Geochemical Characteristics of Cyoconite Debris on Chhota Shingri Glacier, Western Himalaya, India

S. NIZAM[1]*, I.S.SEN[1], M.F. AZAM[2], D. SELBY[3]

[1]Dept. of Earth Sciences, IIT Kanpur, 208016, India
[2]School of Civil Engineering, IIT Indore, 453552, India
[3]Dept. of Earth Sciences, Durham University, DH1 3LE, UK
*Correspondance: sarwar@iitk.ac.in

The glacial mass over the Himalayas and surrounding is the third largest on Earth, and it feeds a number of large river systems in Asia such as Indus, Ganges and Brahmaputra. Serious concerns have been raised due to potential impact of global warming on the shrinking glaciers and its effect on the future supply of potable water. Its alarming rate of melting is being enhanced by albedo reduction by soot and dust. However, the origin, concentrations, and spatial variability of the dust and soot are not well known. Here we report on trace element concentrations (Cd, Pb, As, Zn, Cu, REE etc.) of cryoconite holes, which are composed of microbes, dust and soot particles. Cryoconite samples were collected from the ablation zone of Chhota Shigri Glacier in Western Himalaya. The samples are enriched in heavy metals varying by a factor of 6 or less and majority of them are higher than the average upper continental crust composition. These concentrations are similar to reported cryoconite hole sediments data in the Himalayas, but significantly higher than Arctic and Antarctic regions. We further used trace metal systematics to decipher natural versus anthropogenic origin of samples. For example the average Cd/Zn, As/V and Pb/Cu ratios of natural aeolian dust and UCC are 0.001, 0.015 and 0.8 respectively, whereas cryoconite showed much higher ratios (0.003, 0.003 and 1.4 respectively) suggesting anthropogenic origin for As, Cd and Pb. The latter is further supported by higher cryoconite metal content than local sediments for several metals (e.g. Cr, Co, Ni, Cd, Zn etc.) and high enrichment factor. Future work will aim to establish the source of the anthropogenic input, with the intention to develop an environmental policy to aim in reduction anthropogenic deglaciation of the Himalayan glacier mass.