

Comment on

Marine reflooding of the Mediterranean after the Messinian Salinity Crisis predates the Zanclean GSSP. Reply to the “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)” authored by Roveri et al.

La réinvasion marine de la Méditerranée après la crise de salinité Messinienne est antérieure au GSSP du Zancéen. Réponse au « commentaire sur ‘La Formation de Colombacci et le sommet de la Formation Di Tetto (« Messinien terminal » des Apennins septentrionaux) sont d’âge zancéen : nouvelles données paléoenvironnementales sur la coupe de Maccarone (Marche, Italie)’ par Popescu et al. (2007) Geobios 40 (359–373) » par Roveri et al.

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## Abstract

After some deontological considerations, we confirm that evidence of Mediterranean reflooding by Atlantic waters occurs significantly below the formally defined base of the Zanclean Stage at 5.332 Ma, as shown by the lowest occurrence of the calcareous nannofossil *Ceratolithus acutus* (illustrated) in the lower part of the p-ev<sub>2</sub> Formation in the Maccarone section. This species can be detected only after prolonged investigations of the smear slides. Hence, the cyclostratigraphy of the Marche late Messinian requires revision.

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## Résumé

Après quelques commentaires d'ordre déontologique, nous confirmons que la réinvasion du bassin méditerranéen par les eaux atlantiques est intervenue bien avant la base « officielle » de l'étage Zancéen placée à 5,332 Ma. Cela est notamment illustré par la présence du nannofossile *Ceratolithus acutus* (photographies à l'appui) dans la partie inférieure de la Formation p-ev<sub>2</sub> à Maccarone. La présence de cette espèce ne peut être établie qu'après une recherche au microscope plus longue que de coutume. La cyclostratigraphie du Messinien supérieur de la Province des Marches doit être révisée en conséquence.

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*Keywords:* Pre-Zanclean transgression; *Ceratolithus acutus*; Stratigraphy

*Mots clés :* Transgression anté-zancléenne ; *Ceratolithus acutus* ; Stratigraphie

## 1. Introduction

Our reply to the comment of Roveri et al. is concise because our data are essentially self-evident. First, we wish to make a deontological observation. Roveri et al. in their Introduction wrote: “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)”. The two-step scenario for the Messinian Salinity Crisis (Clauzon et al., 1996) was proposed after comprehensive field observations in the Sorbas Basin and other Mediterranean peripheral basins where well-dated Messinian marginal evaporites are cut by a huge erosional surface overlain by lower Zanclean deposits (see also Gautier et al., 1994). Such a situation which clearly documents two successive sea-level falls, a moderate one corresponding to the marginal evaporites followed by an outstanding one that caused the central basin evaporites and an intense coeval subaerial erosion (including fluvial canyons) of the margins, is observed all around the Mediterranean and **does not necessitate an adjustment of the data as additional support** as suspected by Roveri et al. This assumption written by Roveri et al. curiously resembles that of Bertini (2006: p. 250, line 11): “It is a fact that such event [i.e. “an additional Lago-Mare event” as indicated five lines above] **is indispensable to validate the two diachronous steps-model** proposed by Clauzon et al. (1996)”. Such assumptions seem to run counter to the deontological approach in science. Our concept of stratigraphy is to consider all the data and not merely select those in agreement with our so-called previously edified scenario. The alternative would allow any new data, even contradictory, to be integrated and serve to validate or modify our interpretation. It happens, however, that our two-step scenario (Clauzon et al., 1996) was fully accepted by a group of specialists of the Messinian Salinity Crisis during the **CIESM Workshop in Almeria (November, 7–10, 2007)**, i.e. before submission of the comment by Roveri et al., an agreement recently published in a CIESM paper, the editing of which was curiously led by M. Roveri himself (**CIESM Workshop Monographs, 2007**; see especially its Fig. 4, p. 17).

## 2. The post Salinity Crisis reflooding of the Mediterranean and the Zanclean GSSP

Our contradictors are correct to emphasize that the marine records in the Di Tetto and Colombacci formations cannot be

related to the early Zanclean Stage as clearly defined by the Zanclean Global Stratotype Section and Point (GSSP) at Eraclea Minoa (Van Couvering et al., 2000). The Zanclean GSSP is dated at 5.332 Ma in the Sicilian Series and has its echo in the Argille Azzurre overlying the Colombacci Formation in the Marche Series.

But the signs of marine reflooding of the Mediterranean prior to the Zanclean GSSP are not isolated, as they are also suggested in Morocco (Cornée et al., 2006), Calabria (Cavazza and DeCelles, 1998), Sicily (Londeix et al., 2007), Gulf of Lions (Bache, 2008), northeastern Aegean Sea (Clauzon et al., 2008), etc.

Our somewhat provocative title (Popescu et al., 2007) aimed to show again how greatly the Zanclean GSSP (Van Couvering et al., 2000) is compromised, given that it immediately follows a sedimentary hiatus on the Mediterranean margins and is complicated by a marine reflooding that is now known to occur in two steps. Can such a GSSP be appropriate when linked to such an exceptional succession of major events?

## 3. The Maccarone fossil records

Roveri et al. announce a more complete study of the Maccarone section by their group that is based on a dense sampling. We may expect very promising discussions arising from the paleobiological records and forthcoming geochemical measurements.

It is not necessary to repeat descriptions of the dinoflagellate cyst flora (Bertini, 1992, 2006; Popescu et al., 2007) recalled by Roveri et al. Additional new details on this flora are provided by Popescu et al. (in press). In any case, a complete understanding of ecological variations within Lago Mare facies as reflected in the dinoflagellate cyst record requires a detailed comparison with the type specimens from the Pannonian Basin, these being available only in Komlo and Lyon.

Foraminifers from the Di Tetto and Colombacci formations are considered by Roveri et al. as reworked, and they are rejected only on the weak argument that their presence is in contradiction with the ostracod record which has a freshwater signature. Such contradictory coexisting faunas are not exceptional in coastal environments within the Lago Mare context, as pointed out in Corsica (Casabianda locality) by Saint Martin et al. (2007) for sediments also containing *Ceratolithus acutus*, the marker of the nannofossil subzone NN12b (Popescu et al., 2007).

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