A record of shift in climate and orogenic events in Tethys Himalaya: evidence from geochemistry and petrography of Permo-Carboniferous sandstones from the Spiti region, Himachal Pradesh, India

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Through a multidisciplinary approach, including petrology and geochemistry, the sedimentary provenance and paleoweathering of the Permo-Carboniferous Spiti sandstones (Lipak, Po and Ganmachidam formations) of Tethys Himalaya is investigated. The Spiti region consists of texturally immature to mature sandstones composed of unsorted to sorted and subangular to subrounded clastic grains dominated by variable amounts of quartz and feldspar accompanied by lithic fragments (mostly metasedimentary, sedimentary and plutonic grains). Uniform REE patterns (Fig. 1) similar to UCC with LREE enrichment (La_N/Sm_N= 3.91), flat HREE (Gd_N/Yb_N=1.21-2.5) and negative Eu anomalies with variable amounts of ΣREE and Eu anomalies (0.4-0.8) suggest that hydraulic sorting is significant. The striking similarities of the multi-elemental spider diagrams of the Spiti sandstones and the Himalayan granitoids indicate that the sediments are sourced from the Proterozoic and Cambro-Ordovician orogenic belts of the Himalayan region. The nature of the feldspar observed in thin sections from most altered to euhedral pristine minerals corresponding to Carboniferous to lower Permian sandstones strongly indicate a change in climate from most favorable conditions for rapid feldspar alteration (humid) to conditions where negligible alteration is possible (arid and glacial). It is found that the CIA values of these sandstones accorded with inferences based on sedimentologic and paleontological evidence, discriminating well between warm-humid (indicated by high CIA values) and arid- glacial (representing low CIA) conditions in the Spiti basin. Thus these results document a complete record of glacial and interglacial phases in the Permocarboniferous Spiti sandstones and the interpretations are consistent with other such studies on the Phanerozoic glaciation events on Gondwana supercontinent.

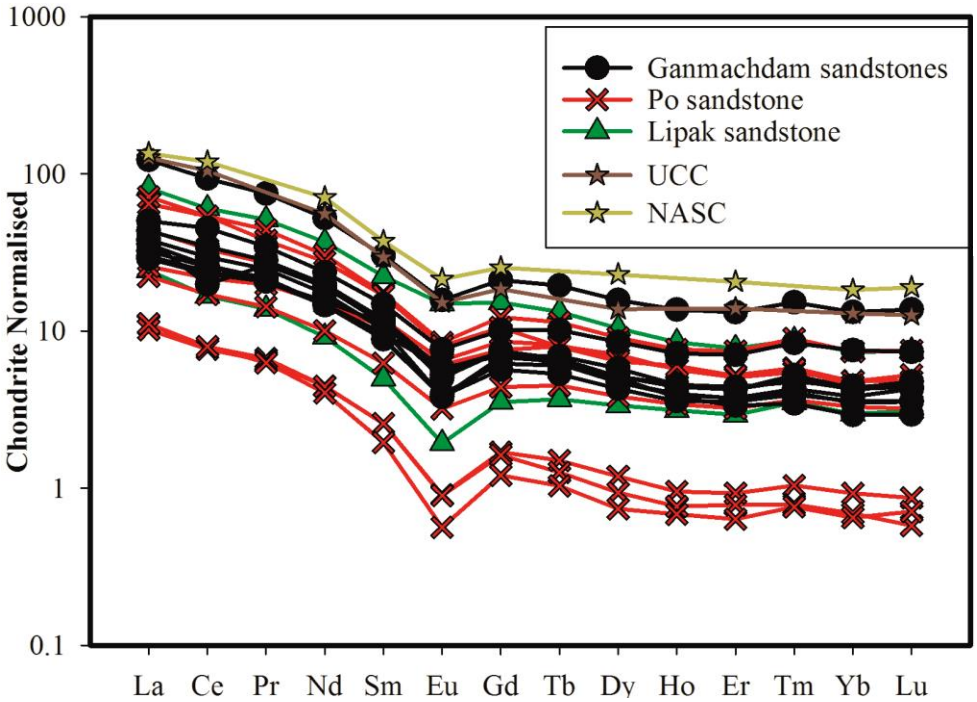

Figure 1. Chondrite-Normalised REE patterns of the Permo-Carboniferous sandstones from the Spiti region, Tethys Himalaya.

Cite as: Rashid, S.A., and Ganai, J.A., 2014, A record of shift in climate and orogenic events in Tethys Himalaya: evidence from geochemistry and petrography of Permo-Carboniferous sandstones from the Spiti region, Himachal Pradesh, India, in Montomoli C., et al., eds., proceedings for the 29th Himalaya-Karakoram-Tibet Workshop, Lucca, Italy.