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Expression of the Toarcian oceanic anoxic event across the Alpine Tethys and in the Andean basin – examples from Switzerland and Chile

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The Early Toarcian oceanic anoxic event (T-OAE, Early Jurassic) was marked by oceanic anoxia and intense burial of organic matter, as well as by a major carbon-cycle perturbation evidenced by a negative carbon isotope excursion (CIE) possibly linked to the Karoo-Ferrar LIP. Geochemical evidence indicates that a change towards global warming caused a change in the hydrological cycle and triggered an increase in continental weathering rates, ultimately leading to the faunal, floral and environmental change. Hitherto, most studies were conducted in epicontinental seas of NW Europe, and interpretations from those relatively restricted basins were often extrapolated onto a global scale. With this, the diversity in T-OAE facies present in other basins, which is not always anoxic and/or enriched in organic matter, may not always sufficiently be taken into account in existing models.

We present new high-resolution datasets from sediments deposited in the Jura, Sub-Briançonnais basin and Lombardian basin (Switzerland) and in the Andean basin (N Chile), in order to reconstruct, compare and confront the paleoenvironmental changes. The sedimentary expression of the T-OAE is contrasted between all studied sites confirming the role of local/regional conditions and mechanisms superimposed on the global environmental perturbation. The sections from the Jura and the Sub-Briançonnais have in common that they are characterized by the presence of organic-rich intervals formed in oxygen-deficient conditions, which were apparently more severe in the Jura. In contrast, the Lombardian basin records well oxygenated conditions. Likewise, the section from the Andean basin does not record a classical expression of the T-OAE; organic-matter burial was not favoured, while dynamic conditions are recorded in a marl-limestone alternation. Humid and hot climate is recorded in the Swiss sites, whereas more arid conditions were prevailing in Chile. Fluctuations in total phosphorus content within the T-OAE intervals appear to have been mainly driven by changes in the detrital input rather than by anoxic conditions. Overall, our Swiss transect and its comparison with Chile indicates that the paleogeographic position of each studied section and the climatic conditions prevailing have ultimately modulated the intensity of the anoxic conditions.