

A MULTI-DISCIPLINARY APPROACH TO THE STUDY OF AN ASSEMBLAGE OF COPPER BASED FINDS ASSIGNED TO THE PREHISTORY AND PROTO-HISTORY OF FUCINO, ABRUZZO, ITALY

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ABSTRACT

The project aims to characterize, by a corpus of archaeometric analyses, an assemblage of finds known as the Fucino bronzes, most of which lacking of finding data. The Fucino bronzes include bronzes emerged during the Fucino lake drainage, at the end of the XIX century, and bronzes locally bought or dug after that by a number of collectors on behalf of various Italian museums, where the finds are currently dispersed.

Research will extend to the analysis of rests of metallurgic production from recent digs, as features, slag, smelting and casting pottery, and more, to the investigation of local ore deposits available in antiquity.

This study proceeds contemporary on varied research and cataloguing phases:

- *quantification*
- *chemical analysis*
- *macro and micro-metallographic examination*
- *drawing up of a database*

For this research, finds are functionally grouped in three main categories: 1) ornaments and accessories, 2) instruments and 3) weapons, but, at the same time, quantification is unrolling by grouping finds also chronologically, typologically, technologically and, when possible, territorially in order to build custom models for interpretation of data.

In this memory we report part of quantification and chemical analysis of a selection of materials, as the "Kardiophylakes", as an example, with about one-third of the known samples in this assemblage, 38 of which reporting provenience from specific Fucino sites.

Chemical analyses are carried on by the portable ED-XRF which provides accurate quantitative results, absolutely comparable with data of similar bronze characterization projects as the San Francesco hoard in Bologna and the Chieti archaeological museum.

Macro metallographic analysis of finds is carried on by optical microscope.

AIMS

The project is finalized to characterize, by a corpus of archaeometric analyses, an assemblage of Prehistorical and Proto-Historical copper-based finds known as 'Fucino bronzes', most of which lacking of any data regarding contexts or specific proveniences.

In a long term picture, research would extend firstly to the analysis of rests of metallurgical productions, emerged by current regular excavations, as vitrified material, slag and smelting and casting pottery, and secondly to the investigation of local mines, available in antiquity.

The study proceeds contemporary on varied research and cataloguing phases:

- *quantification of finds*
- *chemical characterization of materials by ED-XRF*

- macro and micro-metallographic examination of samples
- drawing up of a database

MATERIALS

The corpus of Fucino bronzes include bronzes emerged during the Fucino lake drainage, between the end of the XIX century and the beginning of XX century, and bronzes locally bought or dug in the same period by a number of collectors on behalf of various Italian museums. In this case, contextual or provenience data sometimes exist with various degrees of completeness.

Research takes part to the current picture of update about development of ancient metallurgy by a proposal of widening and re-reading of all the sources available for interpretation of prehistorical and protohistorical bronzes, particularly when for the most out of contexts as in this case.

Currently the Fucino bronzes are in: Roma, Prehistorical and Ethnographic Museum L. Pigorini; Perugia, National Archaeological Museum of Umbria; Chieti, National Archaeological Museum; Sulmona, Civic Museum; Avezzano, Exposition of the Farmer and Pastoral Culture of Torlonia Palace; and Firenze, Archaeological Museum. The bronzes of Chieti Archaeological Museum have been already analysed by a similar project and hence excluded by the analytical phases of this research.

For the moment, only the inventories of the Roma e Perugia Museums are included in the database and quantified.



METHODOLOGIES

Chemical analysis is carried on by the portable ED-XRF which provides accurate quantitative results, absolutely comparable with data of similar bronze characterization projects as the San Francesco hoard in Bologna and the Chieti archaeological museum, that include also Fucino bronzes.

The portable fluorescent X-ray system has the following technical characteristics: Tube: Tungsten anode, Hv max 38 kV anode, Power anode, max 0.5 mA, Air cooled; Size: 60(W)x200(D)x100(H) mm, Weight 2 Kg.; Collimator diameter: 1,0 mm. The tube availed of 35 kV tension and 0.2 mA power.

The characteristics of the detector are: SDD (Silicon Drift Detector) cooled by a Peltier cell. Resolution from 150 eV to 6.4 keV. A multi-channel: 1,024 channels. Pointing system: a laser diode. A portable ACER computer with a self made spectrum management program.

Macro metallographic analysis of finds is carried on by stereo optical microscope (80x).

Because of the huge number of finds involved with the Fucino bronzes complex, chemical analysis and micro metallographic examination of finds are proceeding by:

- analysis of selections of functional classes of objects
- analysis of selections of technological classes of objects (after an advanced phase of macro metallographic examination)
- analysis of territorial selections of objects

This proceeding allows to provide parts and parcels of analyses little by little in order to elaborate custom models for interpretation of data, and facilitating, at the same time, the drawing up of the database.

Micro metallographic examination of finds will be performed by SEM. In this case, the selection will be further narrowed, strictly depending by the receptiveness of the Museums.

CHRONOLOGICAL QUANTIFICATION AND FIRST CHEMICAL RESULTS

For quantification of materials, finds are grouped in three categories: tools, ornaments and accessories, and weapons. In this classification, the weapon's category includes only objects substantially conceived to offence other men.

CATEGORIES OF FUNCTIONAL CLASSES OF OBJECTS					
weapons		ornaments and accessories		tools	
daggers	21	kardiophylakes	61	knives	39
swords	6	fibulas	58	axes	6
lances	6	bracelets	31	razors	5
		pendants	22	arrows	5
		chains	11	aes rudaes	5
		spirals *	10	points	2
		beads *	7	mace head **	1
		rings	7	chisels	1
		quadrupeds	3	javelin	1

		long pins	2	sickles	1
		plaque	1	needle	1
		pectoral	1	hatchet	1
		belt	1		
<p>*The 7 beads and 10 spirals of Pigorini Museum, bought <i>a lotto</i> and inventoried with the same number, show similar patinas due, probably, to a common deposition. For quantification of functional classes of objects, they are considered for the moment as elements of a group.</p> <p>**The only find of iron of the assemblage</p>					

CHRONOLOGICAL QUANTIFICATION OF CATEGORIES OF OBJECTS								
categories	totals	no date	MIA	EIA	FBA	LBA	MBA	EBA
ornaments /accessories	215	51	97	32	33		2	
tools	68	4	5	27	15	13	3	1
weapons	33	3		2	9	6	13	
totals	316	58	102	61	57	19	18	1

MIA: Middle Iron Age; EIA: Early Iron Age; FBA: Final Bronze Age; LBA: Late Bronze Age; MBA: Middle Bronze Age; EBA: Early Bronze Age

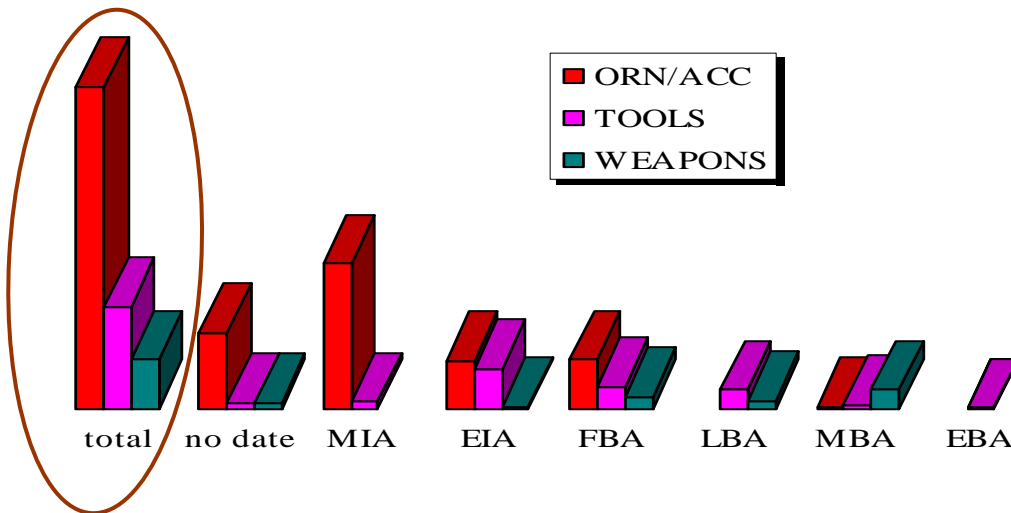
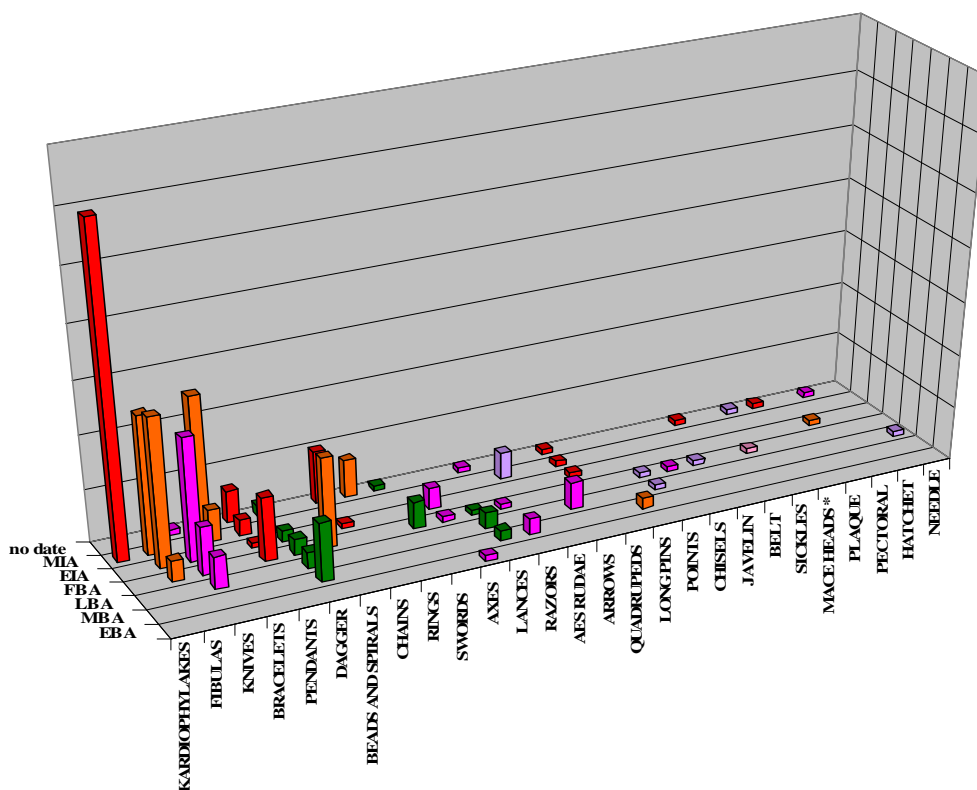


Table and graphic of chronological quantification of objects categories show the usual tendency of Bronze Age/Iron Age inventories of bronze finds that generally count weapons and tools as greater groups in the early-time period and ornaments and accessories in more recent time. The MIA of Italy reports a big peak of the latter category by the spread of rich gift's use in the burial rituals of the rising IA italic communities.

CHRONOLOGICAL QUANTIFICATION OF FUNCTIONAL CLASSES OF OBJECTS



Regarding chemical analysis, functional classes of objects, counting large numbers of dated samples, are for the moment privileged: kardiophylakes, fibulas, knives, pendants, daggers, aes rudaes and the group of beads and spirals.

19 objects from Roma Museum have been chemically analysed: 6 kardiophylakes, the group of 5 aes rudaes, 1 pendant, and 7 beads and 1 spiral of the bead/spiral group.

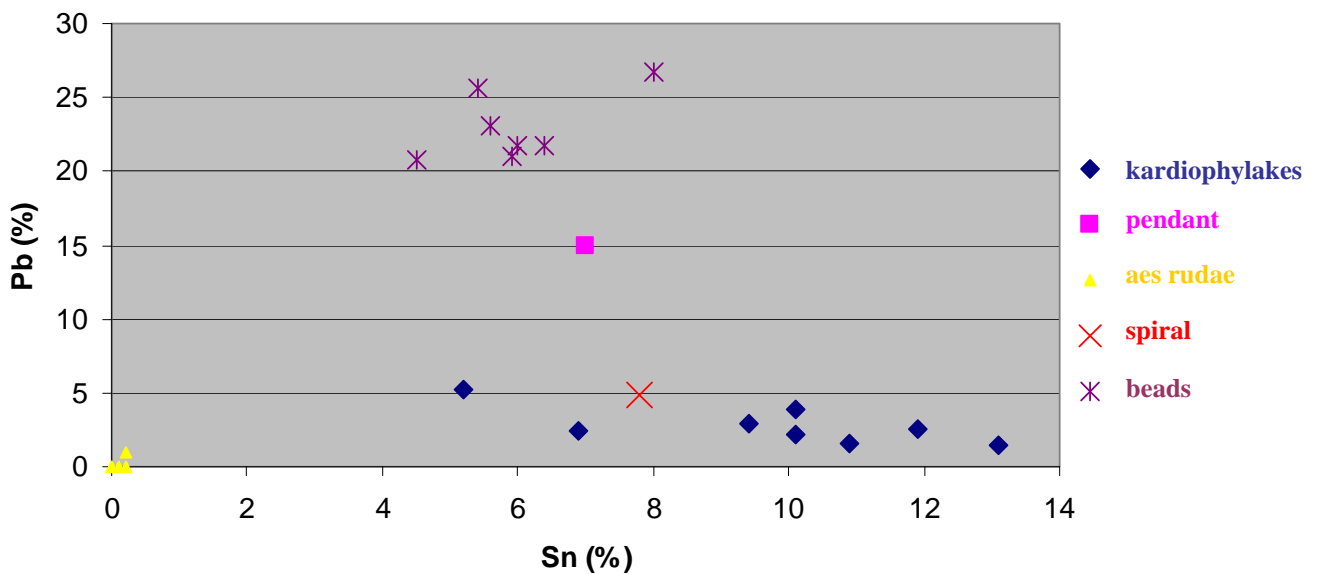


object	inv. n	Cu	Sn	As	Pb	Sb	Ag	Fe	Zn	Ni	Bi
bead	4	65.3	8.0		26.7						
bead	2	72.2	6.0		21.8						
bead	7	71.3	5.6		23.1						
bead	6	74.7	4.5		20.8						
bead	5	69.0	5.4		25.6						
bead	3	72.3	5.9		21.0	0.7	0.1				
bead	1	71.9	6.4		21.7		0.1				
spiral	10	87.3	7.8		4.8		0.1				
pendant		70,7	7,0	2,1	14,9	2,7	0,1			2,5	



ED-XRF ANALYSIS ON A KARDIOPHYLAKE AND A BEAD

SCATTER PLOT DIAGRAM BETWEEN LEAD AND TIN RELATED TO COPPER AS MAJOR COMPONENT



As supposed, all the analysed samples are copper-based products with Cu percentages ranging from 100% of one of the aes rudaie to 65,3% of one of the beads. Compositions of the 5 aes

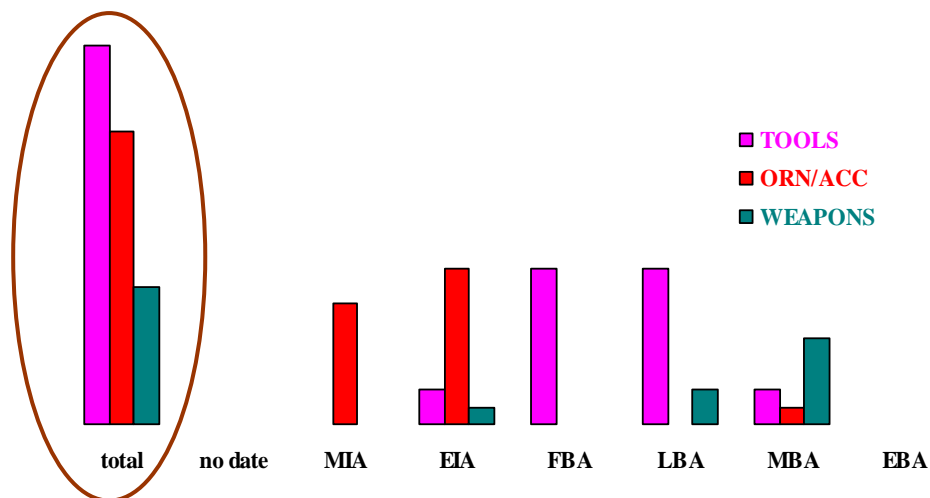
rudae are nearly pure copper except one reporting iron and zinc with percentages respectively of 7,2% and 2,8%.

As showed in the *scatter plot diagram*, all the other samples are ternary bronze alloys (copper, tin and lead) with variable compositions but, for the moment, consistent ones with the functional classes of objects. Spiral composition is more consistent with composition of kardiophylakes than with composition of beads but, on the other hand, spirals were associated to beads for inventory reasons and no further data indicate any association among them than probably in deposition.

TERRITORIAL QUANTIFICATION

For territorial quantification of objects, two areas have been considered as operative models: Ortucchio e Celano. Both the archaeological areas lie behind the lake bed and both report traces of metallurgical production, as rests of furnaces, casting pottery and some finds catalogued as slag.

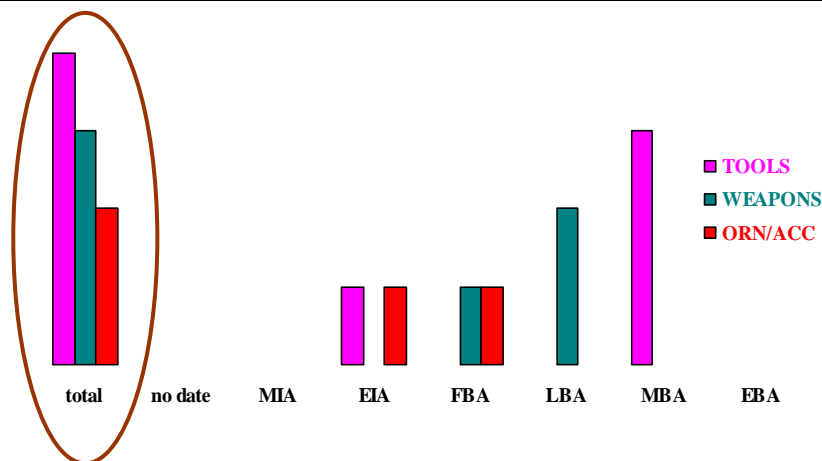
CHRONOLOGICAL QUANTIFICATION OF CATEGORIES OF OBJECTS REPORTING PROVENIENICE ORTUCCHIO								
category	total	no date	MIA	EIA	FBA	LBA	MBA	EBA
tools	22			2	9	9	2	
orn/acc	17		7	9			1	
weapons	8			1		2	5	



Almost all the samples reporting provenience Ortucchio belong to the Bellucci Collection from Perugia Museum. Bellucci personally collected or bought them at the beginning of the XX century, scarcely reporting provenience with no further data. Bronzes are typologically dated.

Bronzes show the general tendency of prehistorical and proto-historical bronze inventories as above quoted but, in the total section, tools are the major group, further supporting the relevance of industrial activities documented in the Ortucchio sites by recent contextual data.

CHRONOLOGICAL QUANTIFICATION OF CATEGORIES OF OBJECTS REPORTING PROVENIENCE CELANO								
category	total	no date	MIA	EIA	FBA	LBA	MBA	EBA
tools	4			1			3	
weapons	3				1	2		
orn/acc	2			1	1			



All the 9 samples reporting provenience Celano have been bought *a lotto* by different acquisitions. They are typologically dated. As in the case of Ortucchio, tools are the major group. Also the Celano bronze inventory could be related to the industrial activities documented in the area by recent digs.

CONCLUSIONS

Objects show to have been frequently repaired in antiquity by additions of metals and alloys. Particular attention is given to the determination of chemical compositions and technologies of the various elements, constitutive of the artefacts or parts of reparations, in order to compare data either inside the same artefact and among objects showing similar reparation interventions. At the same time, bronzes present very different patinas, which nature is attributable either to the different tipologies of deposition and conservation, and to the different chemical compositions, finishing treatments and reparations to which objects have been submitted in antiquity as consumption products.

For the database drawing up, chemical, technological and traceological parameters are considered with the same attention than classical data, as the typological ones for instance, in order to build a framework able to support crossed relationships between materials. Relationships among such parameters, moreover, could provide also useful data about dynamics relate to the objects assemblage.

The Fucino prehistorical and proto-historical archaeology did not give back clear contexts associated to metallurgic processes but, on the other hand, the difficulty of finding such contexts earlier than the full Iron Age is known. At the same time, some finds from Ortucchio and Celano, as already quoted, have been recently catalogued as slag and their chemical compositions could constitute a further parameter for the interpretation of the Fucino bronzes.

REFERENCES

1. AAVV 1989 *Antica terra d'Abruzzo*. L'Aquila
2. AAVV 1997 *Acque, grotte e Dei : 3000 anni di culti preromani in Romagna, Marche e Abruzzo*. Imola
3. AAVV 1998 *Archeologia in Abruzzo: storia di un metanodotto tra industria e cultura*. Chieti
4. AAVV 1999 *Il Fucino e le aree limitrofe nell'antichità : atti del 2. convegno di Archeologia in ricordo di Antonio Mario Radmilli e Giuliano Cremonesi*. Celano-Paludi
5. AAVV 2001 *Il Tesoro del Lago: l'Archeologia del Fucino e la Collezione Torlonia*. Pescara
6. AAVV 2002 *Atti del II Congresso Nazionale di Archeometria*. Bologna
7. AAVV 2003 *Atti della XXXVI riunione scientifica: preistoria e protostoria dell'Abruzzo: Chieti - Celano 27 - 30 settembre 2001*. Firenze
8. Peroni R. 1961 "Bronzi dal territorio del Fucino nei Musei Preistorici di Roma e Perugia". *Rivista di Scienze Preistoriche*. Roma
9. Ridolfi S., Ciarla R., Guida G. 2005 "The Use of Non-Destructive Techniques to Define the Components of the Alloy and Patina in a Chinese Bronze Finishing, in the Form of a Taotie Mask (X-VIII Centuries B.C.)". *Art'05 - 8th International Conference on "Non destructive Investigations and Micronalysis for the Diagnostics and Conservation of the Cultural and Environmental Heritage"*. Lecce

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