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Comment on

‘‘Earliest Zanclean age for the Colombacci and uppermost Di Tetto formations of the « latest Messinian » northern Apennines: New palaeoenvironmental data from the Maccarone section (Marche Province, Italy)’’ by Popescu et al. (2007) Geobios 40 (359–373)☆

« La formation de Colombacci et le sommet de la formation Di Tetto (‘‘Messinien terminal’’ des Apennins septentrionaux) sont d’âge zancléen : nouvelles données paléoenvironnementales sur la coupe de Maccarone (Marche, Italie) » par Popescu et al. (2007) Geobios 40 (359–373)

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Abstract

Two possible alternative interpretations of the claimed Zanclean age (Popescu et al., 2007) of two historical lithostratigraphic units of the Northern Apennines, usually referred to as Late Messinian in age and recording the so called Lagomare final event of the Messinian salinity crisis (MSC), are here discussed. The wrong age attribution of the Colombacci and ‘‘*tetto*’’ Fms. is ruled out based on data from the Maccarone and other sections showing that the Colombacci-Argille Azzurre Fm. boundary is basin wide synchronous and coincident with the Miocene-Pliocene boundary as far as it has been formally defined in the Eraclea Minoa GSSP. Alternatively, the opportunity of emending the Zanclean GSSP to a stratigraphically lower horizon recording the first evidence of marine influences in the Mediterranean following the MSC peak, seems not suitable, as (1) the marine signature of uppermost Messinian deposits is weak and still controversial and (2) no significant bio- and magnetostratigraphic events, well chronologically defined and recognizable at a global scale appear to be available to such a purpose.
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Résumé

Deux interprétations possibles sont discutées à la suite de la toute récente attribution de deux unités lithostratigraphiques historiques des Apennins septentrionaux du Messinien supérieur au Zancléen, unités qui enregistrent l'événement du Lagomare à la fin de la crise de salinité messinienne (CSM). La supposée mauvaise attribution chronologique initiale des formations Colombacci et « *tetto* » résulte des données de Maccarone ainsi que d'autres sections qui suggèrent que la limite entre les formations Colombacci-Argille Azzurre est synchrone à l'échelle du bassin et coïncident avec la limite Miocène-Pliocène tout comme formellement établie dans le GSSP à Eraclea Minoa. Alternativement, l'opportunité d'étendre le Zancléen défini par le GSSP à un niveau inférieur correspondant à l'enregistrement des premiers influx marins en Méditerranée après le pic de la CSM ne semble pas convenable car (1) la signature marine dans les dépôts du Messinien supérieur est faible et encore controversée, et (2) nous manquons d'événements bio- et magnétostratigraphiques chronologiquement bien établis et reconnaissables à l'échelle globale pour corroborer cette proposition.
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Keywords: Messinian; Zanclean transgression; Lago-Mare; Biostratigraphy; Northern Apennines

Mots clés : Messinien ; Transgression zancléenne ; Lago-Mare ; Biostratigraphie ; Apennins septentrionaux

1. Introduction

In a recent paper Popescu et al. (2007), based on a reappraisal of the Maccarone section (northern Apennines), claimed an earliest Zanclean age for two historical lithostratigraphic unit of the Messinian post-evaporitic succession of the Apennine foredeep basin, i.e. the "*tetto*" and Colombacci Fms. Similar conclusions, already anticipated in Clauzon et al. (2005), have been also reached by Sprovieri et al. (2007), based on the revisitation of some key sections of the Northern Apennines. From this new age attribution Popescu et al. (2007) derive palaeoenvironmental implications supporting the Messinian salinity crisis scenario proposed by the same authors group in previous papers (Clauzon et al., 2005).

Setting apart some problems of formal lithostratigraphic nomenclature related to these units (see Vai, 1988 and Roveri et al., 1998) and with the obvious premise that even the most consolidated interpretations may hopefully change when new and more convincing data are provided, the Popescu et al. (2007) paper contains several statements that prompted us to write this comment to contributing in a constructive way to this complex matter.

The common reader, not necessarily interested in Messinian problems or in the details of the Apennines Neogene stratigraphy, when looking at the paper's title, is forced to believe that new data of the two formations are being presented which demonstrates their Early Zanclean age, as far as this stage has been formally defined.

This is of great interest indeed and encourages to go beyond the title; however, at the end of the paper it is not clear whether the authors wish to demonstrate that the current age attribution of the Colombacci and "*tetto*" Fms. to the Messinian Stage was wrong or, on the contrary, that the formal definition of the Zanclean Stage itself does not work and should be emended and lowered at a level currently placed in the late Messinian.

These are two very different scenarios and the authors should clarify which one actually corresponds to their intention.

This uncertainty is reinforced by the paper's conclusions (p. 371) where the authors state that:

- the results of their work allow to close a long-lived debate about the Messinian *versus* Pliocene age of the Colombacci Fm., which is now "*unequivocally*" placed into the Pliocene together with the upper part of the "*tetto*" fm.;
- the Zanclean transgression has to be lowered in the regional stratigraphy.

In our opinion, it seems that, despite the title, the authors are more inclined towards the second hypothesis, even if much uncertainty remains. However, in our comment we will discuss both the hypothesis starting from the first one.

2. Hypothesis 1–A wrong age for the Colombacci and tetto Fms.?

Proposing an Early Zanclean age (MPl1) for the Colombacci and upper "*tetto*" Fms. means that the base of the overlying Argille Azzurre Fm. should be, at least in the Maccarone section, younger than commonly thought. The Zanclean Stage is well constrained by bio- and magnetostratigraphic events that allow to obtain, through astronomical tuning to the insolation curve, a very high-resolution stratigraphy of the basal Pliocene. The key element is the recognition of the Thvera normal chron, which occurs five precessional cycles above the Miocene/Pliocene boundary, according to its formal definition in the Eraclea Minoa GSSP (Van Couvering et al., 2000). This basal interval, even when evidences of lithological cyclicity are lacking, can be well constrained due to the occurrence of an ordered sequence of bioevents: two successive sinistral coiling shifts of *Neogloboquadrina acostaensis* in cycles 2 and 3, the acme of *Sphaeroidinellopsis* spp. between cycles 2 and 6 and the FCO of *Globorotalia margaritae* at cycle 10 (Di Stefano et al., 1996), *i.e.* within the Thvera magnetic event.

As a consequence, any study aiming at the recognition of the Miocene/Pliocene boundary should necessarily and carefully look for these bio- and magnetic events; this implies the collection and multidisciplinary analysis of a good number of samples.

However, in the Popescu et al. (2007) study no magnetostratigraphic analysis have been carried out and only three

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