CALCAREOUS NANNOFOSSIL ANALYSIS OF CERAMICS AND PROBABLE RAW MATERIALS FROM AN ANCIENT PUNIC KILN SITE ON THE ISLAND OF MOZIA, WESTERN SICILY

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Abstract: The analysis of calcareous nannofossils, liberated from several samples of pottery and probable raw materials from a VI-V BC ceramic workshop on the island of Mozia (western Sicily), furthers the interpretation of Alaimo *et al.* (1997) that local potters utilised alluvial clays from the nearby Birgi stream.

Introduction

A ceramic workshop, dated to the VI-V century BC, was found at the ancient Punic settlement on the island of Mozia, off western Sicily. This workshop contained several well-preserved kilns, fired ceramic artefacts and quantities of raw materials. Alaimo *et al.* (1997) analysed samples of the pottery and probable raw materials using mineralogy, geochemistry and macro- and microfossil analyses, and indicated that the two are compatible. The raw materials found at Mozia also proved to be similar to alluvial sediments from the mouth of the Birgi stream, approximately 3km from Mozia (Figure 1).

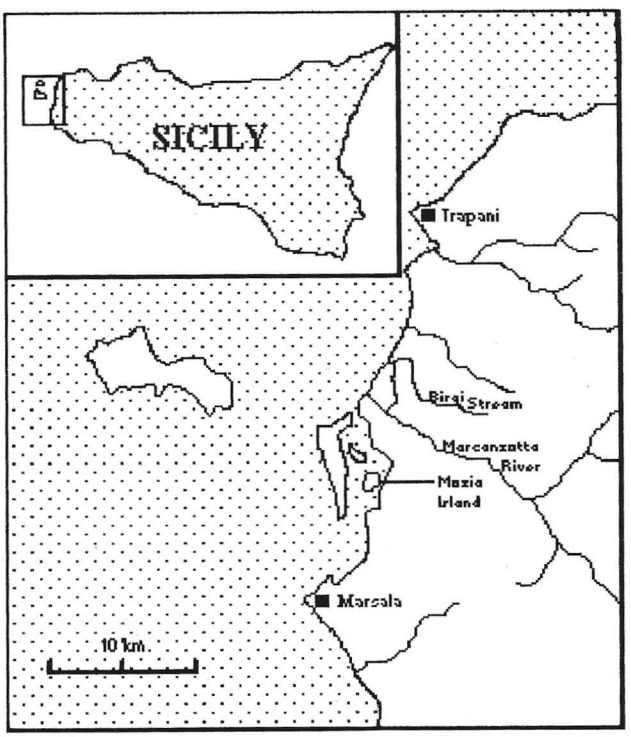

Figure 1: Location of Mozia and the Birgi stream in western Sicily.

For this report, the calcareous nannofossils from six of the seven samples which were studied by Alaimo *et al.* (1997) were analysed in order to confirm, refine or disprove their interpretations.

Methods of calcareous nannofossil analysis

In order to study the calcareous nannofossil specimens contained within the samples of archaeological pottery and probable raw materials from the Mozia kiln, standard nannofossil smear-slides were prepared from each sample. Great care was taken when sampling the pottery sherds in order to avoid incorporating any paints, slips or secondary deposits, which may contain nannofossils, and which could thus have biased the analysis. Sample MK6 was extremely sandy and the coarse fraction had to be separated in water; after ten seconds, the fine clay fraction, which remained suspended, was pipetted onto a coverslip and allowed to dry. As with any calcareous nannofossil preparation, the archaeological material was sampled in a clean environment in order to avoid contamination.

The smear-slides were studied under the microscope using plane- and cross-polarised light at a magnification of x1000. The first 100 calcareous nannofossil specimens encountered were identified and counted in order to attain an overall impression of the assemblage. Further searching was then made in closely-spaced traverses across the whole slide in order to detect any rare calcareous nannofossil taxa which did not score in the counts. The results of this analysis are presented in Table 1 and discussed below. The various nannofossil taxa from each sample are labelled in accordance with their relative abundance as a proportion of the whole assemblage.

Results of the calcareous nannofossil analysis

Sample MK2 (raw material found near the kiln) A very abundant, variable but reasonably well-preserved assemblage containing nannofossils which are indicative of the Early Cretaceous, Late Cretaceous, Late Paleocene or Early Eocene, Late Eocene to Early Oligocene, Late Oligocene to Early Miocene, and Late Neogene.

Sample MK6 (sand found near the kiln, thought to have been used to temper the pottery. Temper is „particulate matter added to a clay...that modifies its properties when wet or dry as well as during and after firing...The properties these materials modify include workability, drying characteristics, firing behaviour, and final characteristics" (Rice 1987, p.406, 407, 408)) An abundant, extremely variable, but generally poorly-preserved assemblage containing nannofossils which are indicative of the Early Cretaceous, Late Cretaceous, Late Oligocene or Early Miocene, Late Neogene (Early Pliocene), and possibly the Late Paleocene or Early Eocene.

Sample MK7 (raw material found near the surface) An extremely abundant, variable but reasonably well-preserved assemblage containing nannofossils which are indicative of the Late Cretaceous, Late Eocene, Early

SPECIES	APPROXIMATE RANGE	SAMPLES						SPECIES	APPROXIMATE RANGE	SAMPLES					
		MK2	MK6	MK7	MK12	MK16	Mo3			MK2	MK6	MK7	MK12	MK16	Mo3
Arkhangelskiella specillata	Late Cret.		R			P		*Helicosphaera recta*	Late Oligoc.-Early Mioc.	P					
Arkhangelskiella sp.	Late Cret.						P	*Helicosphaera* sp.	Ceno.		P				
Biscutum ellipticum	Jur.-Cret.	R						*Heliolithus* sp.	Paleoc.					P	
Braarudosphaera cf. *B. regularis*	Cret.	P						*Lucianorhabdus cayeuxii*	Late Cret.			R			
Calcicalathina oblongata	Eary Cret.	P						*Lucianorhabdus* sp.	Late Cret.	P					
Calcidiscus leptoporus	Mioc.-Rec.	R	F	R			R	*Micula decussata*	Late Cret.	R	P	P			
Calculites cf. *C. obscurus*	Late Cret.	F		F		R	R	*Micula swastica*	Late Cret.			R			
Calculites sp.	Late Cret.	P						*Nannoconus elongatus*	Cret.		P				
Ceratolithoides kamptneri	Late Cret.	P						*Nannoconus farinacciae*	Late Jur.-Early Cret.					P	
Chiastozygus sp.	Cret.-Paleoc.			P				*Nannoconus kamptneri*	Early Cret.						P
Coccolithus formosus	Eoc.-Oligoc.	P	R			P	R	*Nannoconus steinmannii*	Late Jur.-Early Cret.			P			
Coccolithus miopelagicus	Mioc.	P	R	F		R	F	*Nannoconus* sp.	Cret.					P	
Coccolithus pelagicus	Ceno.	A	C	A	P	A	A	*Polypodorhabdus escaigii*	Jur.	P					
Cribrocentrum reticulatum	Late Eoc.	R		P		P	R	*Pontosphaera multipora*	Early Eoc.-Pleistoc.	P		R			
Cribrosphaerella ehrenbergii	Cret.		R					*Pontosphaera segmenta*	Mioc.				P		
Crucielipsis cuvillieri	Early Cret.	P						*Pontosphaera* sp.	Late Paleoc.-Rec.		P				
Cyclagelosphaera margerelii	Jur.-Cret.		P					*Prediscosphaera majungae*	Late Cret.			P			
Cyclicargolithus abisectus	Late Oligoc.	C	A	C		A	A	*Prediscosphaera stoveri*	Late Cret.			P			
Cyclicargolithus floridanus	Eoc.-Mid Mioc.			R		F	F	*Prinsius* sp.	Paleoc.	R					
Dictyococcites antarcticus	Mioc.	R	F	F		P	F	*Pseudoemiliania lacunosa*	Plioc.-Pleistoc.		P				R
Dictyococcites bisectus	Oligoc.	F	C	F		C	F	*Pyrocyclus orangensis*	Mioc.	R					R
Dictyococcites productus	Late Mioc.-Pliestoc.	C	C	F		F	F	*Quadrum sissinghii*	Late Cret.		P				
D. productus/Gephyrocapsa	Mid Zancl.						R	*Quadrum trifidum*	Late Cret.						R
Discoaster barbadiensis	Eoc.	R	P	P		P		*Quadrum* sp.	Late Cret.	P				P	
Discoaster bellus	Late Mioc.						R	*Retecapsa angustiforata*	Cret.			P			R
Discoaster cf. *D. druggii*	Early Mioc.	P		P				*Retecapsa* sp.	Jur.-Cret.						R
Discoaster deflandrei	Eoc.-Mid Mioc.			R		F		*Reticulofenestra minuta*	Early Eoc.-Pleistoc.	VA	A	C		F	A
Discoaster kugleri	Mid Mioc.			P				*Reticulofenestra minutula*	Mioc.-Pleistoc.		A	A		A	A
Discoaster mohleri	Paleoc.	R	R	P		R		*Reticulofenestra pseudoumbilica*	Mioc.-Mid Plioc.	C	C	A		A	A
Discoaster saipanensis	Late Eoc.			P				*Rhagodiscus asper*	Cret.		R				
Discoaster tanii	Late Eoc.-Early Oligoc.			P				*Sphenolithus anarrhopus*	Paleoc.-Early Eoc.	R					
Discoaster tanii nodifer	Late Eoc.			P				*Sphenolithus moriformis*	Eoc.-Mioc.	P		R		R	F
Discoaster variabilis	Mid Mioc.-Late Plioc.					P		*Sphenolithus neoabies*	Late Mioc.-Mid Plioc.	P	F	P			
Discoaster sp. (6-rayed, indeterminable)	Ceno.	R	P		P	R	R	*Sphenolithus obtusus*	Late Eoc.			R			
Eiffellithus eximius	Late Cret.			P				*Sphenolithus predistentus*	Late Eoc.-Oligoc.			R			
Ericsonia cava	Paleoc.	P						*Sphenolithus tribulosus*	Early Oligoc.			P			
Ericsonia robusta	Mid Paleoc.-Early Eoc.	R						*Sphenolithus* sp.	Ceno.	F	F	F		F	
Ericsonia subdisticha	Oligo.	R						*?Speetonia colligata*	Early Cret.						P
Geminilithella sp.	Neog.		R				R	*Scyphosphaera* sp.	Eoc.-Rec.					R	
Gephyrocapsa sp. (large)	Pleistoc.-Rec.					P		*Sollasites* sp.	Jur.-Cret.			P			
Gephyrocapsa sp. (small)	Mid Zancl.-Rec.		R					*Teichorhabdus ethmos*	Late Cret.			P			
Helicosphaera carteri	Mioc.-Rec.	R		R				*Thoracosphaera* sp.	Meso.-Ceno.	P		P			
Helicosphaera compacta	Late Eoc.-Oligoc.	R						*Triquetrorhabdulus carinatus*	Oligoc.-Early Mioc.	P		P			
Helicosphaera euphratis	Late Eoc.-Early Mioc.			P				*?Triquetrorhabdulus shetlandensis*	Early Cret.			P			
Helicosphaera gertae	Early Mioc.			P				*Watznaueria barnesae*	Jur.-Cret.	R	F	F		P	F
Helicosphaera intermedia	Oligoc.-Mioc.	R	P			R		*Zeugrhabdotus embergeri*	Late Jur.-Late Cret.						R
Helicosphaera paleocarteri	Neog.		P	P		P									

Table 1: Results of the semi-quantitative calcareous nannofossil analysis of ceramics and probable raw materials from an ancient Punic kiln site on the island of Mozia. 100 counts were made, abundances translate as follows: VA = very abundant (21-40%); A = abundant (11-20%); C = common (6-10%); F = few (2-5%); R = rare (<2%); P = present (species which did not score in the counts but were detected during further searching).

Miocene and Late Neogene (Late Miocene or Early Pliocene).

Sample MK12 (fragment of an amphora support) An extremely low-abundance, very poorly-preserved assemblage which represents contamination or a highly degraded nannoflora.

Sample MK16 (fragment of a dish) An abundant, variable but reasonably poorly-preserved assemblage containing nannofossils which are indicative of the Early Cretaceous, Late Cretaceous, Late Paleocene, Late Eocene or Early Oligocene, Late Oligocene or Early Miocene, Late Neogene and possibly the Pleistocene.

Sample Mo3 (alluvium from the Birgi stream) A reasonably abundant, variable but reasonably well-preserved assemblage containing nannofossils which are indicative of the Early Cretaceous, Late Cretaceous, Late Oligocene or Early Miocene, Late Miocene, Early Pliocene, and possibly the Late Eocene or Early Oligocene.

Discussion

All of the samples, except MK12, contained rich nannofossil assemblages with a variable state of preservation. In all cases, the nannofossil taxa present in the assemblages were of widely varying geological dates, ranging from the Early Cretaceous to the Early Pliocene and possibly the Pleistocene. Whilst certain calcareous nannofossil taxa occur in some samples and not in others, the assemblages are generally very compatible and it is likely that samples MK2, MK6, MK7, MK12 and Mo3 are of a similar origin.

Sample MK12 contained an extremely poor nannofossil assemblage, characterised by a very low