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Fossil microbial events in the Messinian Calcare di Base Formation from Sutera, Caltanissetta Basin, Sicily

E.Oliveri (1), A.Bellanca (1), R.Neri (1), R.Riding (2)

(1) Dipartimento di Chimica e Fisica della Terra, CFTA, Via Archirafi 36, I-90123 Palermo, Italy,(2) School of Earth, Ocean and Planetary Sciences, Cardiff University, Cardiff CF10 3YE, United Kingdom

(elviraoliveri@libero.it)

The Calcare di Base in the Sutera area of the Caltanissetta Basin displays evidence of fossil microbial mats in an evaporitic environment of Messinian age. In this area, the stromatolites are intercalated in marls, dolomitized diatomites, aragonitic limestones and claystones.

The microbial event occurs in three carbonate beds (from 30 to 70 cm in thickness) showing irregular and crinkly millimetric lamination with small fenestrae and low domes up 7 cm wide and 1 cm high. Three main types of microfabric are recognizable: i) micro ($<$1mm) fenestral pelsparite with poorly-defined filaments and very irregular, locally dendritic clumps of clotted peloidal micrite-microspar in a sparry or, locally, micritic matrix with disseminated pyrite; ii) alternation of laminae consisting of a dense filamentous felt including voids partially filled by pyrite, laminae of cyanobacterial filaments (about 70 mμ in diameter) in sparry calcite, and mainly clastic laminae with fenestral pores; iii) irregular clusters and layers of micro-"chicken-wire"-spar-filled fenestrae, probably after evaporites. The filaments, preserved as dolomicrite, resemble *Beggiatoa*-like filamentous sulphur bacteria occurring in methane seep settings (see Peckmann et al., 2004, Geomicrobiology Journal, 21:247-255).

SEM observations reveal spherical aggregatestes of dolomite (10 μm) constituting the filaments; dolomite crystals are also arranged as rounded grains ($<1\mu$m) which locally appear incorporated or absorbed into developing crystal faces. Biofilm remains occur in the micrite and sparry calcite filling the microporosity.

Consistently, the dolomite shows positive δ^{18}O (mean value +6.44 $\%_{\text{˛}}$) and negative

δ^{13}C values (down to -8,03 ‰) that support formation of this phase as a primary precipitate or very early diagenetic product with substantial contribution of biogenic CO_2. The coexisting calcite exhibits extremely negative δ^{13}C values (down to -29.21 ‰) coherent with an origin by bacterial sulphate reduction, although we cannot exclude the possibility that these very negative δ^{13}C values might be influenced by anaerobic oxidation of methane.