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The Permian-Triassic boundary in western Slovenia (Idrijca Valley and Masore section): stable isotopes (C, O, S), elemental chemistry, palinofacies and biomarker study

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The Permian-Triassic (P/T) boundary is marked by the greatest mass extinction event in the history of life, and is associated with isotopic and elemental anomalies recorded in numerous P/T boundary sections worldwide. A high resolution study of the stable isotopic composition of carbonates, sedimentary organic matter and pyrite, together with a geochemical analyses of major, minor, trace and rare earth element (REE) abundances, palinological data and biomarker (n-alkanes) composition from the P/T boundary in the Idrijca Valley section in Western Slovenia were used to evaluate the nature and the causes of the P/T boundary events in this part of the Western Tethys.

The P/T boundary in western Slovenia lies within the Tesero Horizon with a maximum thickness of 5 cm in the Idrijca Valley and 20 cm in the Masore section, and is represented by an up to 0.8 cm thick clayey marl (PTB) layer showing a characteristic magnetic susceptibility pulse and magnetite spherules. The results of the stable isotope analyses revealed: 1) a light carbonate and organic carbon isotope event across the P/T boundary, reflecting well known perturbations in the carbon cycle at the end of the Permian, associated with a dramatic increase in the isotopic fractionation between the carbonate and organic carbon due to a sudden breakdown in primary productivity, also indicated by Ba depletion at the P/T transition; 2) a general trend of carbonate $\delta^{18}O$ toward more positive values, which might indicate a slightly warming trend across

the P/T boundary; 3) A remarkable isotope excursion of pyrite sulphur toward more negative values at the topmost Permian followed by a positive shift of about 15‰ at the basal Scythian.

The elemental chemistry, the temporal pattern of Ce/Ce*, the Th/U ratio, as well as the depth profile of redox sensitive elements such as Mn, Mo and V suggest more or less anoxic conditions during the deposition of the Upper Permian beds, oxygenated conditions at the boundary followed by oxygen-deficient conditions in the remaining Lower Scythian. The palinological analyses and the n-alkanes distribution revealed increased inputs of terrestrial organic carbon from the coastal area, as well as sea-level fluctuation at the P/T boundary. The appearance of planktonic prasinophyte algae (*Leiosphaeridia* and *Tasmanites*) at the P/T boundary, which could be regarded as a "disaster species", suggests that the ecological conditions were not conducive to the development of phytoplankton communities at that time.

The marked isotopic and elemental disturbances, as well as a crash in primary bioproductivity, could be explained by a combination of factors such as a global sea-level fall, the oxidation of buried organic carbon and marine gas hydrates together with changes of the seawater redox conditions and volcanic activity, which accelerated climatic changes across the P/T boundary. However, the exact controls still remain enigmatic.