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Comment on "*Carbonate deposition and diagenesis in evaporitic environments*: *The evaporative and sulphur-bearing limestones during the settlement of the Messinian Salinity Crisis in Sicily and Calabria*" by Caruso et al., 2015. Palaeo3, 429, 136–162

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ABSTRACT

A recent paper by Caruso et al. (2015) dealing with the Calcare di Base of Sicily and Calabria reintroduced an earlier idea that onset on the Messinian salinity crisis is diachronous. The paper provided a stratigraphic correlation of five sections together with the reference section of Falconara and Gibliscemi (Sicily) in order to establish the diachronous nature of restricted saline conditions. In our opinion their conclusions are not supported by the data, and the paper contains some stratigraphic errors that depend on a flawed presentation of the main stratigraphic concepts provided over the past few years covering the deposits of the Messinian salinity crisis in Sicily. In this discussion we challenge the stratigraphic conclusion of Caruso et al. (2015) holding that: a) they did not fully consider the different types of deposits included in the Calcare di Base unit and consequently did not recognize the large scale unconformity at the base of the brecciated limestone (Calcare di Base type 3); b) they did not provide univocal criteria for the definition of the onset of the Messinian salinity crisis; c) they hold the idea that the onset of the salinity crisis must be coincident with the onset of the evaporites, concept which is not necessarily true; d) they arbitrarily correlated different evaporitic deposits formed during different stages of the MSC; e) they provided a stratigraphic correlation of the study sections and their tuning with the insolation curve that lacks of reliable stratigraphic constraints.
Consequently, they have presented an unreliable schematic evolution of the Caltanissetta basin.

1. Introduction

In a recent paper Caruso et al. (2015) question the largely accepted scenario of a synchronous onset of the Messinian salinity crisis (MSC) at 5.971 Ma (CIESM, 2008; Manzi et al., 2013; Krijgsman et al., 1999, 2004; Hilgen et al., 2007; Roveri et al., 2014). They provide a correlation (see their Fig. 18) of 5 sections (Gibliscemi, T. Vaccarizzo, S. Elisabetta, and Serra Pirciata in Sicily, and Cropalati in Calabria) together with the reference section of Falconara (Hilgen and Krijgsman, 1999; Blanc-Valleron et al., 2002). In these sections Caruso et al. (2015) place the onset of the MSC at the transition between the Tripoli Formation and the Calcare di Base, a carbonate unit with gypsum intercalations. The age of this transition is obtained by dating the uppermost bed of the Tripoli Fm., which is different from place to place, thus suggesting a diachronous onset of the salinity crisis that locally would predate the 5971 Ma age (Manzi et al., 2013). This conclusion is actually not a novelty as these authors already suggested it some 10 years ago and apparently they did not provide new evidence to support it (Rouchy and Caruso, 2006).

Since then, a number of studies based on the detailed study of the Messinian evaporites (Roveri et al., 2014 and references therein) provided significant contributions to the understanding of the complex Messinian stratigraphy of Sicily and Calabria basins, and of the problems related to the correct recognition of the MSC onset, resulting in a synchronous scenario (CIESM, 2008) which has a majority agreement in the Messinian community.

Apparently, Caruso et al. (2015) have not discussed (Roveri et al., 2008a; Manzi et al., 2011) or have completely ignored (CIESM, 2008;

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Manzi et al., 2009; Lugli et al., 2010; Roveri et al., 2014, not cited) the content of a number of papers and, remarkably, they did not provide new and definitive data to support their interpretations.

As a consequence, we hold that their conclusions, leading to a completely arbitrary age attributions and highly speculative palaeoenvironmental reconstructions, are based on a number of wrong or obsolete assumptions particularly regarding 6 main points:

1. the stratigraphic meaning of the Calcare di base facies;
2. the criteria for placing the onset of the Messinian salinity crisis;
3. the genetic and stratigraphic relationships between the Primary Lower Gypsum and the Calcare di Base;
4. the stratigraphic implications of the primary vs. resedimented gypsum and Lower vs. Upper Gypsum facies;
5. the operative limits for the application of cyclostratigraphy;
6. the timing of the sulphur formation.

Our comment is aimed at clarifying the main issues related to the improper definition of the onset of the MSC in the sections presented by Caruso et al. (2015).

Before entering into detail in the discussion of the above-mentioned points, on which the comment will focus, it is necessary to briefly introduce the Messinian stratigraphy of the Sicilian basins and the criteria that can be used for correctly placing the onset of the Messinian salinity crisis.

2. The Messinian stratigraphy of Sicily

The sedimentary succession deposited during the Messinian salinity crisis in Sicily was originally subdivided in two sedimentary cycles by Decima and Wezel (1971) (Fig. 1A): the lower cycle included the Tripoli Formation conformably overlain by the Calcare di Base and the Lower Gypsum (Cattolica Gypsum massive selenite) – with lateral transitions among them – followed by a gypsum turbidite unit and the main halite unit; the upper cycle included the Upper Gypsum (Pasquasia Gypsum) and the Arenazzolo Formation.

Later, a different scenario, derived from the original Decima and Wezel (1971) but envisaging lateral transitions between the Tripoli Fm., the Calcare di base, the Lower Gypsum and the halite units, was proposed by Garcia-Veigas et al. (1995) and has been adopted also by Rouchy and Caruso (2006) (Fig. 1B).

All these models were limited to the Messinian sediments within the Caltanissetta Basin. More recently, Roveri et al. (2008a, 2008b)

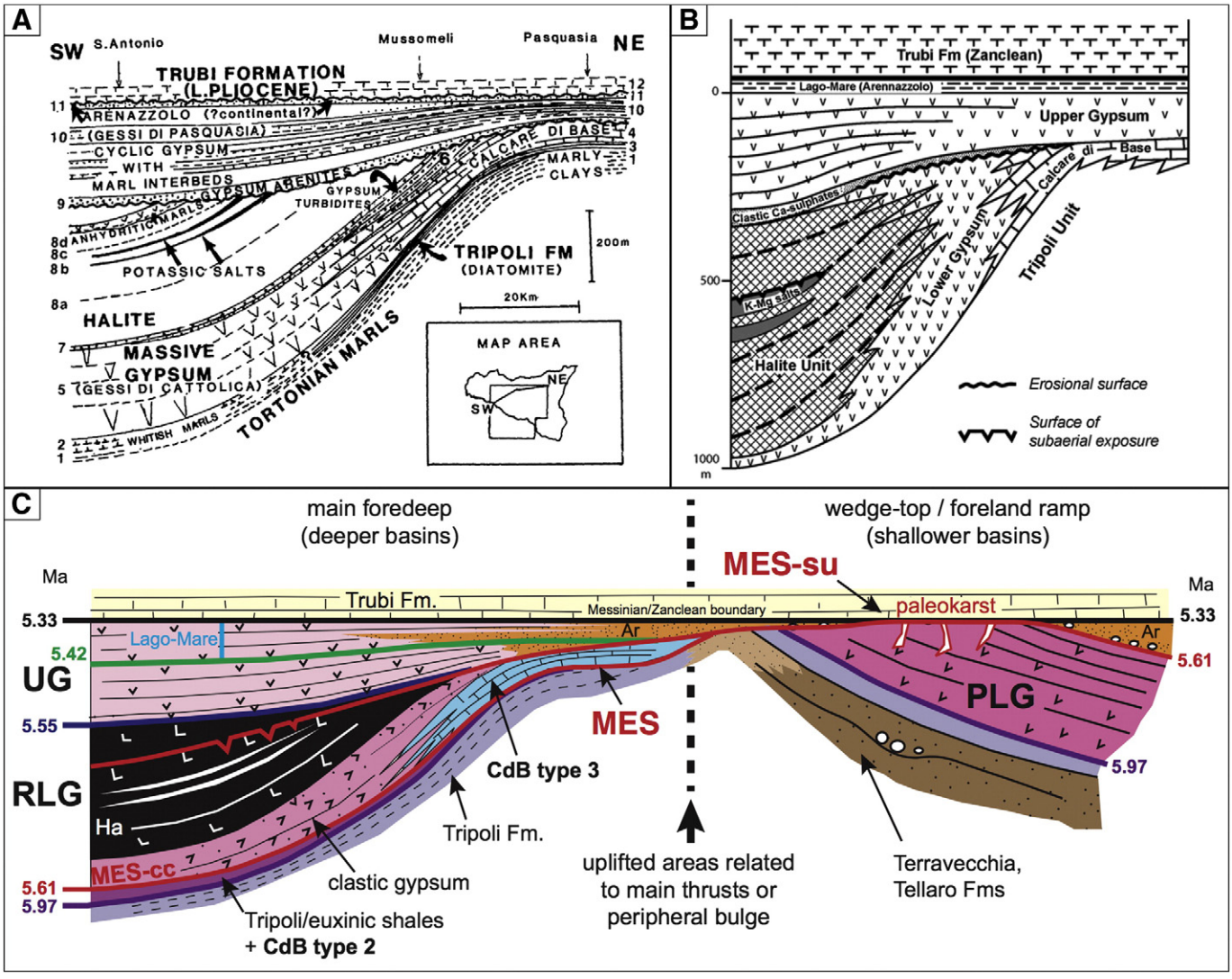

Fig. 1. Stratigraphy of the Messinian succession of Sicily according to: A) Decima and Wezel (1971); B) Rouchy and Caruso (2006) modified after Garcia-Veigas et al. (1995); C) modified after Roveri et al., 2008b.Messinian units: PLG, Primary Lower Gypsum; RLG, Resedimented Lower Gypsum; UG, Upper Gypsum; CdB, calcare di base distinguished among laminated dolostone (type 2) deposited during MSC stage 1 and brecciated limestone (type 3) deposited during the MSC stage 2. Surfaces: MES, Messinian erosional surface; MES-su, the same surface developed in subaerial conditions; MES-cc, the MES correlative conformity surface, characterized by continuous sedimentation.