Drastic changes in weathering processes around the Norian-Rhaetian Boundary

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Abstract

The Late Triassic time interval witnessed several important biological turnovers, extinctions and onset of new life forms. Among these events, the extinction around the Norian-Rhaetian Boundary (NRB) was of major importance and has been largely overlooked until now. The nektonic marine fauna has been the most affected, but in the same time some sensitive organisms such as scleractinian corals or the newly appeared coccolithophorids were preserved. To better constrain the tectonic, climatic and oceanographic framework during this time of changes, we collected new δ13Ccarb, 87Sr/86Sr and δ44/40Ca dataset across the late Norian - Hettangian interval, established from carbonate successions in Austria, Turkey and United Arab Emirates. A characteristic change in the 87Sr/86Sr record is a sharp trend towards unradiogenic values, which started in the latest Norian (middle-upper *M. hernsteini* - *E. bidentata* Zone) and continued across the lower Rhaetian (*E. bidentata* - *M. posthernsteini* Zone). This strong decline in 87Sr/86Sr ratios associated with the first appearance of *Misikella posthernsteini* could be used as a proxy for the definition of the NRB. The δ44/40Ca shows as well a marked decrease at this level. The strong correlation between the strontium and calcium isotopic systems indicates that they are coupled through the same driving process. The δ13Ccarb is in contrary quite stable around this interval, at odd with several negative peaks in δ13Corg reported in the literature. The δ44/40Ca measurements helped to exclude the hypothesis that the early Rhaetian decrease in 87Sr/86Sr would have been driven by volcanism, elevated hydrothermal circulation or enhanced silicate weathering. Indeed, the two first of these processes seems to have a negligible effect on Ca-isotopes, while the third one would result in a radiogenic 87Sr/86Sr trend, the opposite of the observed pattern. Instead, a large increase in chemical weathering of carbonates and evaporites as consequences of a major sea-level fall at the NRB is proposed. This new hypothesis could as well explain the stability of the carbon cycle during this interval as recorded in the δ13Ccarb, and the variability of the δ13Corg more prone to terrestrial influences.

Keywords: Norian, Rhaetian, strontium, calcium, carbon isotope, weathering

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