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Paleoenvironmental change during the Early Triassic in the Tethyan Himalaya

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One of the most important episodes of mass extinction of animal groups in the whole of the Phanerozoic eon occurred at the Permian-Triassic boundary; the adverse effects of this event on the environment continued until the Early Triassic. Oceanic and climatic conditions during the Early Triassic were probably among the most unusual and severe conditions to have existed on the earth and they might have affected the speed of biotic recovery from the mass extinction. However, certain aspects of the changes in marine and terrestrial environments during the Early Triassic remain unclear, especially in the southern Tethys area.

This study aims to impose constraints on drastic environmental changes after the Permian-Triassic boundary in the southern Tethys area on the basis of the change in the microfacies of mudstone and geochemical proxies. Two Lower Triassic sections during Scythian were selected in the Tethyan Himalaya, which includes the Jomsom and Manang areas in central Nepal.

In these sections, the lithofacies of the Lower Triassic are characterized by nodular limestone and alternated beds of thin (< 5 mm) carbonaceous mudstone and lateritic mudstones. A study of these mudstones indicates limited benthic biological activity as suggested by burrowing and bioturbation: therefore, the subtle and thin stratification in the mudstones has been preserved without biogenic disturbance.

Changes in the mudstone composition along the sections were evaluated on the basis of significant elemental ratios such as the CIA index and Zn/TiO2 and total trace elements. The intensity of the oxygen-poor environment was estimated based on the concentration of redox sensitive elements such as Zn, Ni, Cr and specific element ratios such as V/Cr and Zn/Zr. The provenance characters were determined by Al2O3/TiO2 and the compositional trend in A-CN-K diagram. The biogenic flux was assessed as a function of the total organic carbon content.

Lower Triassic sections in the studied areas were found to be strongly affected by a general decrease in the sediment input accompanied by an increase in the concentration of several trace elements. Paleoweathering intensity indicated by the CIA index is significantly high, suggesting the presence of strong weathering environments in the hinterland. The lithofacies and characteristics observed in the Lower Triassic are interpreted as reflecting an abrupt rise of sea-level and the appearance of dysoxic/anoxic conditions in the depositional environment. The results suggest that oxygen-poor environments of short durations occurred repeatedly during the Early Triassic around the southern Tethys Sea.