peloponnese.

But how did this technology transfer happen? In this specific context, we would like to draw attention to some weapons with special typological details, which are confined to Italy and the Aegean. These are spearheads with a dashed decoration on the socket between the blades [56] and Naue II swords with a blade that shows a double-stepped profile in its distal part close to the tip [57]. According to our analytical results, both groups are represented in the Aegean with 1) imported pieces made of southern Alpine copper and 2) local products containing Cypriot copper. That means there must have been some kind of a direct contact between Italian and Aegean weapon workshops. This conclusion opens up a new question: Did the late Mycenaean smiths only copy type and style of Italian weapons, or did they also adopt their production techniques in every detail? Was there, in fact, a more elaborate technology transfer going on? Unfortunately, we are not sufficiently informed about weapon production in either Greece or Italy in the 2nd millennium BC. The casting process of a sword was probably carried out with a two-part mould [58]. Such moulds are known from all over Italy, from Sabucina (prov. Caltanissetta) in Sicily [59] to Piverone (prov. Torino) in Piemonte [60], Castellaro del Vhò (prov. Cremona) in Lombardy [61] and Frattesina in the Veneto [62]. By contrast, in Greece, no sword moulds of any kind have been found so far [63]. At Tiryns fragments of terracotta moulds for spearheads came to light in LH IIIB levels [64]. If swords were also made in terracotta moulds, this might explain why no Mycenaean sword mould is known from Greece today. We could observe damages at the end of the grip tongue on different swords from Greece. They probably result from the casting process. Clearly, the producers must have had difficulties in casting the thin grip tongue when pouring the bronze into the mould from the tip. One mould from Piverone indicates, however, how this problem was solved [65]. By means of small runners [66] at the proximal end of the grip tongue the fluid bronze could flow through the grip tongue without being stopped by gas bubbles at the end of the mould. Consequently, the quality of the cast was improved. In the *chaîne opératoire* the casted product had to be further reworked. Differences between the production techniques applied in Greece and Italy may have affected these later steps such as forging, annealing and polishing.

In order to clarify this issue, metallographic analyses are carried out in the laboratory of the Vienna Institute for Archaeological Science by Mathias Mehofer. They focus on the production technology of swords

in Mycenaean Greece. Imported and locally produced Naue II swords were sampled, whereas a few Aegean-type swords were additionally analysed. In total, thirteen swords with Italian and Greek provenance were sampled for metallographic studies. We are currently carrying out the analyses but as a first result we want to highlight the very good quality of the Italian swords. They are intensively annealed and hammered. Nearly no shrink holes are visible. By contrast, several of the Mycenaean products have shrink holes and are not so heavily hammered.

REMELTING OF IMPORTED ARTEFACTS?

Another point of interest emerges when the results of the chemical analyses carried out in our project are further evaluated. The results of our analytical program suggest that during the 13th and 12th centuries BC, in the late Palatial period as well as in the following Post-palatial period, no large-scale recycling was practised, or at least – to be precise – no recycling involving imported metal objects. This conclusion rests on the premise that a recycling process would be easily visible in the chemical composition and in the lead isotope ratios of the metal only in the case of a mixture of copper of different provenance. This may stand in contrast to what other scholars have postulated [67]. They referred to the collection of bronze scrap, tools and ingots on the Gelidonya shipwreck as an illustration for the praxis of bronze recycling. George F. Bass had already interpreted that ship as belonging to a merchant, who »not only traded with metals, but was a tinker who worked with them himself«. Apart from the pure metal he had aboard, there were also »bronze scraps and ingots for being recast« [68]. Nevertheless, we may point out several indicators in support of our hypothesis that recycling of imported Italian objects was not practised to any great extent in LH IIIB and IIIC:

1. The diagrams show a clear separation between the majority of the artefacts found in Greece and those found in Italy (figs 5-6). This means that there was no large-scale exchange of raw metal between these regions. 2. Those objects identified as imports to Greece can be classified as Italian types. Their isotopic and chemical patterns coincide in most cases with those of the Italian finds. If their metal was a mixture of »Italian« and Cypriot copper resulting from bronze recycling in Greece, their trace element patterns and their lead isotopic ratios should position them between the »Italian« and the »Greek« groups. However, only few Italian-type objects plot between the two large clusters. If recycling was a recurrent practice, there should be many artefacts filling the space between the two isotopic and chemical groups. There are indications that at least some of the objects that neither belong to the »Greek« nor to the »Italian« set form a separate group with specific chemical and isotopic characteristics. This might be related to an ore deposit that is still unknown to us [69].

Regarding the problem of recycling, one can further argue that a sword is an object, which has to be produced with great care using the best material as well as the best available forging technology, because the sword fighter's survival depends on the quality of his weapon [70]. Adding scrap metal (with e. g. a high lead content) during the casting process would produce a sword with an unpredictable chemical composition and thus unpredictable mechanical properties [71]. Therefore, this had to be avoided and can thus not be assumed for such »high quality« objects. But even if examining the chemical composition of artefacts of everyday use that did not need to have precisely defined properties depending on their alloy, one can hardly find an object that has to be classified as produced with recycled metal [72]. Those »everyday objects« belong either to the »Italian« or to the Cypriot group. Moreover, we may add that up to the end of the LH IIIC period the tin contents [73] of the analysed artefacts remained constantly high, whereas the lead contents stayed consistently low. Large-scale recycling of bronze objects due to a shortage of tin supply

would lead to more varied (or decreased) tin contents, which was not observed. These results lead to our conclusion that there was no large-scale exchange of raw or scrap metal between Italy and Greece. It is more likely that only personal items like knives or prestige objects such as weapons were taken by single individuals to Greece and were eventually buried with their owners.

Even though we want to reserve the discussion of these problems for the final publication of the analytical results, we want to point out that the influence of added tin on the lead isotope ratios of bronze artefacts is insignificant, as has been described in a study on tin ingots found in the Late Bronze Age shipwrecks of Uluburun (Turkey, prov. Antalya), Kefar Shamir and Hishuley Carmel (both Israel, district Haifa)[74]. Usually, copper that is freshly smelted from the ore can contain up to 1% lead. However, the analyses of the tin ingots illustrated that these are nearly free of lead. The lead content of 13 tin ingots varies between 0.5 and 32 ppm, while two further ingots have maxima at 220 and 630 ppm[75], which is much lower than the usual lead content of raw copper (cf. the oxhide ingots from the Uluburun wreck, which contain far less than 1% lead)[76]. Therefore, the authors of that study were able to conclude that only the lead, which entered the alloy as impurity of the copper, causes the measured lead isotope ratios[77].

CONCLUSIONS

We would now like to turn to the question being posed in the title of our paper. Were the relationships between Mycenaean Greece and Bronze Age Italy most strongly characterised by cooperation, trade or war? Regarding possible war scenarios, the laconic Linear B lists only support that the kingdom of Pylos (nomos Messenia) took measures to guard its coast. This happened most likely as a protection against pirates[78]. Some researchers interpreted the relevant texts in terms of regular administration and not in terms of emergency measurements during the last days before the palace burnt down[79]. If they are right, one may infer a longer lasting threat of seaborne attacks against the territory of Pylos. There are also archaeological arguments for the existence of a prolonged period of (military) pressures on the palace system at Pylos and in the Argolid after LH IIIB Middle, during the second half of LH IIIB[80]. It is not rendered irrelevant that warriors operating from the western coasts of the Adriatic were organising pirate attacks against at least the western coasts of the Peloponnese. However, the well-known pictorial sherds found at Termitito (prov. Matera) in the Basilicata demonstrate that a fruitful cooperation of palatial pottery workshops in the region of Mycenae and potters from southern Italy must have existed at least at some time during the 13th century BC[81]. Unquestionably, the situation was not one of permanent war between »Italian« warriors and the Mycenaean armies.

Several researchers agreed with H. Catling that mercenaries from Italy were employed by the Mycenaean palace state(s) in the last decades of the 13th and at the beginning of the 12th century BC and thus during the years that were overshadowed by the crisis of the East-Mediterranean states[82]. The existence of locally produced handmade pottery of Italian type in layers dating to LH IIIB Developed and Final at Tiryns, Midea, Mycenae and Nichoria on the Greek mainland[83] is indeed a strong argument supporting the hypothesis that people coming from continental Italy were residing among the indigenous Mycenaean population already prior to the fall of the Mycenaean state system. The evidence of our analytical project makes it now much more probable that the local production of Italian-type *impasto* pottery and the introduction of bronze types of the metallurgical *koiné* starting in LH IIIB Middle are in fact related to each other. This connection, therefore, changes its common status of being a mere assumption to that of strong evidence.

The fundamental differences in the social and economic structures between RBA southern Italy and the Mycenaean palace state render it improbable to assume the existence of a real arms trade between the two

regions during the 13th century BC. Many RBA and FBA settlements provided evidence for bronze workshops inside their borders and there are indications that at least in southern Italy the metal production might have been controlled by eminent personalities [84]. However, the fragmented settlement patterns and the limited circulation of pottery vessels in several south Italian regions rather suggest the existence of small political and economic units [85]. Thus, one can plausibly exclude the proposition of a continuous production of finished metal objects that would have been specifically destined for interregional exchange. Even Susan Sherratt's »decentralized low-level trade« [86] does not seem to be a reasonable explanation for the first appearance of these new bronzes, as weapons and other objects of Italian type and originating in the Palatial period are not found ubiquitously in the Aegean. By contrast, they are markedly concentrated at the political and economic centres of the Mycenaean state. This suggests that the ruling classes of Mycenaean Greece had an interest in the new weapon technology from Italy [87]. Yet, these objects are single instances. Weapons in the Late Palatial period were predominantly Mycenaean in type, as LH IIIB warrior tombs demonstrate [88]. One may add that the Tsountas hoard I includes six swords, of whose merely one is of Italian in type.

The mentioned socio-economic and political differences make it also not likely that warriors could or would have been hired in Italy by the rulers of Mycenae. According to our opinion, a good analogy is offered by Egyptian historical sources. Texts dating from Ramesses II to Ramesses III describe attacks of various tribes from the desert and from across the sea – incursions, which often ended in the submission of the invaders and their subsequent integration into the Pharaonic army [89]. Occasionally enemy groups of different origins formed coalitions before attacking Egypt, but they were never hired in their homelands by the Pharaoh for the Egyptian army. There is also no evidence that the Libyan chief Mariyu »recruited from Sicily, Tyrsenia, and Sardinia«, that »prospectors for mercenaries would undoubtedly have found the lands of the central Mediterranean a promising vein« and that »Meryre advertised for skirmishers« [90]. The relevant Merenptah inscriptions do not tell us, how Mariyu assembled his coalition of »Aqa⟨a⟩washa, Tursha, Luk(k)u, Sherden, Shekelesh, Norther[ners, wander]ers of all lands« [91]. Clearly, it is a matter of military necessity to equip one's army with new types of weapons if the neighbours possess more deadly weapons than oneself. Long slashing swords were unknown in the eastern Mediterranean prior to their introduction from Italy [92]. This makes it highly likely that the Mycenaean armies, who seem to have been the first to adopt the new sword type, were precisely under the pressure of western warriors equipped with such weapons. Once they had integrated some contingents of those modern fighters, they were able to participate in the new combat technology of Italian and Central European origin.

Later on, after the fall of the palace regime in the Aegean, Italo-Mycenaean relationships intensified rather than diminished [93]. However, they functioned in a totally different socio-political framework as both regions were now organised in small-scale political units. By LH IIIC Advanced the Cetona and Allerona types had become the most common swords of Mycenaean warriors [94]. In certain regions such as Achaea they had ousted the Mycenaean sword types completely [95]. However, not all those lethal but elegant weapons that were buried with their owners turned out to be local Aegean products. A number of them could be traced back to their western area of origin. We think they can most probably be interpreted in terms of gift exchange relations between the chiefs in Italy and Greece, who maintained close relationships and met each other on an equal footing. To use a Homeric term – which fits quite well despite of the chronological difference – a sword would have been a praised ξείνιον [96] of highest esteem in a time when weapon burials ranked among the richest grave assemblages both in RBA 2-FBA 2 Italy and in LH IIIC-Submycenaean Greece [97]. In the terramare area of northern Italy the function of the sword as a rank signifier becomes archaeologically visible even in a negative way. As an illustration, one can point towards swords that have been ritually destroyed in the cemetery area and not put into the tomb of a single person because the

austere burial rite prohibited the equipment of the dead with the symbol of his mortal power[98]. One cannot, of course, exclude that some of the weapons produced by smiths in Italy reached the Aegean as war booty during LH IIIC-Subymcenaean. Nevertheless, we think that the mentioned indications for inter-regional workshop contacts throw a clear light on the peaceful side of Italo-Mycenaean relationships, in the framework of which both metallurgical know-how and the weapons themselves could be exchanged.

Acknowledgements

We wish to express our sincere gratitude to all the colleagues from Italy and Greece for the excellent and fruitful collaboration. We owe special gratitude to L. Kolonas (Pátras), I. Moschos (Pátras), E. Papazoglou-Manioudaki (Athens), E. Pernicka (Curt-Engelhorn-Zentrum Archäometrie, Mannheim) and L. Salzani (Verona). – The project presented in this paper was financially supported by the Institute for Aegean Prehistory (Philadelphia), the Austrian Science Fund (FWF: project no. P17912), the Vienna Institute for Archaeological Science/University Vienna, the Society for the Study of Mycenaean Achaea (Pátras) and the Austrian Academy of Science. We would like to thank the anonymous reviewers for their valuable comments on an earlier version of this paper.

Notes

1) Catling 1968, 103; cf. also Catling 1961, 121.
2) Matthäus 1980. – Harding 1984, 132-134. 137-140. – Damiani 1991, 17 fig. 8; 20. – Papadopoulos / Kontorli-Papadopoulou 2000. – Bettelli 2002, 117-137. – Jung 2006, 21-57. – Kilian 2007.
3) von Merhart 1958, 137-147. – Hiller 1986.
4) Sandars 1983. – Sandars 1985, 88. – Bouzek 1985, 215. 217. 222. – Harding 1995, 38.
5) Jung 2006, 177-179 pl. 15, 1-2.
6) Schliemann 1878, 167 fig. 221.
7) Cf. the pottery published by Iakovidis 2006.
8) Salzani 2005, 131 fig. 274; 336 pl. 6, Tb 41,A. – de Marinis / Salzani 2005, 405 f. 431. 434 f. – For the dating see also Cupitò 2006, 204 f.
9) Or Naue II, type A, Bianco Peroni 1970, 62-65; Kilian-Dirlmeier 1993, 94-96. 100-105.
10) Sandars 1963, 151 f. pl. 26, 36. 46-47. – Spyropoulos 1972, 12-16 figs 10-12; 14-15 pls 4-6. 7γ. 8α.
11) Osgood 1998, 101-112.
12) Jung / Moschos / Mehofer 2008, 94. 105 fig. 8. – Jung / Mehofer / Moschos in prep.
13) Sandars 1963, 119.
14) Molloy 2010, 421.
15) Jung / Mehofer 2009, 113 fig. 4, 2. – Jung / Mehofer / Moschos in prep.
16) Kristiansen 1984, 188-195; 1999, 101 fig. 1, 3; 103-105 fig. 5; 2002, 323 f. fig. 3c, right.
17) It is such a late sword of type F with a long blade, influenced by the Naue II design, that was reproduced and tested by B. Molloy and showed cutting abilities comparable to those of replica Naue II swords, Sandars 1963, 134 f. 139 f.; Kilian-Dirlmeier 1993, 167; Jung / Mehofer 2009, 131 f.; Giannopoulos 2008, 176 f.; Molloy 2010, 419-421.
18) Angelini / Molin / Artioli 2009, 157-164 tabs 2-4. – Artioli et al. 2009, 171 tab. 3. – Begemann et al. 2001. – Gale / Stos-Gale 2005. – Hook 2007. – de Marinis et al. 2005, 680-682. – Marino / Pizzitutti 2008. – Stos-Gale et al. 1995. – Stos-Gale / Gale / Annetts 1996. – Stos-Gale et al. 1997.
19) For summaries see Stos-Gale / Gale 2009; Kayafa 2006; Jung / Moschos / Mehofer 2008, 86 f.
20) For a detailed discussion see Jung / Mehofer / Pernicka 2011, 236-239.
21) Jung / Mehofer / Pernicka 2011, 238. 240. – Jung / Mehofer / Moschos in prep.
22) Their lead isotope ratios either coincide with published lead isotope ratios of Cypriot copper ores (Gale et al. 1997) or with the lead isotopes of the copper ingots found on the Uluburun shipwreck (most of which were published only in graphs, see Gale / Stos-Gale 2005, 121 fig. 3; 123 fig. 5; 124 fig. 6; 126 fig. 7).
23) The hilt of the sampled sword is much corroded and partly broken off today, but most probably it is to be identified with Baumgärtel 1953, pl. 9, 1; Bianco Peroni 1970, 24 cat. no. 39 pl. 6, 39.
24) Tunzi Sisto 1999, 254 no. 1496; 255 pl. 1, 1496.
25) Recchia 1993, 394 fig. 27, L.13. – Peroni 1999.
26) Bianco Peroni 1970, 26 f. pl. 68, D. – Cf. Bettelli 2006.
27) Jung / Mehofer / Pernicka 2011, 241. – Jung / Mehofer / Moschos in prep.
28) Peroni 1997, 35.
29) de Marinis et al. 2005, 680-682. – Jung / Mehofer / Pernicka 2011, 239 f. fig. 23.7.
30) Maggiulli 2009, 319-327.

31) Bietti Sestieri 2008, 29 f.

32) Salzani 2000.

33) Their results will be published in the near future.

34) Bettelli et al. 2006, 402 f. figs 3-4.

35) ICP-MS/ES analyses with 30 measured elements, see Jones et al. 2002; Salzani et al. 2006.

36) Chemical analyses by ICP-MS/ES with 46 measured elements, see Jones / Levi 2004.

37) According to typological and stylistic criteria see Jung 2005, 59; Vagnetti et al. 2009.

38) R. Guglielmino in: Pagliara et al. 2008, 260. – Guglielmino / Levi / Jones 2010.

39) Jung 2006, 32-39 pl. 26.

40) Bettelli 2002, 121-126. – Bettelli 2009.

41) The fragment, which has also been discussed previously (Jung 2006, 34 with bibliography), was found during Mastrokostas' excavations in the settlement. It will be published by I. Moschos and the authors of the present contribution.

42) Lipari, acropolis, Ausonio I (RBA-FBA 1): Bernabò Brea / Cavalier 1980, 110 pl. 202, 4a. – Coppa Nevigata: P. Boccuccia / G. Recchia in: Cinquepalmi / Radina 1998, 39 with fig. 34. – Cortine di S. Maria in Campo (RBA 1[-2]): Damiani 1991, 13 fig. 4B; 15; Damiani 2005, 630 f. with fig. 2, 10. 15. – Conelle di Arcevia (RBA 1[-2]): Moscoloni / Danesi / Galluzzi 2007, 92 fig. 6, 11; 93.

43) Rutter 1975, 18 f. illustration 1 pl. 1 fig. 1.

44) Kilian 2007, 105 f. pls 22, 278; 23, 283. 288. 291.

45) Jung 2006, 38. – Kilian 2007, 29-31.

46) T. Scarano in: Pagliara et al. 2007, 338 fig. 13, IV. 32; 341.

47) Belardelli 1999. – Adrimi-Sismani 2006a-b.

48) Jung 2006, 47-51 pls 5, 3. 4; 7, 6; 17, 1-4. – Jung 2012, 109-112 fig. 10.4.

49) S. T. Levi / M. Bettelli in: Bettelli 2002, 96 f. fig. 44A-B.

50) Bianco Peroni 1970, 72-74 pl. 24, 174. – Bietti Sestieri 1973, 386-388 fig. 1, 1.

51) Sandars 1963, 137 f. 151 f. pls 25, 43; 28, 69.

52) Guglielmino 1996, 261 f. figs 5; 8, 1.

53) Gazis 2010.

54) Mastrokostas 1967, 134 f. pl. 177, α. – Papadopoulos 1998, 29 cat. no. 136 pl. 22, 136. – Jung 2006, 204.

55) It belongs to variety VI A according to Kilian 1985, 150 fig. 3, VIA3; 153; 166 f. – For the Italian parallels and the date to RBA 2 and LH IIIC Early see also Jung 2006, 115 f.

56) Jung 2006, 53 f. pl. 1, 2-3. – Bruno 2007, 105 f. 350 pl. 24, 115-117.

57) Jung / Moschos / Mehofer 2008, 91. 105 fig. 7.

58) The casting and production processes of (European) bronze swords are described by Ankner 1977, 269-459; Northover 1988, 131; Born / Hansen 2001, 182-224; Ó Faoláin 2004, 75-102; Wüstemann 2004; Bunnefeld / Schwenzer 2011.

59) Albanese Procelli 2000, 77-80 figs 3; 4, 1.

60) Bianco Peroni 1970, 72 nos 168-170 pl. 25, 168-170.

61) Cierny et al. 2001, 76 fig. 37, 6.

62) Lefèvre-Lehöerff 1992, 206 no. 77.

63) We wish to thank Claus Reinholdt for confirming this observation.

64) Rahmstorf 2008, 81 f. pls 35, 1789-1791; 90, 9.

65) Bianco Peroni 1970, pl. 25, 170.

66) Born / Hansen 2001, 203.

67) Catling 1964, 298. – Knapp / Muhly / Muhly 1988, 237. 257. – Sherratt 2000, 87 f. – Muhly 2005, 510 f.

68) Bass 1967, 163.

69) Stavropoulou-Gatsi / Jung / Mehofer 2012, 256-259 fig. 9.

70) Westphal 2002, 3.

71) Sperber 2004, 329. – Mehofer 2011, 126 f.

72) Of course it is clear that waste from a casting process like the casting jets or the runners are recycled, but this remelted metal will have more or less the same chemical and isotopical signature. Therefore, it can hardly provide evidence for recycling by analytical means.

73) It is still very hard to prove recycling by metallographic methods. To date, recycling of bronze is only analytically verified for metal remnants in crucibles, which were found in a metal workshop. It is difficult, however, to provide with a metallographic evidence for finished products, see Schwab in print.

74) Begemann et al. 1999.

75) Ibidem 282 tab. A-1.

76) Hauptmann / Maddin / Prange 2002, tab. 1.

77) Begemann et al. 1999, 281. – The lead content of the objects analysed in our project is 4685 ppm (= 0.4685 %) on average.

78) Deger-Jalkotzy 1978, 14-52.

79) Palaima 1995. – Cf. Shelmerdine 1999, 403-405.

80) Shelmerdine 1987. – Shelmerdine 1999. – Deger-Jalkotzy 2008, 388-390.

81) Vagnetti 2000-2001, 108-110. 113. – Jung 2005, 59 f.

82) Peroni 1996, 285 f. – Bettelli 2002, 134-137. – Eder / Jung 2005, 485 f.

83) Jung 2006, 24. 34. 179-181 with bibliography. – Kilian 2007, 47. – Demakopoulou / Divari-Valakou / Schallin 2003, 10 f. fig. 9; 14 f. fig. 22.

84) Bernabò Brea et al. 2006, 88 f.

85) Vanzetti 2000, 137 no. 9.

86) Sherratt 2000, 87.

87) Jung 2009, 136-138.

88) Jung 2005, 48 fig. 1; 64. – Moschos 2007, 14 fig. 6; 21 fig. 12.

89) Gnirs 1996, 60-62.

90) Drews 1993, 217-219.

91) Kitchen 2003, 2. 19. 29.

92) Jung / Mehofer 2009, 117-123.

93) Eder / Jung 2005.

94) Eder / Jung 2005, 487 pls 107-108. – Deger-Jalkotzy 2006.

95) Giannopoulos 2008, 202-240 tab. 3. – Moschos 2009, 360.

96) Cf. e. g. Ulf 1990, 202-207. – Wagner-Hasel 2000, 79-82. 91-104.

97) Eder / Jung 2005, 490 f. – Deger-Jalkotzy 2006. – Giannopoulos 2008, 239-241.

98) Cardarelli / Labate / Pellacani 2006, 633 fig. 12, 1-16; 636-639 fig. 16.

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Zusammenfassung / Abstract / Résumé

Kontakte zwischen dem mykenischen Griechenland und dem bronzezeitlichen Italien: Kooperation, Handel oder Krieg?

Die Interaktionen zwischen Italien und Griechenland vom 14. bis zum 11. Jahrhundert v. Chr. sind der Gegenstand des vorliegenden Beitrags. Während dieses Zeitraumes können wir die Ausbreitung spezifischer archäologischer Typen, wie etwa der Naue II-Schwerter, der Lanzenspitzen mit gegossener Tülle, verschiedener Gerätschaften oder spezieller Kleidungsaccessoires, die zur metallurgischen Koine gehören, in den Mittelmeerraum beobachten. Die Prozesse, die zur Ausbreitung dieser Urnenfelderbronzen führten, können zurzeit nur teilweise erklärt werden, da die zur Verfügung stehenden typologischen Studien nur von begrenzter Aussagekraft sind. Daher wird ein interdisziplinärer Lösungsansatz vorgestellt, bei dem archäometallurgische Analysen mit der technischen und typologischen Klassifikation von Objekten, die in verschiedenen Regionen der Ägäis sowie Italiens gefunden wurden, kombiniert werden. Als ein wichtiges Ergebnis dieser Studie kann eine Reihe von Bronzeartefakten aus spätmykenischen Kontexten als Importstücke aus Italien angesprochen werden. Darüber hinaus liefern diese Forschungserkenntnisse Argumente dafür, dass die Phänomene der lokalen Produktion von Impastokeramik italienischen Typs und der Übernahme von Bronzeformen der metallurgischen Koine in den spätpalastzeitlichen und nachpalastzeitlichen Gesellschaften der Ägäis miteinander in Beziehung standen.

Mycenaean Greece and Bronze Age Italy: cooperation, trade or war?

The interactions between Italy and Greece from the late 14th to the 11th century BC are the subject of this paper. During that particular period, new bronze types such as Naue II swords, spearheads with cast socket, different implements and dress accessories belonging to the metallurgical *koiné* spread to the Mediterranean world. Available typological research explains little and thus leaves the processes leading to the distribution of *koiné* goods only insufficiently understood. We therefore pursue an integrated approach combining archaeometallurgical analyses with the technological and typological classification of artefacts found in different Aegean and Italian regions in order to solve the problem. As a result, a number of bronzes from late Mycenaean contexts can be identified as imports from Italy. Furthermore, our research supports the theory that the local production of Italian-type *impasto* pottery and the introduction of bronze types of the metallurgical *koiné* were two related phenomena in the Late Palatial and Post-palatial Aegean societies.

Contacts entre grèce mycénienne et âge du Bronze italique: coopération, commerce ou guerre?
Les interactions entre l'Italie et la Grèce entre les 14e et 11e siècle av. J.-C. font l'objet du présent article. Nous pouvons observer à cette époque la diffusion de différents types d'artefacts spécifiques correspondant à des types archéologiques comme les épées Naue II, les pointes de lance à douille coulée, différents outils et accessoires de parure qui font partie de la koinè métallurgique méditérranéenne. Les processus qui ont permis la diffusion des ces bronzes des Champs d'Urnes ne peuvent être entièrement expliqués à l'heure actuelle car les études typologiques disponibles ne sont que peu signifiantes. Une propositon de solution à ces questions reposant sur une coopération interdisciplinaire est donc présentée ici; elle repose sur des analyses archéométallurgiques croisées à des classifications techniques et typologiques d'objets en provenance de différentes régions de l'Egée et de l'Italie. Parmi les résultats significatifs, une série d'artefacts de bronze en provenance de contexte mycéniens tardifs peuvent être considérés comme des importations d'Italie. Les résultats de ces recherches livrent également des arguments permettant de proposer que les phénomènes de production locale de céramique à impasto de type italique ainsi que la reprise de formes de bronze de la koinè métallurgique sont également à mettre en relation pour les phases palatiales tardives et au-delà dans les sociétés égéennes. Traduction: L. Bernard

Schlüsselwörter / Keywords / Mots clés

Bronzezeit / Mittelmeergebiet / Ägäis / Italien / Bleiisotopenanalyse / Archäometallurgie / Bewaffnung
Bronze Age / Mediterranean / Aegean / Italy / lead isotope analysis / archaeometallurgy / weapons
Âge du Bronze / Méditerranée / Égée / Italie / analyses d'isotopes du plomb / archéométallurgie / armement

Reinhard Jung
Österreichische Akademie der Wissenschaften
Institut für Orientalische und Europäische Archäologie
Abt. Europa
Fleischmarkt 22
A - 1010 Wien
reinhard.jung@oeaw.ac.at

Mathias Mehofer
VIAS – Vienna Institute for Archaeological Science
Archaeometallurgy
Franz-Klein-Gasse 1
A - 1190 Wien
mathias.mehofer@univie.ac.at