Insight into calcareous nannofossil palaeoecology at the beginning of the Messinian Salinity Crisis in the classical section of Alba (NW Italy)

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In the last decade, a renewed interest on the onset and developement of the Messinian Salinity Crisis (MSC) led to a general revision of several classic sections in the Mediterranean area (see review in Rouchy & Caruso, 2006). One of the classical land Messinian sections, the composite Alba section of Sturani (1973), has been recently revisited. New stratigraphical, palaeontological, sedimentological, geochemical and petrographical data were collected in the Tortonian-Messinian sediments cropping out along the Tanaro River, near Verduno, in order to re-examine the onset and development of the MSC in this critical area of the Tertiary Piedmont Basin (BTP).

This work only deals with calcareous nannofossil (CN) data, while integrated biostratigraphical, palaeoecological, sedimentological and petrographical analyses are in progress.

The sampled section consists of five main lithologic units: 1) hemipelagic, laminated marly clay, up to 37 m thick; 2) three primary selenitic gypsum beds intercalated with thinly laminated marly clays (14 m); 3) finely-laminated, fine- to coarse-grained primary 'balatino' gypsum (7 m); 4) thinly-bedded marly clays intercalated with coarse-grained, diagenetic gypsum beds (34 m); 5) marly clays of the Lago-Mare facies, with root traces; 6) marly clays of Pliocene age, with abundant marine fossils.

Unit 1 only contains well to moderately preserved CN assemblages, whose composition reflects the progressive deterioration of the marine environment prior to the onset of the MSC (Unit 2).

The occurrence of Messinian marker species, such as *Amaurolithus primus/delicatus*, *Amaurolithus tricorniculatus* identifies the MNN11c subzone of Raffi *et al*. (2003). The absence of *Nicklithus amplificus*, whose occurrence is restricted to the lower part of the MNN11c subzone, could indicate the uppermost MNN11c subzone above the LO of *Nicklithus amplificus* or, alternatively, could be due to unfavourable palaeoenvironmental conditions. The scattered occurrence of *Reticulofenestra rotaria*, usually recorded only in MNN11b, may be ascribed to reworking, as strongly supported by the occurrence of high percentages of Cretaceous, Paleogene and Early-Middle Miocene CN. The topmost 3 m of Unit 1 are barren of CN.

The relative abundance of stress-tolerant CN species supports a pulsating environment with different characteristics of the water column. According to recent studies on the ecological preferences of several Messinian CN species (Flores *et al*., 2005; Kowenhoven *et al*., 2006; Wade & Bown, 2006), we can reconstruct the changes in the environment during the successive phases of the onset of the MSC. In general, the upper 14 metres of Unit 1 'normal' Messinian CN assemblages alternate with several strongly oligotypic assemblages, with changing composition at different stratigraphic levels. In particular, 12 metres below the first selenitic gypsum bed, the relative abundance of 'small' *Reticulofenestra* (*R. minuta* and *R. haqii* combined, up to 70% of the total assemblage) suggests episodes of eutrophic and brackish-to-hypersaline surface-waters. An abundance peak of *Sphenolithus abies* (up to 60% of the total assemblage) and high relative abundance of *Helicosphaera carteri* (up to 20% of the total assemblage) are recorded 8 metres below Unit 2. The concomitant abundance of both species in our material suggests a shallow-water environment (supported by *H. carteri*), rich in nutrients and with fluctuating, possibly high, salinity. In fact, *S. abies* is interpreted as a schizohaline species, and *H. carteri* as tolerating high-salinity waters (Kowenhoven *et al*., 2006). Another peak of 'small' *Reticulofenestra* is recorded 3 metres below the selenitic gypsum bed, and supports the hypothesis of eutrophic surface-waters, and increasing salinity.

The occurrence of discrete oligotypic CN assemblages, in a succession of 'normal' Messinian CN assemblages, suggests the presence of surface waters relatively rich in nutrients and progressively increasing in salinity towards the top of Unit 1. The presence of shallow-water markers supports the idea of a decreasing depth of the basin during the pre-evaporitic phase, and the development of a progressively restricted environment. The occurrence of 'normal' Messinian CN assemblages also testifies that this trend towards increasing salinity and more restricted environment was interrupted by several episodes of re-establishment of salt concentration close to the global ocean values during the pre-evaporitic phase.

The occurrence of euryhaline fishes (*Aphanius* sp.) just 1.5 m below the selenitic gypsum beds of Unit 2 also testifies that the increase in salinity started before the precipitation of gypsum, during the pre-evaporitic phase.

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