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"Buntsandstein" magnetostratigraphy and biostratigraphic reappraisal from eastern Iberia: Early and Middle Triassic stage boundary definitions through correlation to Tethyan sections

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Abstract

A new magnetic polarity stratigraphy is reported from 214 sampling sites representing 265 m of fluviatile red beds of the Buntsandstein facies succession from the Catalan Coastal Ranges (Riera de Sant Jaume, RSJ section). The Buntsandstein constitutes the lowermost of the six lithostratigraphic units in which the Triassic from the CCR is subdivided (also grouped into the typical three-fold subdivision of the Germanic Facies from the Tethys Realm: Buntsandstein, Muschelkalk and Keuper). Magnetostratigraphic data from four sections though the uppermost Buntsandstein facies located in the Molina de Aragón area in the Iberian Ranges (Rey, D., Turner, P., Ramos, A., 1996. Palaeomagnetism and Magnetostratigraphy of the Middle Triassic in the Iberian Ranges (Central Spain). In: Morris, A., Tarling, D.R. (Eds.), Palaeomagnetism and Tectonics of the Mediterranean Region, Geol. Soc. Sp. Pub. 105, 59–82) are also discussed in the light of a new biostratigraphic reappraisal of the palynoflora content presented herein. Characteristic magnetizations are carried mostly by hematite with minor contributions by magnetite for the Buntsandstein red beds. The magnetic polarity sequence at the RSJ section consists of 9 magnetozones (and one additional less reliable magnetozone) that are represented by more than two samples. A detailed study along a magnetic reversal indicates that the nature of the remanence in the studied red beds is partially controlled by a chemical magnetization process (delayed remanence acquisition), in addition to a detrital signature (the characteristic primary direction). Chronostratigraphic constraints are provided by conodont fauna from the overlying Muschelkalk facies that indicates a middle–late Pelsonian to late Illyrian age (middle–late Anisian) (Marquez-Aliaga, A., Valenzuela-Rios, J.I., Calvet, F., Budurov, K., 2000. Middle Triassic conodonts from northeastern Spain; biostratigraphic implications. Terra Nova 12, 77–83) and a few palynostratigraphic determinations in the Buntsandstein red beds. These biostratigraphic constraints and the magnetic polarity pattern allow an unambiguous correlation of the RSJ magnetostratigraphy to the conodont-ammonoid-calibrated magnetostratigraphy from the Tethys realm (Muttoni, G., Kent, D.V., Meco, S., Balini, M., Nicora, A., Rettori, R. Gaetani, M., Krystine, L., 1998. Towards a better definition of the Middle Triassic magnetostratigraphy and biostratigraphy of the Tethyan realm. Earth Planet. Sci. Lett.

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164, 285–302; Muttoni, G., Gaetani, M., Budurov, K., Zagorchev, I., Trifonova, E., Ivanova, D., Petrounova, L., Lowrie, W., 2000. Middle Triassic paleomagnetic data from northern Bulgaria; constraints on Tethyan magnetostratigraphy and paleogeography. Palaeogeogr. Palaeoclimatol. Palaeoecol. 160, 223–237; Muttoni, G., Nicora, A., Brack, P., Kent, D.V., 2004a. Integrated Anisian–Ladinian boundary chronology. Palaeogeogr. Palaeoclimatol. Palaeoecol. 208, 85–102; Muttoni, G., Kent, D.V., Olsen, P.E., Di Stefano, P., Lowrie, W., Bernasconi, S., Hernandez, F.M., 2004b. Tethyan magnetostratigraphy from Pizzo Mondello (Sicily) and correlation to the Late Triassic Newark astrochronological polarity time scale. Geol. Soc. Amer. Bull. 116, 1043–1058). The proposed correlation identifies for the first time in the Triassic from Iberia the Olenekian (Scythian)–Anisian stage boundary (245 Ma) within magnetozone N3 in the Riera de Sant Jaume units. Likewise, the new palynostratigraphic reconsideration allows the identification of the Anisian–Ladian stage (Illyrian–Fassanian substage) boundary (taken the option at the base of the *Curionii* ammonoid Zone favored by Muttoni et al. (2004a) [Muttoni, G., Nicora, A., Brack, P., Kent, D.V., 2004. Integrated Anisian–Ladinian boundary chronology. Palaeogeogr. Palaeoclimatol. Palaeoecol. 208, 85–102] for this boundary within the upper part of the Rillo Mudstone and Sandstones Formation (RMS Formation) and the Fassanian–Longobardian substage boundary (Ladinian) within the Torete Multicoloured Mudstone and Sandstone Formation (TMMS Formation). Our data are consistent with the notion that the lower Muschelkalk transgression progressed from east to west (i.e., the Buntsandstein/Muschelkalk boundary is younger in the Iberian Ranges with respect to the Catalan Coastal Ranges).

The Early/Middle Triassic paleopole for the Catalan Coastal Ranges is located at 55.1°N 172.4E (Dp=1.4, Dm=2.7).and the Middle/Late Triassic paleopole for the Iberian Ranges is 55°N 201E (Dp=1.7, Dm=3.1). These paleopoles are compatible with the general trend of the Iberian apparent polar wander path which indicates a northward motion during the Triassic related to the general northward translation of Pangea.

Keywords: Buntsandstein; Olenekian–Anisian boundary; Anisian–Ladinian boundary; Palynostratigraphy; Conodonts; Catalan Coastal Ranges; Iberian Ranges

1. Introduction

We present magnetostratigraphic data for the Buntsandstein facies along sections located in the Catalan Coastal Ranges (CCR) and Iberian Ranges at the eastern Iberian Peninsula. Available pollen data and other biostratigraphic constraints (conodont and ammonoid biostratigraphy) are reviewed with the aim to present an integrated chronology for the Lower and Middle Triassic succession.

The terms "Zechstein" and "Buntsandstein" are typically used as lithostratigraphic units to design mostly continental strata in Central Europe. The first is usually assigned to the Permian, whereas the Buntsandstein is the basal unit of the classic Germanic Triassic (von Alberti, 1834). The Buntsandstein is mainly clastic and was deposited in a large intracratonic basin in a fluvio-lacustrine environment, with marine influences restricted to the upper part. As a lithological facies, the Buntsandstein has no precise chronostratigraphic meaning.

The Lower Triassic reference magnetostratigraphy is chiefly based on data from the Arctic region stratotypes (Ogg and Steiner, 1991). However, significant progress has been achieved in the last decade in constructing a Triassic geomagnetic polarity sequence correlated with biostratigraphic and chronostratigraphic data in Tethyan marine sections (e.g., Gallet et al., 1992, 1993, 1994, 1998; Muttoni et al., 1994, 1995, 1996, 1997, 1998, 2004a,b). Likewise, the Germanic Triassic successions from the central European basin have been the target of thorough magnetostratigraphic studies (e.g., Nawrocki, 1997; Szurlies et al., 2003; Szurlies, 2004), as well as the onshore Triassic from Britain (e.g., Hounslow and McIntosh, 2003). Our work provides an integrated magnetostratigraphic and biostratigraphic reappraisal (palynoflora and conodont fauna) that allows a direct correlation of the Iberian sections to conodont-ammonoid-calibrated magnetostratigraphy from the Tethys realm (Muttoni et al., 1998, 2000, 2004a) and allows the recognition of both the Olenekian (Scythian)–Anisian and Anisian–Ladinian boundary (Early and Middle Triassic) in the Buntsandstein continental succession from the eastern Iberian Peninsula. This work contributes to an