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The Early Toarcian Oceanic Anoxic Event: A Southern Hemisphere record from Chile

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The Early Toarcian was marked by important environmental changes, marine oxygen deficiency and extensive organic-rich sediment deposition (T-OAE; ∼182 Ma, Early Jurassic). The T-OAE coincides with a marked negative carbon isotope excursion (CIE) recorded in marine carbonate, and marine and terrestrial organic carbon. This is commonly attributed to the massive release of isotopically light carbon to the atmospheric and oceanic reservoirs derived from the destabilization of methane hydrates from marine sediments and/or the emissions of thermogenic methane from the eruption of the Karoo-Ferrar LIP (e.g., Hesselbo et al., 2000; Kemp et al., 2005; Svensen et al., 2007; Mazzini et al., 2010). Moreover, in most documented marine sections, this episode is marked by a generalized crisis in carbonate production and marine invertebrate extinctions (e.g. Jenkyns, 1988; Röhl et al., 2005; Suan et al., 2001).

Several studies of the T-OAE have been conducted on sediments in central and northwest Europe, but only few data are available from the Southern Hemisphere, leading to large uncertainty concerning the exact expression of this event in this part of the world. The aims of this study are to characterize the sediments deposited during the Andean equivalents of the tenuicostatum and falciferum European Zones and establish in which way the T-OAE affected this region.

In the Early Jurassic, the Andean basin was in a back-arc setting with marine corridors connected to Panthalassa. In this study, we have generated new high-resolution sedimentological, geochemical and mineralogical data from the sections of El Peñon and Quebrada Asiento, located in Chile in the northeastern area of the city of Copiapó, Atacama region. The biostratigraphy of these sections has been studied by von Hillebrandt and Schidt-Effing (1981) and complemented here by a biostratigraphy based on calcareous nannofossils. The sections consist of a succession of marl, limestone and siltstone of Pliensbachian and Toarcian age. The carbon isotope composition of sedimentary organic matter reveals a negative excursion of $\sim 5‰$ which correlates with the excursion recorded during the T-OAE in NW European sections and in the Arroyo Lapa section, Neuquén Basin (Al-Suwaidi et al., 2010). Interestingly, the amount of total organic carbon (TOC) preserved in the interval equivalent to the T-OAE appears relatively low (< 1 wt. %) compared to the values of most European sections (> 5 wt. %). Additional analyses of clay, phosphorus and mercury contents are underway and will assist in our study of the impact of the T-OAE in this particular part of the world.