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Geochemical evidences for palaeoclimatic fluctuations at the Triassic-Jurassic boundary: southwestern margin of the Neotethys in the Salt Range, Pakistan

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The Triassic-Jurassic boundary interval reveals a change from warm-arid to a warm and humid climate in the Tethyan domain. Sea-level reconstruction records across the European basins during this interval reveal an end-Triassic global regression event and is linked to the Central Atlantic Magmatic Province (CAMP) activity and Pangaea breakup. In the Tethyan Salt Range of Pakistan a succession of Upper Triassic dolomites/green-black mudstones (Kingriali Formation), overlying quartzose sandstone, mudstones, laterites and Lower Jurassic conglomerates/pebbly sandstones (Datta Formation) provides information on the palaeoclimatic evolution of the area. Preliminary palynological results from the mudstones indicate a Rhaetian age for the Kingriali Formation and a Hettangian age for the Datta Formation. X-ray diffraction (XRD) analysis of the mudstones (upper part of the Kingriali Formation) indicates the presence of mainly illite while kaolinite is a minor component. The kaolinite content, a reflection of the advanced stage of chemical weathering and hence warm-humid conditions, increases upsection in the overlying sandstone-mudstone succession. The overlying laterite-bauxite horizons lack illite/smectite and are entirely composed of kaolinite, boehmite and haematite. At places these kaolinite rich horizons are mined in the area (Western Salt Range). The bulk rock geochemistry of the succession confirms a similar trend. The Chemical Index of Alteration (CIA) displays an increasing trend from the Upper Triassic shales (CIA 75-80) through the overlying sandstones/mudstones-laterites to the overlying quartz rich sandstones and mudstones (CIA 90-97). The overall results for the succession reveal an increasing chemical maturity trend (increase in the intensity of chemical weathering) from Rhaetian to Hettangian thereby supporting a change from warm-arid to a warm-humid palaeoclimate, probably extreme greenhouse conditions.