Micropalaeontology in archaeology: reconstruction of provenance of a prehistoric artefact through microfossil and lithological analyses

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Abstract The fortuitous and rare discovery, in a fragment of prehistoric pottery, of some specimens of larger benthic foraminifera (*Nummulites* spp.) suggested an investigation aimed at determining the age and provenance of the calcareous sediment used as a degreaser in the ceramic mixture. Eocene calcareous nannofossil assemblages and Paleogene nummulites found in clasts in the fragment, as well as a heterogeneous lithological assemblage recognised in other clasts, allows us to hypothesise a source of the sediment from the area east of the Lake Garda as a probable place of origin and manufacture of the artefact. Since the artefact was found in a region far from the original place of manufacturing, this inference is useful to reconstruct or support migration and/or commercial ways in prehistoric times.

Keywords Eocene; *Nummulites*; calcareous nannofossils; Bronze Age; Po River

1. Introduction

The period between the early Bronze Age and Iron Age is defined as the 'protohistoric phase', comprising the first half of the IV Millennium to the end of the II Millennium BC.

During the protohistoric age in Italy, numerous and complex civilisations were born as part of an evolutionary trend of cultural and trade exchange between European peoples.

The search for metals, in particular copper and tin, established links between widely dispersed populations, ranging between the easternmost regions of the Mediterranean Sea and north-central Europe.

Within this context, during the Early Bronze age, in the area of Lake Garda (NE Italy), the cultural facies of Polada was developing (Barich, 1971; de Marinis *et al*., 1996). The archaeological evidence of the Polada facies identifies several relatively extensive and densely populated villages, located within the lakes, owing to the construction of pilings. Although limited to the specific territory of the Lake Garda area, the Polada culture had well-developed contacts with the area of Valsugana (Trentino, NE Italy), for the exploitation of its metalliferous basin, and through links with the trans-Alpine territory, its influence also reached the Northern Apennines (De Marchi, 2003).

The Polada facies is also evident from a few findings in the Po Valley, but it is only from the Middle Bronze Age that the Po Valley was occu-

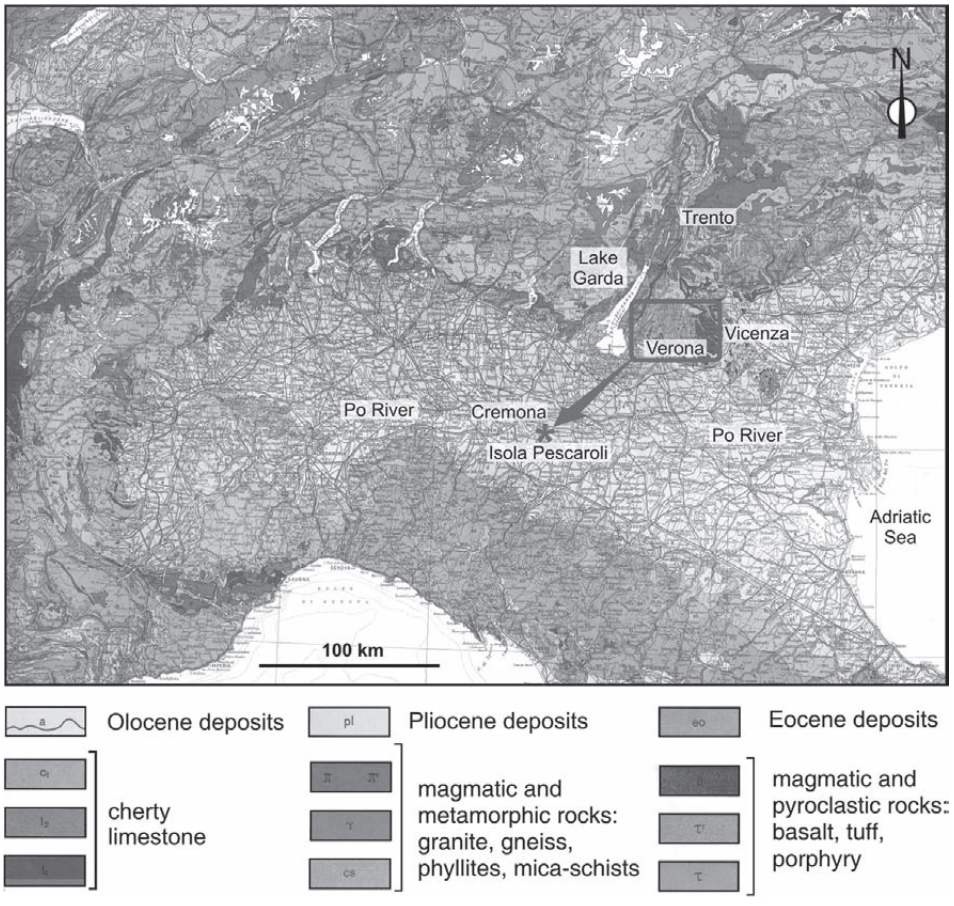


Figure 1 – Location map with geological sketch and hypothetical provenance area of the pottery (square) and discovery location (*).

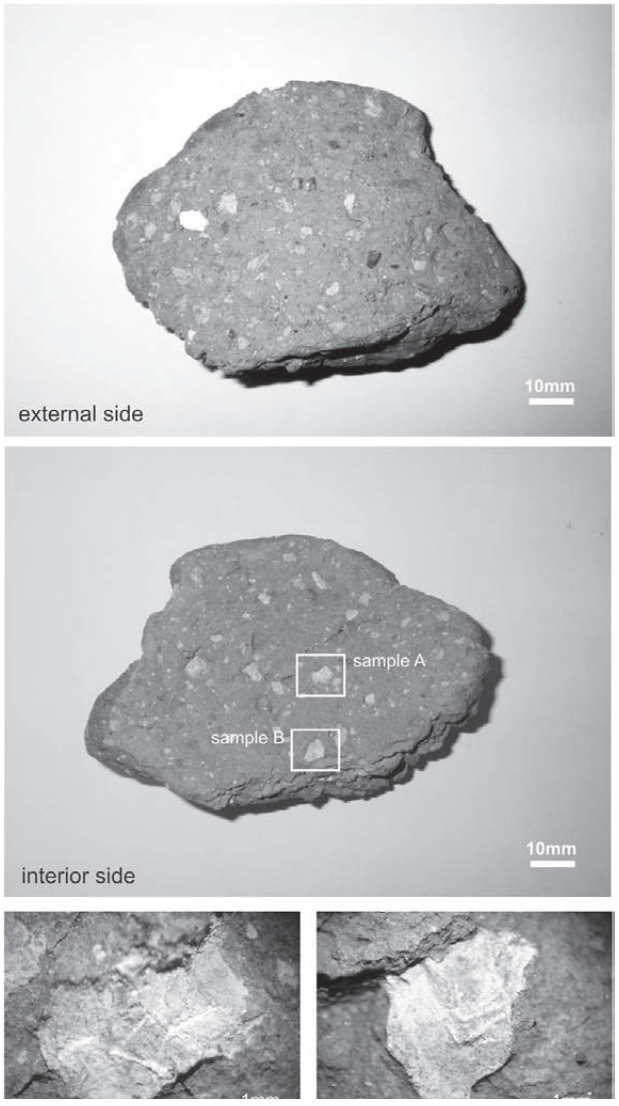


Figure 2 – Fragment of pottery (top, middle) and analysed calcareous clasts (bottom).

pied by a dense network of fortified villages, characterised by the presence of houses built on pilings, but in a dry environment (the Terramare civilization).

The Terramare is an important middle to late Bronze Age culture of northern Italy, which developed between 1650 and 1150 BC, covering an area that included, south of the Po River, the Emilia Romagna between the Arda and Reno Rivers and north of the Po River, the lower plains of Cremona, Mantova and Verona (Bernabò Brea *et al*., 1997).

The cultural proximity between the Lake Garda and Terramare populations allows us to adopt a single term to indicate the middle and late Bronze Age of the Po Plain: the palafitticolo-terramaricola culture (de Marinis, 1997).

In addition to its close link with the Benacense area (near Lake Garda), the Terramare civilization was permeated by different influences from neighbouring regions, due to the strategic location of its settlements at the heart of a major trade route that extended from central Europe, across the Alps, through the Po River region, then southwards reaching the Adriatic and Aegean Seas.

Today, the Po River is a rich archaeological site and a fragment of pottery was found in June, 1997, in the sand quarry of Isola Pescaroli (Po River, Cremona, Italy). These river sediments are not suitable for the stratigraphic attribution of this fragment, which can therefore be differentiated only through typological speculation or in relation to the materials used in its manufacture.

The approach used in this work follows, at least in part, the method applied by Quinn *et al*. (2007) and Zambetakis-Lekkas *et al*. (2007), in the determination of the origin of ancient pottery, and Fiorentino (1998) in the identification of the origin of the Riace Bronzes, where the casting material was provenanced using calcareous nannofossils.

2. Material and methods

The artefact is 88 x 60 mm and is a fragment of the base of a vase (Fig. 2) with an estimated diameter of about 155 mm. The fragment contains common *Nummulites* spp. (Fig. 3) and several calcareous clasts (size from 3 to 8 mm).

Two calcareous clasts (samples A and B) were selected for nannofossil analysis (Fig. 2).

These were cleaned to remove the surface crust and then smear-slides were prepared, and microscope analysis performed using polarised-light at 1250x magnification.

The other lithologies in the fragment were examined using a stereoscopic microscope at 40x magnification.

3. Results

The fragment of ancient pottery is a part of a vessel made from a coarse mixture. It lacks diagnostic morphological elements that would allow it to be ascribed accurately to a specific cultural facies. However, some technological elements, in particular the mixture from which it was manufactured, allows it to be dated as protohistoric, and probably from the Bronze Age.

It was manufactured with a varied mixture, characterised by a calcareous clay matrix, incorporating a heterogeneous assemblage of clasts, composed largely of *Nummulites* spp. that suggested the artefact was not of local origin. Through analogy of the lithological and biological components, the region of origin is recognisable as the Venetian Pre-Alps (Fig. 1).

The clasts comprise predominantly coccoliths, a terrigenous component, and calcite crystals. Part of the latter may be ascribed to the effect on coccoliths of high firing temperatures (about 800°C) to which such ceramic artefacts were likely subjected (Carpenito *et al*., 2006), or alternatively to natural diagenesis.

Eight poorly-preserved calcareous nannofossil taxa were identified:

Cyclicargolithus floridanus (sample A, B)
Ericsonia formosa (sample A, B)
Coccolithus pelagicus (sample A, B)
Cribrocentrum reticulatum (sample A, B)
Cribrocentrum sp. (sample A)
Dictyococcites bisectus (sample A, B)
Dictyococcites scrippsae (sample A, B)
Sphenolithus moriformis (sample A)

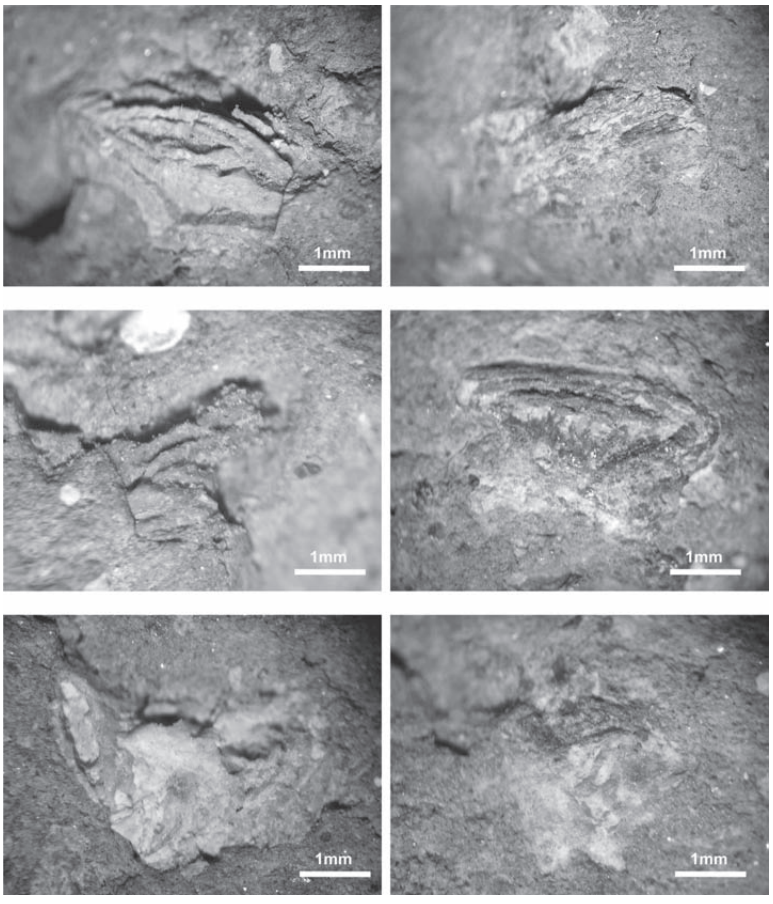


Figure 3 (above) – Specimens of *Nummulites* spp. incorporated into the pottery

Lithological analysis revealed the presence of porphyry, red granite, quartzite, chert and volcanic tuff alongside the calcareous clasts (Figure 4).

Observation of the pottery surface revealed the presence of at least seven nummulites, although poor preservation prevented classification to a specific level.

4. Discussion

The presence of Eocene calcareous nannofossils in the pottery fragment, rules out its provenance from the geographical region where it was found, i.e. the Po River near Cremona (Isola Pescaroli, San Daniele Po).

Although the calcareous nannofossil assemblages are poorly-preserved, two biostratigraphic markers were identified: *D. bisectus*, and *C. reticulatum*. These taxa constrain the age of the clasts to the Middle to Late Eocene (c. 40.6 to 34.85 Ma), nannofossil zones base MNP16B (base occurrence of *D. bisectus*, Bartonian) to top MNP19 (top occurrence of *C. reticulatum*, Priabonian) (based on Fornaciari *et al.*, 2010).

Lithologies containing Eocene nannofloras associated with nummulitic formations (the lower Eocene Calcare di Torbole and Pietra di Avesa; the middle Eocene Calcare di Monte Postale; the upper Eocene Calcare di Nago), and in the vicinity of cherts, limestones, volcanic tuffs, quartzites, basalt, porphyry and granite, crop out in the region of the Lessini Mountains (Trentino, Adamello and Predazzo), east of Lake Garda.

5. Conclusions

1. Nannofossils from the calcareous clasts give an age of Bartonian to Priabonian (Eocene, 34.85 to 40.6Ma);
2. Based on micropalaeontological and lithological associations, the manufacturing site of the ceramic can be constrained to the east of the Lake Garda region.
3. The results of our study, together with numerous previous findings of Bronze Age pottery in the same region, confirm the contribution of cultural elements from the Benacense region to the Po Valley area, especially during the Bronze Age, emphasizing the existence of continuous contact between the two areas during the pre-protohistory.
4. Our study underlines the utility of

Figure 4 (below) – Examples of lithologies incorporated into the pottery.

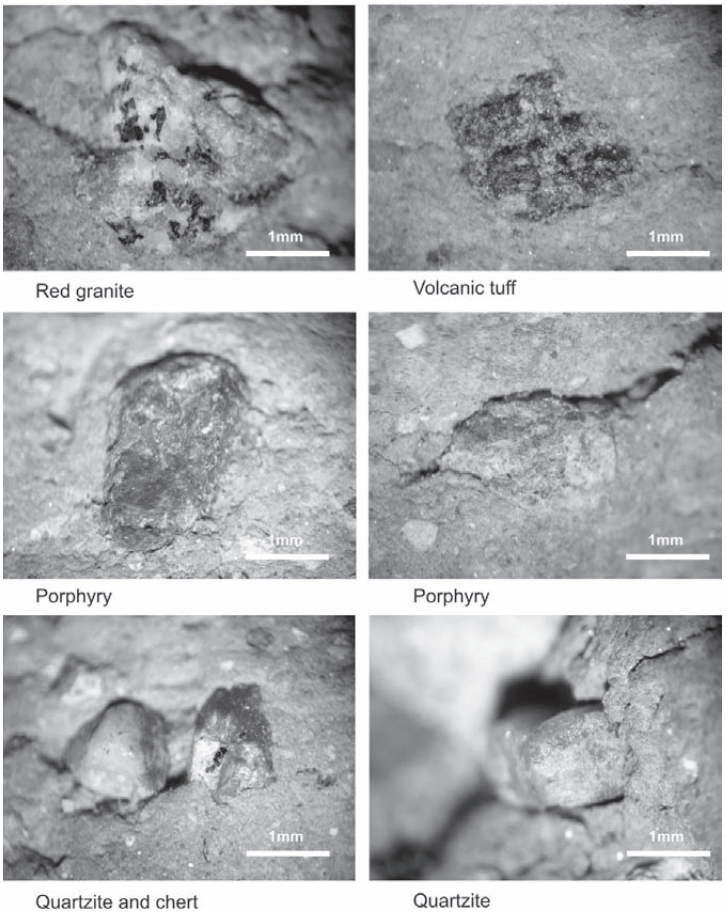
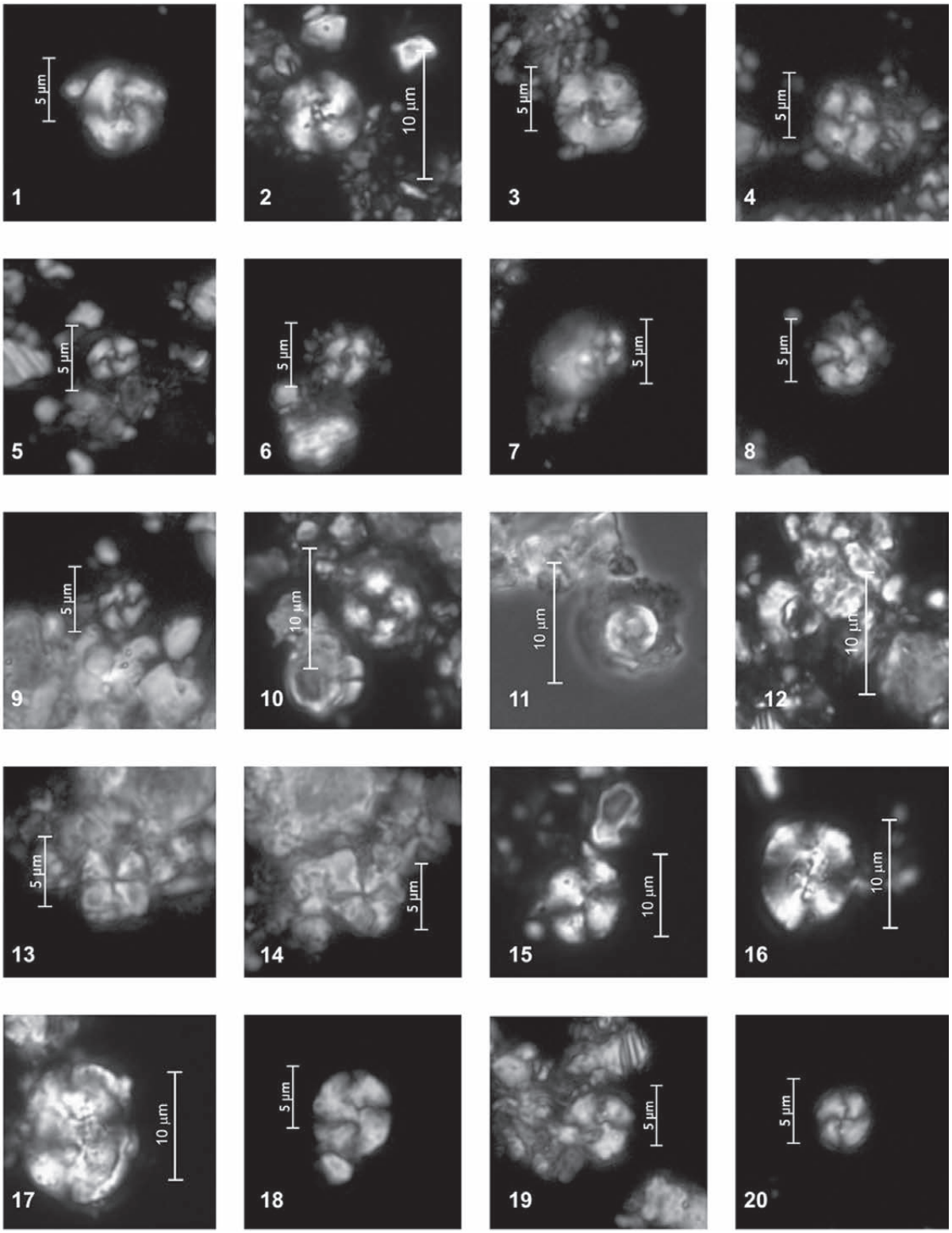


Plate 1



Figs. 1-2. *Cribrocentrum reticulatum* crossed nicols, sample A, 1250X; ***Figs. 3-4***. *Cribrocentrum* sp., crossed nicols, sample A, 1250X. ***Figs. 5-9***. *Cyclicargolithus floridanus;* crossed nicols, sample B, 1250X; ***Fig. 10,11***. *Ericsonia formosa*; crossed nicols and phase contrast (same specimen), sample A, 1250X; ***Fig. 12***. *Coccolithus pelagicus*; crossed nicols, sample B, 1250X; ***Fig. 13,14***. *Sphenolithus moriformis*; crossed nicols (view at 0° and 45°), sample A, 1250X; ***Fig. 15-18***. *Dictyococcites bisectus*, crossed nicols, sample A, 1250X; ***Fig. 19-20***. *Dictyococcites scrippsae*, crossed nicols, sample B, 1250X.

applying micropalaeontological studies to archaeology. Essential factors are the presence in the pottery of fossiliferous marine sediments, and a firing temperature of the artefacts compatible with calcareous nannofossil preservation.

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References

Barich, B. 1971. Il complesso industriale della stazione di Polada alla luce dei più recenti dati, *Bullettino di Paletnologia Italiana*, **80** (22): 77-182.

Bernabò Brea, M., Cardarelli, A., & Cremaschi, M. 1997. Le Terramare - La più Antica Civiltà Padana, Electa, Milano.

Carpenito, G., Levi, S.T. & Vezzalini, G. 2006. Indagini archeometriche della frazione fine di ceramiche "d'impasto" provenienti da siti terramaricoli del territorio modenese. IV Congresso di Archeometria – Scienza e Beni culturali. Associazione Italiana di Archeometria, Pisa, 1-3 February 2006.

De Marchi, L. 2003. Archeologia della preistoria tra parmense e reggiano. L'età del Bronzo nelle Valli Parma, Enza e Baganza, Parma.

de Marinis, R., Baioni, M., De Gasperi, N., Mangani, C. & Seragnoli, L. 1996. Nuovi scavi al Lavagnone (Desenzano del Garda-Lonato) e considerazioni sull'antica età del bronzo in Italia settentrionale, in L'antica età del bronzo in Italia, Atti del congresso (Viareggio 1995) Firenze (1996), pp. 257-271.

de Marinis, R. & Pedrotti, A.L. 1997. L'età del rame nel versante italiano delle Alpi centro-occidentali. In: Atti della XXXI Riunione Scientifica "La Valle d'Aosta nel quadro della preistoria e protostoria dell'arco alpino centro-occidentale", Courmayeur, 2-5 June 1994. [Istituto Italiano di Preistoria e Protostoria] Firenze, pp. 247-300.

de Marinis, R. 1997. L'età del Bronzo nella regione benacense e nella Pianura Padana a nord del Po, in Le Terramare, pp. 405-422.

Fiorentino, A. 1998. The potential of nannofossil analysis applied to archaeological studies: the case of the Riace's Bronzes. *Journal of Nannoplankton Research*, **20** (2): 101-103

Fornaciari, E., Agnini, C., Catanzariti, R., Rio, D., Bolla, E. & Valvasoni, E. 2010. Mid-Latitude calcareous nannofossil biostratigraphy and biochronology across the middle to late Eocene transition. *Stratigraphy*, **7**(4): 229-264.

Zambetakis-Lekkas A. and Elefanti P., 2007. Micropaleontology and biostratigraphy efficient tools in archaeological research. Raw material provenance in the upper Palaeolithic Kastritsa cave, Ioannina Region (Greece). Bulletin of the Geological Society of Greece vol. XXXX, 2007. Proceedings of the 11th International Congress. Athens, May 2007: 1874-1879.

Quinn, P. S & Day P. M. 2007. Ceramic micropalaeontology: the analysis of microfossils in ancient ceramics. *Journal of Micropalaeontology*, **26**, pp. 159-168.