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Metal finds at the Middle and Late Bronze Age settlement of Scoglio del Tonno (Taranto, Apulia): results of archaeometallurgical analyses

Hallazgos metálicos en el yacimiento del Bronce Medio y Final de Scoglio del Tonno (Taranto, Apulia): resultados de los análisis arqueometalúrgicos

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ABSTRACT

Scoglio del Tonno (Taranto) is a settlement with a strategic location in one of the best natural harbours of the Italian Peninsula. During the Late Bronze Age it was an emporion, a privileged and permanent landing place for ships sailing between the Aegean and Italian Peninsulas. Crucibles and a number of metal artefacts were found during its excavation (1899, Quagliati 1900; Säflund 1939); this work reports the quantitative analysis of these metal artefacts by energy dispersive X-ray fluorescence. All are made of copper alloys except for one piece, an eyelet pin made of a gold-silver-copper alloy. The examination of these objects and the analytical data obtained help reconstruct the functions of this site. Metal was systematically accumulated at Scoglio del Tonno, presumably to be shipped towards the eastern Mediterranean. The site highlights the exponential increase in northern Italian metal production during the Recent Bronze Age (ca. 14th-13th c. BC).

RESUMEN

Scoglio del Tonno (Taranto) es un yacimiento con una posición estratégica sobre uno de los mejores puertos naturales de la península italiana. Durante el Bronce Tardío fue un emporion, lugar permanente de contactos entre el Egeo y la península italiana. Crisoles y diversos objetos de metal recuperados en las antiguas excavaciones (1899) han sido recientemente analizados con ED-XRF. Excepto una pieza (una aguja de una aleación de oro, plata y cobre), todos los objetos son aleaciones de base cobre. El estudio de los objetos de metal, incluido los datos de su composición, aporta elementos útiles para una reconstrucción de las funciones de este lugar. En Scoglio del Tonno el metal era sistemáticamente almacenado, presumiblemente para ser enviado hacia el Mediterráneo oriental. El yacimiento ilustra también el aumento exponencial de la producción de metal en el norte de Italia durante el Bronce Reciente (siglos XIV y XIII a.C.).

Key words: Archaeometallurgy; Bronze Age; Italy, Cu-Sn Alloys; ED-XRF.

Palabras clave: *Arqueometalurgia; Edad del Bronce; Italia; Aleaciones Cu-Sn; ED-XRF.*

1. INTRODUCTION

Scoglio del Tonno is presently part of the urban area of Taranto (Apulia) and is among the most important sites of Bronze Age southern Italy. The period of interest of the present paper is the local Late Bronze Age (LBA), i.e., the Recent Bronze Age (RBA), ca. 1350-1200 BC, and possibly the earliest part of the Final Bronze Age (FBA), ca. 1200-1000 BC.

In the overall context of Italy's present territory, Apulia shows a number of distinctive features and specific potentials. From an Italian Peninsular perspective, it is characterized by the

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Fig. 1. Location of the Scoglio del Tonno in the Mediterranean Sea.

homogeneous morphology that reigns over a large part of the area it occupies; unlike most of Italy, Apulia is an exceptionally large natural region not occupied by high mountains. Moreover, it is a naturally circumscribed region, its eastern and western borders being formed by the Adriatic and Ionian coasts. In the Mediterranean context, the region occupies the southwestern end of the Adriatic sea, the maritime passageway between the eastern Mediterranean and Central Europe, and is that part of Italy which is first sighted by ships coming from the East. Thus, this region is particularly suited to interior and interregional communication by land and sea.

Apulia's coasts gradually became occupied from the end of the 3rd/beginning of the 2nd millennium BC. Settlements were mainly sited on small peninsulas or promontories, often in connection with lagoons (generally drained over time). Along the Adriatic coast there is consistent evidence of contact with the Balkan coast. Occupation was particularly dense in the eastern Ionian area. A recurrent feature is the artificial isolation of these settlements by means of strong walls, generally built to coincide with the isthmus joining the peninsula or promontory to the mainland. The interior was also systematically settled, with some major sites controlling the main natural routes towards the north and the Tyrrhenian coast, e.g., Santa Maria di Ripalta (Tunzi Sisto 1999). Both the coastal and the interior sites were usually rather small (= 5 ha). However, and despite the limited degree of intraregional integration, systematic contacts between the coast and the interior are indicated by the overall homogeneity of the material culture as well as by the circulation of metal and metal artefacts.

In the 17th-16th centuries BC, the coastal areas of Apulia were among the main destinations of the earliest systematic sailing ventures from the Aegean, the coasts and islands facing the southern Tyrrhenian sea, and southern Sicily. LH I, II and III A1 pottery has been found in several Apulian sites (e.g., Manaccora, Molinella, Punta Le Terrare, Santa Sabina, Giovinazzo, Porto Perone: see Cinquepalmi, Radina 1998). The main reason for the sailing ventures from the Aegean to the central Mediterranean was to search for raw materials such as copper and tin, as well as amber from the Baltic sea which travelled throughout Europe before reaching the northern end of the Adriatic sea (the Caput Adriae).

During the final phase of the MBA and RBA (ca. 15th-13th centuries BC, LH III A2-III B), several settlements on the Adriatic and Ionian coasts of Apulia were fully involved in the Mycenaean connection (Vagnetti 1982), although this interest was not based on any overall organized strategy. Apparently, it was not a political enterprise dependent on the palaces of Mycenae but a series of independent, freelance actions aimed at participating in local exchange networks. An effective means to this end may have been the establishment of small groups of Aegean origin within the indigenous communities; these may have that attained different degrees of integration. Two sites that played an apparently more organized and formally defined role in this context are Roca Vecchia on the Adriatic, and Scoglio del Tonno on the Ionian coast.

2. THE SITE

The site of Scoglio del Tonno is one of the most important Bronze Age complexes of southern Italy. Its most notable archaeological feature is the particularly intensive and systematic occurrence of Mycenaean-LH pottery dating from the second half of the 2nd millennium BC.

The chronology of the settlement (ca. 18th-11th cent. BC) comprises the local MBA, RBA and FBA. The site was excavated in 1899 by Quintino Quagliati, under pressure due to the construction of the railway station at Taranto. No stratigraphic data have been preserved for most of the finds made.

Overlooking the sea, the site lies on a small terraced hill of the local calcareous rock (Martinis, Robba 1971: 17-22). The settlement has a strategic location in one of the best natural harbours of the entire Italian Peninsula, at the junction between the Mar Grande and Mar Piccolo. This was apparently one of the main factors resulting in the structural difference between Scoglio del Tonno and the majority of contemporaneous coastal sites in this area. Other elements that point to special political and economic roles for this site are the presence of exceptionally large and complex buildings (such as the well known apsidal building, ca. 20 × 15m), and the high proportion of imported Mycenaean pottery compared to that seen at other sites in the Ionian region (e.g., Broglio) in which the pottery of Aegean type is mainly locally-made (cf. Gorgoglione 2002, pp. 126-135; Gorgoglione *et al.* 2006). Apparently, Scoglio del Tonno was an *emporion,* a privileged and permanent landing place for ships sailing between the Aegean and the Italian Peninsulas.

Several metal artefacts dating from the MBA and LBA were found during the excavation mentioned above. Except for one piece (an eyelet pin, inv. 203931), all are made of copper alloys. Due to the poor excavation data that remain, no detailed reconstruction of the stratigraphic positions of these finds is possible. However, it seems likely that both the "strato mediano" and the "strato superiore" (middle and upper layers) identified by Quagliati can be dated to the RBA and to the initial phase of the FBA (Quagliati 1900). The local RBA is characterized by its Subapennine archaeological features which also characterise the contemporaneous sites of Apulia (Porto Perone, Satyrion, Roca Vecchia), Basilicata (Termitito) and of the Ionian area of Calabria (e.g., Torre Mordillo and Broglio di Trebisacce).

The material from Scoglio del Tonno includes locally made wheel-turned grey pottery (so-called Mynian) (Biancofiore 1963, pl. I: a-c; Säflund 1939, pp. 473-474, Abb. 15-17, 19). However, a specific feature of Scoglio del Tonno is the very high proportion of imported LH-Mycenaean pottery; locally produced pottery is usually found at the majority of contemporaneous sites in this area. Moreover, it includes two Mycenaean cult figurines. These may well have been brought to the Apulian site by their owners, presumably one or more individuals of Aegean origin (Quagliati 1900, p. 419; Biancofiore 1963, Tab. XXXIV: i).

Closed vessels, probably shipped for their contents, prevail among the abundant Mycenaean pottery, while large transport amphorae are not represented. This contrasts with the situation seen at Roca Vecchia, where mainly open vessels have been found (presumably opened for consumption) along with a substantial number of large, coarse stirrup jars of a well known Minoan type.

The bronze artefacts found at Scoglio del Tonno, some of whose descriptions remain unpublished, have usually been examined from an exclusively chrono-typological standpoint (see for example the pieces illustrated in the PBF (please identify) series). According to Müller Karpe (1959, p. 34, Pl. 13.1-17), with the exception of single Early Iron Age spearhead they all date from the phase of the earliest violin-bow fibulae ("Peschiera" phase) and that immediately succeeding it. In the present Italian terminology, this timespan corresponds to the RBA and to an early moment of the FBA.

3. METAL FINDS

• Pin and spring from a fibula (inv. 203910) (Fig. 2.1): fragment of an unclassifiable fibula; bow and catchplate missing. L. 6.8 cm, diam. 0.2 cm.

• Pin from a fibula (inv. 203912) (Fig. 2.2): fragment of an unclassifiable fibula; bow, part of spring and catchplate missing. L. 9.7 cm, diam. 0.3 cm.

• Violin-bow fibula with two knobs (inv. 203915) (Fig. 2.3): fragment of a violin-bow fibula; incised decoration with group of encir-

cling lines on the bow, series of indentations on the edge of the knob; part of the bow, pin and catchplate missing. L. 6.6 cm, diam. 0.5 cm.

• Violin-bow fibula with two knobs (inv. 203913) (Fig. 2.4): fragment of a violin-bow fibula; incised decoration with group of encircling lines and chevrons; pin and catchplate missing. L. 11.6 cm, diam. 0.7 cm.

• Violin-bow fibula with two knobs (inv. 203914) (Fig. 2.5): fragment of a violin-bow fibula; incised decoration with group of encircling lines; pin and catchplate missing. L. 9.5 cm, diam. 0.5 cm.

• Pin (of fibula?) (inv. 203839) (Fig. 2.6): 3 fragments of pin, probably belonging to an undetermined fibula. L. 7 cm, diam. 0.1 cm.

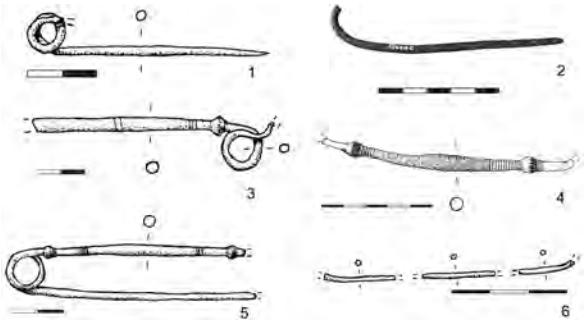

Fig. 2. 1. Pin and spring from a fibula (inv. 203910), 2. Pin from a fibula (inv. 203912), 3. Violin-bow fibula with two knobs (inv. 203915), 4. Violin-bow fibula with two knobs (inv. 203913), 5. Violin-bow fibula with two knobs (inv. 203914), 6. Pin (of fibula?) (inv. 203839).

• Double spiral-head pin of the Garda type (inv. 203919) (Fig. 3.7): fragment of unfinished double spiral-head pin with thin shank and one spiral missing. L. 8.5 cm, diam. 0.2 cm.

• Pin with straight neck (inv. 203927) (Fig. 3.8): pin with straight neck and thick shank; the head is bent and flatted through hammering. L. 7.5 cm, diam. 0.4 cm.

• Roll-head pin (inv. 203835) (Fig. 3.9): fragment of a roll-head pin; the head is mostly missing - only the flat lower part is preserved. L. 7 cm, diam. 0.3 cm.

• Roll-head pin (inv. 203844) (Fig. 3.10): roll-head pin with bent shank, decorated with groups of incised chevrons below the head. L. 13.3 cm, diam. 0.5 cm.

• Pin with swollen neck of the Fontanella type (inv. 203818) (Fig. 3.11): fragment of pin with small biconical-head and swollen neck of shank. L. 5.9 cm, diam. 0.6 cm.

• Pin with elliptical head (inv. 203808) (Fig. 3.12): fragment of pin with large elliptical head and shank heavily corroded. L. 10.7 cm, diam. 0.5 cm.

• Shank from a pin (?) with square-section (inv. 203807) (Fig. 3.13): fragment of corroded, square-sectioned shank. L. 10.8 cm, diam. 0.5 cm.

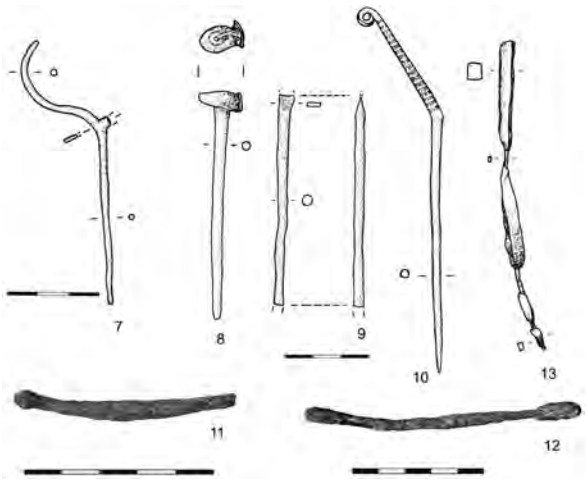

Fig. 3. 7. Double spiral-head pin of the Garda type (inv. 203919), 8. Pin with straight neck (inv. 203927), 9. Roll-head pin (inv. 203835). 10. Roll-head pin (inv. 203844), 11. Pin with swollen neck of the Fontanella type (inv. 203818), 12. Pin with elliptical head (inv. 203808), 13. Shank from a pin (?) with square-section (inv. 203807).

• Ovoid-head pin (inv. 203809) (Fig. 4.14): fragment of pin with elliptical head and thin shank, slightly diminishing below the head; made from arsenical copper. L. 8.1 cm, diam. 0.3 cm.

• Conical-head pin of the Vidolasco type (inv. 203926) (Fig. 4.15): pin with a large conical head and short shank. L. 12.6 cm, diam. 1.3 cm.

• Double spiral-head pin (inv. 203929) (Fig. 4.16): pin with small double spiral-head and bent shank, decorated with incised encircling lines and groups of chevrons. L. 16.9 cm, diam. 0.5 cm.

• Eyelet pin, made of a copper-silver-gold alloy (inv. 203931) (Fig. 4.17); fragment of an eye-

let pin; part of the shank missing. L. 4 cm, diam. 0.6 cm.

• Awl (inv. 203815) (Fig. 4.18): awl with square section to the haft. L. 6.2 cm, W. 0.5 cm.

• Awl (inv. 203812) (Fig. 4.19): awl with square section to the haft. L. 4.2 cm, W. 0.5 cm.

• Awl (inv. 203811) (Fig. 4.20): awl with double point and square section to the haft. L. 7.6 cm, W. 0.5 cm.

• Awl (inv. 203820) (Fig. 4.21): awl with square section to the haft. L. 5.1 cm, W. 0.5 cm.

• Awl (inv. 203813) (Fig. 4.22): awl with square section to the haft. L. 6.8 cm, W. 0.5 cm.

• Awl (inv. 203814) (Fig. 4.23): awl with double point and square section to the haft. L. 5.3 cm, W. 0.4 cm.

• Awl (inv. 203827) (Fig. 4.24): awl with double point and square section to the haft. L. 5.5 cm, W. 0.4 cm.

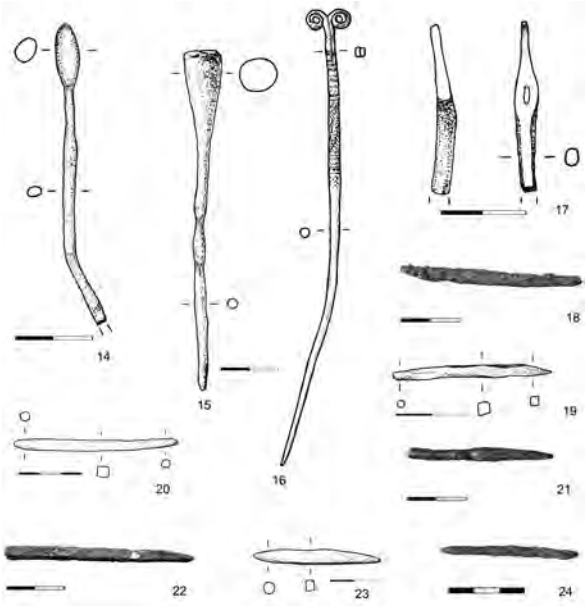

Fig. 4. 14. Ovoid-head pin (inv. 203809), 15. Conical-head pin type Vidolasco (inv. 203926), 16. Double spiral-head pin (inv. 203929), 17. eyelet pin (inv. 203931), 18. Awl (inv. 203815), 19. Awl (inv. 203812), 20. Awl (inv. 203811), 21. Awl (inv. 203820), 22. Awl (inv. 203813), 23. Awl (inv. 203814), 24. Awl (inv. 203827).

• Decorated "tool" with two working ends (inv. 203935) (Fig. 5.25): small tool with circular haft, flattened and curved at one end, flattened and rectangular at the other end, divided by three knobs from the haft. Incised decoration with groups of encircling lines and chevrons. L. 8 cm, diam. 0.7 cm.

• Chisel (inv. 203810) (Fig. 5.26): thin rod with square section, flattened and rectangular at lower end; cutting edge slightly widened. L. 10.6 cm, W. 0.5 cm.

• Chisel (inv. 203833) (Fig. 5.27): thin rod with square section, circular at central position, flattened and rectangular at the lower end; cutting edge slightly widened. L. 15.1 cm, W. 0.7 cm.

• Chisel (inv. 203897) (Fig. 5.28): thin rod with square section, circular at central position, flattened and rectangular at the lower end; cutting edge slightly widened and curved. L. 25.5 cm, W. 1.1 cm.

• Winged axe (inv. 203904) (Fig. 5.29): winged axe with medial-butt wings, long and narrow blade, curved cutting-edge. L. 14.8 cm, W. 2.6 cm.

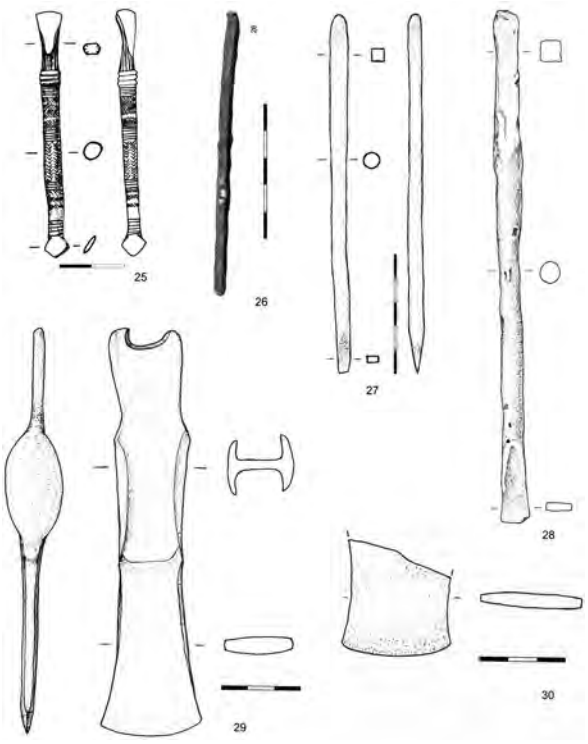

Fig. 5. 25. Decorated "tool" with two working ends (inv. 203935), 26. Chisel (inv. 203810), 27. Chisel (inv. 203833), 28. Chisel (inv. 203897), 29. Winged axe (inv. 203904), 30. Flat axe of the Scorrano type (?) (inv. 203832).

• Flat axe of the Scorrano type (?) (inv. 203832) (Fig. 5.30): fragment of axe with rectangular blade and rectangular cutting edge. L. 4.2 cm, W. 3.8 cm.

• Dagger of Torre Castelluccia type (inv. 203902) (Fig. 6.31): dagger with elongated triangular tang; circular rivet-hole. L. 10.6 cm, W. 2.2 cm.

• Rivet of the dagger (inv. 203902) (Fig. 6.31): cylindrical rivet. Diam. 0.4 cm.

• Dagger of the Torre Castelluccia type (inv. 203903) (Fig. 6.32): dagger with elongated triangular tang; circular rivet-hole. L. 12.3 cm, W. 2.4 cm.

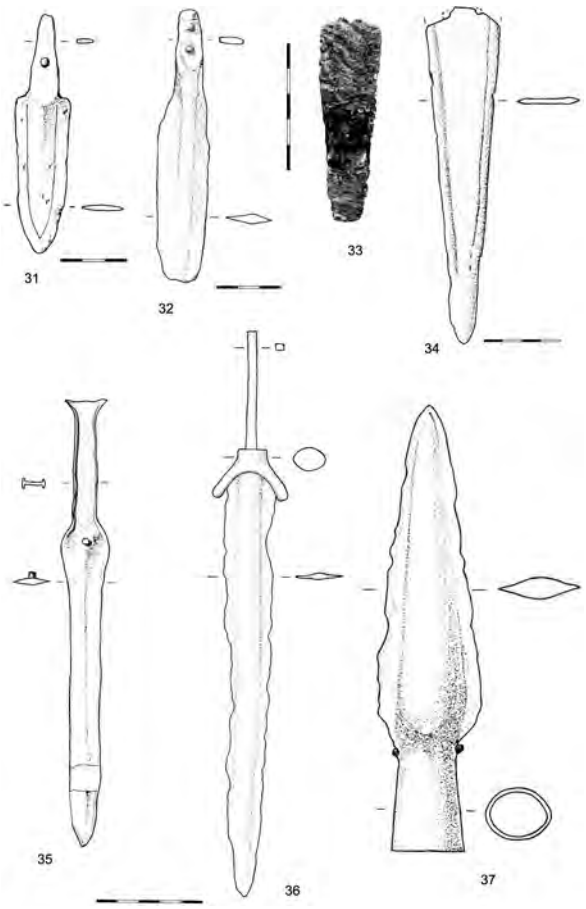

Fig. 6. 31. Dagger of the Torre Castelluccia type (inv. 203902), 32. Dagger of the Torre Castelluccia type (inv. 203903), 33. Dagger with narrow tang (inv. 203901), 34. Dagger of Sant'Ambrogio type (inv. 203843), 35. Dagger of Pertosa type (inv. 203906), 36. Dagger with tang and separately cast shoulder-cap (tang) (inv. 203907), 37. Spear head (inv. 203932-a).

• Rivet of the dagger (inv. 203903) (Fig. 6.32): long cylindrical rivet. Diam. 0.3 cm.

• Dagger with narrow tang (inv. 203901) (Fig. 6.33): fragment of dagger with narrow tang and wide blade; part of the tang missing, blade restored. L. 9.1 cm, W. 2.7 cm.

• Dagger of the Sant'Ambrogio type (inv. 203843) (Fig. 6.34): fragment of triangular dagger; base of the blade with two rivet holes. L. 17.5 cm, W. 3.8 cm.

• Dagger of the Pertosa type (inv. 203906) (Fig. 6.35): dagger with flanged hilt and one circular rivet-hole at base; elongated blade, restored. L. 22 cm, W. 2.4 cm.

• Rivet of the dagger (inv. 203906) (Fig. 6.35): cylindrical rivet. Diam. 0.4 cm, L. 1.2 cm.

• Dagger with tang and separately cast shoulder-cap (tang) (inv. 203907) (Fig. 6.36): dagger with rectangular sectioned tang, semicircular shoulder-cap, long blade. L. 30.9 cm, W. 2.7 cm.

• Spearhead (inv. 203932-a) (Fig. 6.37): blade with rounded profile towards the lower end, wide plain socket with two lateral pin-holes. L. 21.2 cm, W. 4.9 cm.

• Pin of spear head (inv. 203932) (Fig. 6.37): cylindrical pin. Diam. 0.3 cm.

• Flat tang knife of Baierdorf type (inv. 203934) (Fig. 7.38): narrow blade and flat tang with four rivets; bone hilt entirely preserved. L. 18.5 cm, W. 1.7 cm.

• Flat tang knife of Aegean type (inv. 203933) (Fig. 7.39): narrow blade and flat tang with two rivets. L. 17.1 cm, W. 1.9 cm.

• Hook (inv. 203925) (Fig. 7.40): barbed fishing hook. L. 3.9 cm, W. 0.6 cm.

• Razor of Scoglio del Tonno type (inv. 203930) (Fig. 7.41): openwork symmetrical razor; part of the blade missing. L. 10.8 cm, W. 4.8 cm.

• Tubular bead (inv. 203836) (Fig. 7.42): long cylindrical bead of circular section; incised decoration with groups of encircling chevrons. L. 3.8 cm, diam. 0.7 cm.

• Sickle (inv. 203905) (Fig. 7.43): short straight tang with central hole, blade curved; two parallel nervatures on tang and blade. L. 18 cm, W. 10.3 cm.

• Nail (inv. 203900) (Fig. 8.44): large rod nail flattened at upper end; square section that becomes circular at the lower end. L. 5.2 cm, W. 0.9 cm.

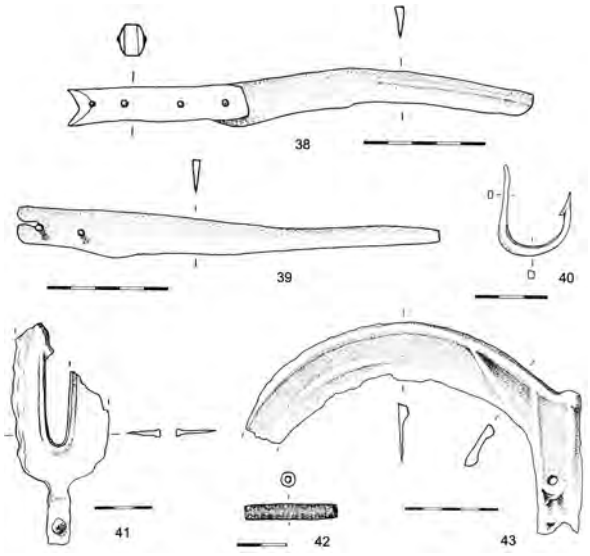

Fig. 7. 38. Flat tang knife of the Baierdorf type (inv. 203934), 39. Flat tang knife of the Aegean type (inv. 203933), 40. Hook (inv. 203925), 41. Razor of the Scoglio del Tonno type (inv. 203930), 42. Tubular bead (inv. 203836), 43. Sickle (inv. 203905).

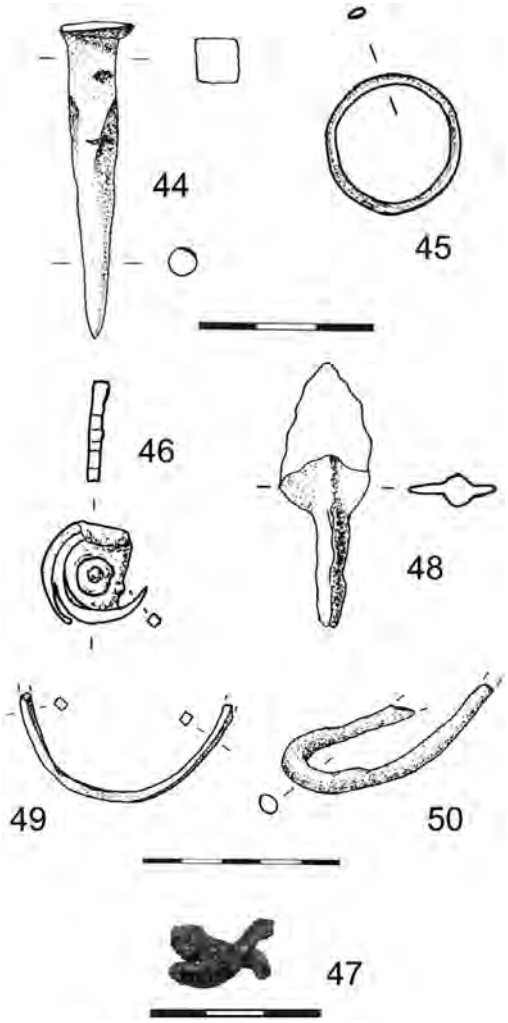

Fig. 8. 44. Nail (inv. 203900), 45. Ring (inv. 203908), 46. Wire spiral (inv. 203921), 47. Fragments from a violin-bow fibula (inv. 203841), 48. Tanged arrowhead (inv. 203923), 49. Rod (inv. 203828), 50. Bracelet (inv. 203909).

• Ring (inv. 203908) (Fig. 8. 45): wire of elliptical section. Diam. 2.1 cm, section 0.2 cm.

• Wire spiral (inv. 203921) (Fig. 8.46): fragmentary spiral of thin wire of circular section. Diam. 1.8 cm.

• Two fragments from a violin-bow fibula with a knob, (inv. 203841) (Fig. 8.47): bent into an S shape and overlapping. L. 2 cm, W. 1.1 cm.

• Tanged arrow head (inv. 203923) (Fig. 8.48): tang with circular section that becomes a nervature on the blade; triangular blade partially missing and restored. L. 4.4 cm, W. 1.6 cm.

• Rod (inv. 203828) (Fig. 8.49): wire of round section. L. 5 cm, W. 0.5 cm.

• Bracelet (inv. 203909) (Fig. 8.50): fragment of thick wire coil of rectangular section. L. 5 cm, W. 0.4 cm.

4. METHODOLOGY

Energy dispersive X-ray fluorescence (ED-XRF) was used to determine the chemical composition of the alloys used in making the above objects. Measurements were taken in one or more areas after removing the patina using aluminium oxide grinding stones mounted on a precision drill-grinder.

The ED-XRF apparatus used to analyse the samples was portable. The X ray system (X ray tube and silicon drift detector [SDD]) was an EIS srl Rome system while the multi-channel analyser was an Amptek MCA. The technical characteristics of the system used were as fol-

lows: tube with tungsten anode (HV max 38 kV anode; maximum current 0.5 mA), air cooled, size: 60 (W), 200 (D), 100 (H) mm, weight 1 Kg, collimator diameter: 1.0 mm. The tube was operated at 38 kV and 0.2 mA. The SDD was cooled by a Peltier cell. The resolution was 150 eV at 6.4 keV. A multi-channel analyser with 1024 channels was used. The pointing system was a laser diode.

Quantitative results were calculated following a fundamental parameter procedure using standard reference materials for calibration. The precision of the results was estimated using the Monte Carlo procedure (< 2 % for concentrations higher than 10 %; < 10 % for concentrations between 4 % and 10 %; < 20 % for concentrations between 1 % and 4 %; < 30 % for concentrations less than 1 %). The detection limit was less then 0.1 % for all the elements considered.

5. RESULTS

Most of the artefacts were found to be made from a tin-copper alloy, with varying, non-systematic proportions of lead. The majority of the items (more than 1/3) contain less than 2 % lead. Only seven objects have more than 5 % lead. Intentional low quantity additions of lead are difficult to distinguish from natural levels. Generally, a content of less than 2 % can be regarded as unintentional in prehistoric artefacts (Rychner, Stos-Gale 1998, pp. 159-161; Heath *et al.* 2000, p. 66). The proportion of tin in the weapons is generally higher than in the other objects.

One pin (inv. 203931) stands out since it is made of an alloy of silver, copper, lead, tin and gold. The analysis was repeated in different areas to check the composition of the alloy and to rule out the possibility of it being a gilded piece.

The occurrence of several bronze pieces of northern Italian type (Peschiera dagger, winged axe, violin-bow fibulae, pins, razor etc.) probably indicates a systematic connection with the Palafitte-Terramare region for the acquisition of both raw material and the models for objects. In turn, this region acquired copper from the Alpine area.

Bronze melting and recycling were performed at Scoglio del Tonno, as indicated by the finding of stone moulds and crucibles (mould inv. 7096:

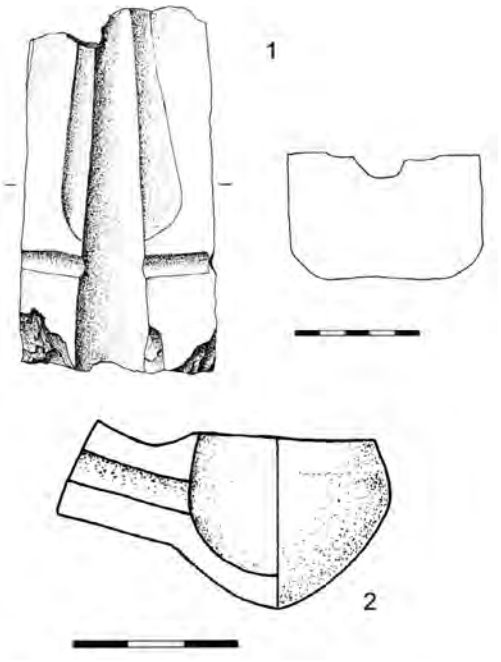

Fig. 9. 1. Mould for spearheads (inv. I.G. 7096), 2. Crucible (inv. I.G. 5626).

L. 14.2 cm, W. 7.6 cm; crucible inv. 5626: L. 5.9 cm, W. 3 cm) (Figs. 9. 1-2).

The examined artefacts were subsequently finished with whetstones (inv. 5703: L. 8.9 cm, W. 5.1 cm; inv. 7099: L. 14.8 cm, W. 4.3 cm) (Figs. 10.1-2). At least some of them were probably to be shipped towards a destination in the Aegean or eastern Mediterranean area.

That a metallurgical workshop was active within the settlement is indicated by the occurrence of a bivalve sandstone mould for spearheads and by a small crucible. Significant evidence of local production has also been found at Roca Vecchia (Guglielmino 2005).

The average tin content for the overall sample is 10.9 %, while that of lead is 2.3 %. Thus the alloys are generally rich in tin but have a rather low lead content. The presence of this lead may lie in it being an impurity of the copper ore used. Apparently, these objects represent local production of high quality, which would have been dependent on a plentiful and steady supply of raw materials, especially tin.

The iron content of the objects is generally low (average 0.06 %); this probably indicates that in Italy, as well as in Central and Western Europe, the smelting of copper involved a poorly reduc-

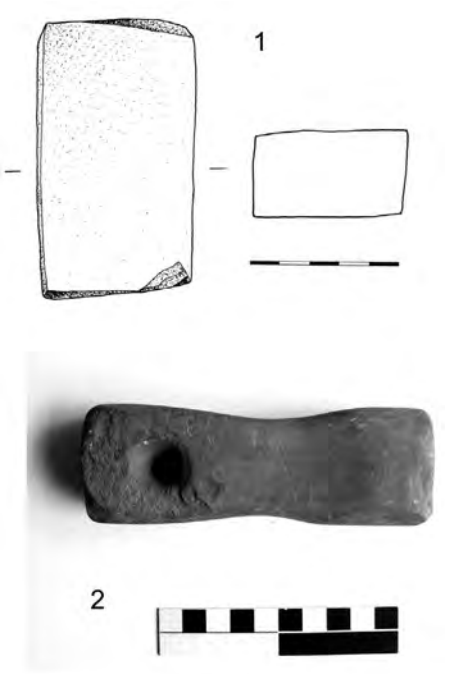

Fig. 10. 1. Whetstone (inv. I.G. 5703), 2. Whetstone (inv. I.G. 7099).

ing process rather than the slagging-smelting process used in the Aegean Peninsula and the Middle East (Craddock 1995, pp. 140-143; regarding Italian B.A. bronze artefacts see also Barker, Slater 1971).

Only a few and rather uncertain pieces of information on the stratigraphic situation of these pieces have been preserved. The sickle (inv. 203905) was found in hut IV, middle layer (Quagliati 1900, p. 446). A broken violin-bow fibula with two knobs came from hut II, middle layer (Quagliati 1900, p. 440, Fig. 10). The winged axe (inv. 203904) was found lying on the clay mass along the southern side of hut II, while the dagger with the square tang, originally covered with bone discs (inv. 203907), was found 45 cm from the southern edge of hut II, along with an *impasto* horned handle of Subapennine type. A globular headed pin probably came from the same hut (Quagliati 1900, pp. 440-442). A foliate violin-bow fibula was found in trench F, middle layer, above the floor of the "terramara superiore" (Quagliati 1900, p. 458).

Several bronze pieces were apparently found within or around hut II, the large apsidal structure noted above. About 6 m from this building a group of hearths was found associated with a stratified heap of ashes and charcoal. The combination of these two features might be reasonably interpreted as representative of workshop activity.

It seems likely that hut II, the largest structure at Scoglio del Tonno, was not an ordinary house, but was probably connected to some public/political function. Metal-related activities, from the procurement of both raw materials and finished objects to the local production and finally the shipment of part of these material towards the Aegean, might be associated with the central functions of the building.

An interesting parallel to the apsidal hut is represented by the large FBA building of Roca Vecchia, where there is important evidence of the practice of rites, metal storage and manufacturing, among other activities.

A significant feature related to the metals and metallurgy at Roca Vecchia and the Salento area in general is the frequency (as well as the local production) of bronze pieces of the Aegean type (Bietti Sestieri 2008, pp. 29-30). At Scoglio del Tonno, bronze artefacts of the Aegean type are the exception. One of these exceptions is a flat tanged knife (inv. 203933; Bianco Peroni 1976, pp. 24-25, Tab. 8: 25). Cypriot parallels of this type are also known (Catling 1964, p. 103, Fig. 10: 13). In Apulia, similar pieces have been found at Roca Vecchia (Bietti Sestieri 2008, Fig. 18, right), in tomb 12 of the Santa Sabina barrow, the settlement of Torre Castelluccia, and in the bronze hoard of Scorrano (Guglielmino 2005, p. 41, Figs. 4-5, 12-13, notes 56-58). The second knife from Scoglio del Tonno (inv. 203934) belongs to a south Italian type, which has parallels in central European and northern Italian Baierdorf types (Bianco Peroni 1976, n. 16, pp. 13-15). These two knives differ in terms of the alloy used to make them: the Aegean type piece has 0.5 % lead and 19.5 % tin while the second knife has 6.8 % lead and 13.9 % tin.

One of the daggers, of the Pertosa type (inv. 203906; Bianco Peroni 1994, n. 1485, pp. 149-152), could be an Aegean import. Despite this type's wide distribution throughout continental Italy, the piece from Scoglio del Tonno is typologically very close to knives from Crete and Philakopi (Milojèiæ 1955, Fig. 2: 1, 2, 5, 6). Compared to that of the main body of the dagger, the tin percentage of one of the rivets is very high

(23.6 % compared to 14.6 %). This probably indicates an intention to make the rivet look like silver or pale gold. Similar variations between artefacts and their rivets have been recorded at Moscosi di Cingoli, in the Marche (De Marinis *et al.* 2005, pp. 681, 683). The remaining daggers all belong to northern Italian (Peschiera) types.

Two pieces, PBF 1157 (inv. 203902) and 1158 (inv. 203903) (Bianco Peroni 1994, pp. 122-130), belong to the Torre Castelluccia type, a type generally seen in mainland Italy, particularly in the northern regions. Other types include a dagger with a narrow tang and wide blade (inv. 203901; PBF 1449, Bianco Peroni 1994, pp. 145-146), a dagger with a composite handle (inv. 203907, PBF 1672) similar to an antler handle from Frattesina (PBF 1673, Bianco Peroni 1994, pp. 169-170), and an earlier (MBA) dagger of the Sant'Ambrogio type (inv. 203834; Bianco Peroni 1994, pp. 97-101) (a type widely distributed over mainland Italy). Another northern Italian type is the openwork symmetrical razor (Scoglio del Tonno type) (Bianco Peroni 1979, pp. 9-11, n. 40). Its alloy has a high tin content at 18 %, and 2.5 % lead.

Several pins, all northern Italian types, were found mainly in Palafitte-Terramare contexts, including one of the Vidolasco type (inv. 203926, Carancini 1975, no. 1509), a type with a double-spiral head (inv. 203929, Carancini 1975, no. 649), an unfinished Garda type pin with a double-spiral head (inv. 203919, Carancini 1975, no. 572), a type with a roll-head and pin of circular section (inv. 203844; inv. 203835, Carancini 1975, pp. 99-110), a type with an elliptical head (inv. 203808), a Fontanella type with a biconical head and swollen neck (FBA) (inv. 203818, Carancini 1975, pp. 200-202; cf. also Bietti Sestieri, Macnamara 2007, p. 79, n. 199), and a type with a straight neck (inv. 203927; Carancini 1975, no. 1810) made of unalloyed copper (99.1 % Cu; 0.9 % Pb). A pin with an ovoid head (inv. 203809), made from arsenical copper (89.8 % Cu; 10.2 % As), may have originally belonged to the earliest layers of the settlement, which begin in the Neolithic.

Other pieces include a small bar of quadrangular section and of almost pure copper (inv. 203828; 99.7 % Cu; 0.3 % As; perhaps used as metal for repairs), a broken bracelet made from a thin rod of circular section with an unusually high tin content (21.1 %), and a cylindrical bead with an incised chevron decoration (inv. 203836) with a composition of 10.8 % tin and 2.6 % lead.

One eyelet pin (inv. 203931) has a unique composition: 3.7 % Sn, 17.2 % Pb, 44 % Ag, 10.2 % Au, 24.6 % Cu, 0.3 % Fe. This alloy of precious metals has no known parallels in Italy, where both silver and gold were extremely rare throughout the Bronze Age. Some good typological parallels can be found in Cyprus. A similar piece, made from a silver and copper alloy, was found at Enkomi, T. 8, an early LC IA burial site (Gjerstad *et al.* 1934, p. 503, pl. LXXX 2: 50), together with two others made of gold (Gjerstad *et al.* 1934, pp. 502-503, pl. LXXX 2: 9, 45; cf. also Catling 1964, p. 237, Fig. 20). Other gold eyelet pins are also known from Enkomi, T. 19 and T. 66 (Murray *et al.* 1900, p. 43, pls. VIII, IX: 285). This type, with some variations, has also been found at Megiddo and Gezer (see Catling 1964, p. 237, note 12); two bronze specimens are also known from the Peloponnese (Tyrins and Midea) (Kilian Dirlmeier 1984, p. 59, pl. 5: 145A, 145E). This exotic piece is a further indication that Scoglio del Tonno played a role in the maritime routes connecting the eastern and central Mediterranean. Along with other elements, it might support the hypothesis of early Cypriot-Phoenician presence and activity in the future area of Taranto. The identification of Cypro-Mycenaean III B pottery (Lo Schiavo *et al.* 1985, pp. 5-6; cf. also Vagnetti 2000-2001) in the same context, and further elements from Roca Vecchia and the Adriatic area (from Frattesina to the region of the Caput Adriae) (cf. Bietti Sestieri 2008, pp. 31-34), should also be remembered.

Another important characteristic of the metal artefacts of Scoglio del Tonno is the consistent presence of northern Italian types, some of which might be imports from the Palafitte-Terramare region. The supply of copper for the metal industry of this region, clearly the main producer of bronze artefacts in Italy during the RBA, came from Alpine ores. The order of magnitude of the copper production in the eastern Alpine zone is indicated by the substantial evidence of smelting activities at Acqua Fredda di Bedollo (Trento) near the Redebus Pass: a battery of six smelting furnaces with an estimated production of 800-1000 tons of slag for the period between the 13th and 11th centuries B.C. (Cierny *et al.* 2004, pp. 125-130). During the RBA, mining and smelting were carried out by Alpine communi-

ties, while casting, the actual manufacture of bronze artefacts, was performed by Palafitte-Terramare communities, especially those around lake Garda (Pearce 2007, pp. 99-102; Bietti Sestieri 2008, p. 10). The location of Apulia, however, at the southernmost end of the Adriatic rendered it an important terminus for raw or semi-processed materials, particularly metals. These travelled along the peninsula from northern Italy, probably both by land and sea. The findings made at Scoglio del Tonno are confirmed by those made at Roca Vecchia, especially the so-called *ripostiglio dei bronzi,* a bronze hoard dating from the FBA, which comprises a collection of broken pieces, many of which belong to types specific to Friuli and the northern Balkan region (Bietti Sestieri 2008, p. 30; Maggiulli 2009).

6. CONCLUSIONS

The examination of the metal objects of Scoglio del Tonno, along with their analytical data, allows the tentative reconstruction of some of the features and functions of this important site. Overall, the data available on the site's position and archaeological features, plus the rather specific characteristics of its Mycenaean/LH pottery, indicate its importance in Italy's presence in the Aegean/Eastern Mediterranean, as well as its special role within its supra-regional context.

The metal finds from this site show some similarities, but also some significant differences, to those of Roca Vecchia. Scoglio del Tonno was a specialized site, active in both manufacture and trade, with foreign visitors systematically participating in its activity; in other words, it was a local *emporion.* In contrast, the specific features of Roca Vecchia seem to indicate the presence of a resident foreign group that transferred its habits, religious practices and manufacturing templates to its new home. With respect to the roles of these sites in the international trade network, Roca Vecchia might be seen as an extension of the Greek mainland to Italy, while Scoglio del Tonno is more directly representative of an indigenous Italian community.

The number of bronze objects retrieved at Scoglio del Tonno is unusually high for a settlement, and supports the hypothesis that the site was an important terminus where this material was systematically accumulated, presumably in order to be shipped towards the eastern Mediterranean. In other words, it shows a concentration and intensification of the activities that in other contemporaneous sites in the Ionian area were quantitatively less important and not systematically organized. Moreover, the site reveals the exponential increase in northern Italian metal production during the RBA, and indicates the routes through which it was distributed around the Italian Peninsula before finally reaching the Aegean and the eastern Mediterranean.

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Addendum

Bietti Sestieri, A.; Giardino, C., and Gorgoglione, M. 2010: "Metal finds at the Middle and Late Bronze Age settlement of Scoglio del Tonno (Taranto, Apulia): results of archaeometallurgical analyses". *Trabajos de Prehistoria, 67*(2): 457-468 doi: 10.3989/tp.2010.10050

In the printed version of this article, some data regarding the ED-XRF analyses of the finds have been mistakenly omitted. These data are added now in this online version, and the *Erratum* will be advertised in the forthcoming Issue as appropriated.

We apologize for the inconvenience.

February 4th, 2011.

Table 1. Scoglio del Tonno (Taranto, Apulia). ED-XRF analyses of the finds (Weigth %)

Object (part analysed)	***Inv.***	***Cu***	***Sn***	***Pb***	***As***	***Ag***	***Sb***	***Fe***	***Ni***	***Au***	***Zn***
pin and spring from a fibula	203910	89.8	8.4	1.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0
pin from a fibula	203912	84.6	13.7	1.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0
violin-bow fibula with two knobs	203915	83.2	14.5	2.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
violin-bow fibula with two knobs	203913	86.6	10.4	1.9	0.7	0.0	0.4	0.0	0.0	0.0	0.0
violin-bow fibula with two knobs	203914	85.5	12.2	2.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
pin (of fibula ?)	203839	92.2	5.7	1.2	0.0	0.0	0.0	0.9	0.0	0.0	0.0
double spiral-head pin of Garda type	203919	88.7	9.2	2.0	0.0	0.1	0.0	0.0	trace	0.0	0.0
pin with straight neck	203927	99.1	0.0	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0
roll-head pin	203835	86.3	13.5	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0
roll-head pin	203844	88.2	8.1	1.4	0.7	0.1	1.4	0.0	0.0	0.0	0.0
pin with swollen neck of Fontanella type	203818	87.1	11.3	1.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
pin with elliptical head	203808	94.1	4.6	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
shank from a pin (?) with square-section	203807	88.0	10.6	0.0	1.3	0.0	0.0	0.0	0.0	0.0	0.0
ovoid-head pin	203809	89.8	0.0	0.0	10.2	0.0	0.0	0.0	0.0	0.0	0.0
conical-head pin type Vidolasco	203926	93.5	4.4	1.7	0.0	0.0	0.5	0.0	0.0	0.0	0.0
double spiral-head pin	203929	84.3	10.4	4.4	0.0	0.1	0.8	0.0	0.0	0.0	0.0
eyelet pin	203931	24.6	3.7	17.2	0.0	44.0	0.0	0.3	0.0	10.2	0.0
awl	203815	88.9	9.2	1.9	0.0	0.0	0.0	0.0	trace	0.0	0.0
awl	203812	88.9	10.1	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
awl	203811	87.7	10.4	1.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0
awl	203820	94.2	3.9	1.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0
awl	203813	85.8	13.3	0.5	0.4	0.0	0.0	0.0	0.0	0.0	0.0
awl	203814	95.7	3.4	0.0	0.0	0.0	0.0	0.9	0.0	0.0	0.0
awl	203827	86.0	12.4	1.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
decorated "tool" with two working ends	203935	86.0	5.8	7.0	0.0	0.1	1.1	0.0	0.0	0.0	0.0
chisel	203810	86.6	12.4	1.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0

Object (part analysed)	*Inv.*	*Cu*	*Sn*	*Pb*	*As*	*Ag*	*Sb*	*Fe*	*Ni*	*Au*	*Zn*
chisel	203833	90.0	7.8	1.2	0.3	0.1	0.7	0.0	0.0	0.0	0.0
chisel	203897	88.4	10.5	0.9	0.0	0.0	0.3	0.0	0.0	0.0	0.0
winged axe	203904	86.4	12.8	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0
flat axe of Scorrano type (?)	203832	87.8	11.0	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
dagger of Torre Castelluccia type	203902	81.1	12.6	6.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
rivet of the dagger 203902	203902 a	81.3	11.8	6.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0
dagger of Torre Castelluccia type	203903	84.3	13.5	2.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
rivet of the dagger 203903	203903 a	79.0	13.2	7.0	0.0	0.1	0.0	0.7	0.0	0.0	0.0
dagger with narrow tang	203901	84.9	13.1	1.3	0.0	0.0	0.6	0.0	0.0	0.0	0.0
dagger of Sant’Ambrogio type	203843	86.5	13.2	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
rivet of the dagger 203906	203906 a	74.9	23.6	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
dagger of Pertosa type	203906	84.5	14.6	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0
dagger with tang and separately cast shoulder-cap (tang)	203907 d	87.6	10.8	1.2	0.0	0.1	0.0	0.3	0.0	0.0	0.0
dagger with tang and separately cast shoulder-cap (tang)	203907 a	86.6	12.0	0.9	0.0	0.0	0.5	0.0	0.0	0.0	0.0
dagger with tang and separately cast shoulder-cap (blade)	203907 c	83.2	16.0	0.8	0.0	0.1	0.0	0.0	0.0	0.0	0.0
dagger with tang and separately cast shoulder-cap (shoulder-cap)	203907 b	86.7	12.2	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
spear head	203932	75.4	23.5	0.9	0.0	0.1	0.0	0.0	0.0	0.0	0.0
pin of spear head 203932	203932 a	80.3	17.8	1.5	0.0	0.1	0.0	0.3	0.0	0.0	0.0
flat tang knife of Baierdorf type	203934	79.3	13.9	6.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0
flat tang knife of Aegean type	203933	78.9	19.5	0.5	0.7	0.0	0.4	0.0	0.0	0.0	0.0
hook	203925	89.0	8.0	1.1	2.0	0.0	0.0	0.0	0.0	0.0	0.0
razor of Scoglio del Tonno type	203930	79.5	18.0	2.5	0.0	0.1	0.0	0.0	0.0	0.0	0.0
tubular bead	203836	86.6	10.8	2.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
sickle	203905	91.1	8.1	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0
nail	203900	88.8	10.0	0.9	0.0	0.0	0.2	0.0	0.0	0.0	0.0
ring	203908	86.5	11.9	1.5	0.0	0.1	0.0	0.0	0.0	0.0	0.0
wire spiral	203921	94.1	4.8	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Object (part analysed)	*Inv.*	*Cu*	*Sn*	*Pb*	*As*	*Ag*	*Sb*	*Fe*	*Ni*	*Au*	*Zn*
fragments from a violin-bow fibula	203841	88.4	9.6	1.6	0.4	0.0	0.0	0.0	0.0	0.0	0.0
tanged arrow head	203923	81.1	8.4	10.2	0.0	0.0	0.0	0.3	0.0	0.0	0.0
rod	203828	99.7	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0
bracelet	203909	77.2	21.1	1.7	0.0	0.0	0.0	0.0	trace	0.0	0.0