Geochemical and isotopic composition of quartzites near the MCT zone (Garhwal Himalaya, India): Implications to their provenance & deposition

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Quartzites are one of the major clastic sedimentary rocks in the Himalaya that had deposited in the Tethys Ocean basin and exhibit varying chemical composition, protoliths, age (pre-Himalaya) and depositional settings [1, 2, 3]. In this study, geochemical and isotopic composition were determined in the quartzite samples collected form the either side of MCT zone of the Garhwal Himalaya to determine their provenances and nature of the protoliths.

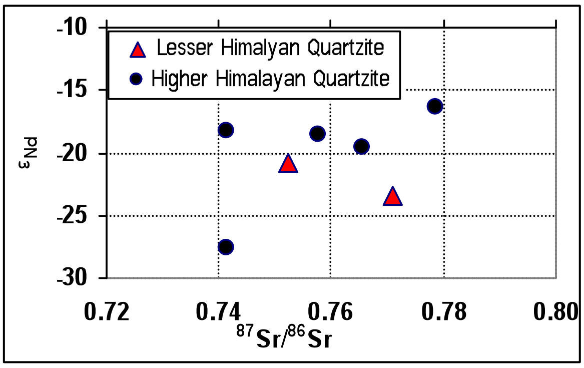

Figure 1: $^{87}Sr/^{86}Sr$ & ε_{Nd} of the Himalayan Quartzites near the MCT zone of the Garhwal Himalaya (India).

Major elements data of the Lesser Himalayan quartzites (Kaliasaud-Alaknanda region) demonstrate significant difference from those of the Higher Himalaya. For example, TiO_2/SiO_2, Al_2O_3/SiO_2, Fe_2O_3/SiO_2 are one to two order of magnitude higher for Higher Himalayan quartzites compared to those from the Lesser Himalaya. These differences could be related either to source variability or to mineralogical sorting during their weathering, transport and deposition. The limited samples measured in this study indicate overlapping Sr and Nd isotope composition between Higher (ε_{Nd} -16.5 to -27.7; $^{87}Sr/^{86}Sr$ 0.7414-0.7788) and the Lesser (ε_{Nd} -20.8 to -23.5; $^{87}Sr/^{86}Sr$ 0.7524-0.7714) Himalayan quartzites making it difficult to differentiate their sources. More work is underway to generate larger data set to study their protoliths.

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Heat flow in the laser-heated diamond anvil cell and the thermal conductivity of the lower mantle

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The thermal conductivity of the lower mantle is a critical parameter for understanding the current heat budget and thermal evolution of the Earth. However, thermal conductivity measurements at high pressure and temperature are difficult due to the small sample volumes and large temperature gradients characteristic of the laser-heated diamond anvil cell (LHDAC) [1]. Temperature distributions in the LHDAC are determined by laser and sample geometry as well as physical properties such as sample absorbance and thermal conductivity [2]. During heating experiments, precise measurements of peak sample temperatures and 2-D hotspot intensity gradients can be made [3]. In order to infer physical properties of a sample using measured temperature distributions in the LHDAC, a quantitative understanding of heat flow in the LHDAC is needed.

We have developed a 3-D numerical model of steady-state heat conduction for continuous heating experiments in the LHDAC. The numerical model has been benchmarked against an existing 2-D analytic solution [2], yielding agreement in predictions of temperature distributions as a function of input laser power, sample geometry, and sample thermal conductivity. Model calculations show that peak temperature and hotspot width are strongly correlated and dependent on laser power, laser and sample geometry, and sample thermal conductivity. The rate of change of the peak temperature and hotspot width as a function of input laser power is especially dependent on sample thermal conductivity, all other variables being equal.

[1] Benedetti & Loubeyre (2004) *High Pressure Res.* **24**, 423–445. [2] Panero & Jeanloz (2001) *J. Geophys. Res.* **106**, 6493–6498. [3] Kavner & Nugent (2008) *Rev. Sci. Inst.* **79**, 024902.