



Environmental Magnetism and Heavy Metal Assemblages in Lake Bottom Sediments, Anchar Lake, Srinagar, NW Himalaya, India

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Abstract

Lake sedimentation represents a collective record of atmospheric and surface processes operating over the catchment areas. Magnetic minerals along with heavy metal assemblages can selectively represent the ongoing impact of dominant environmental processes over the catchment regions. Lake bottom sediments collected from Anchar Lake were investigated to trace the magnetic and heavy metal signatures in context to quantify the environmental conditions from one of the ideal setup of lake catchment in the Srinagar valley of Kashmir Himalaya. Magnetic parameters such as χ_{ARM} , SIRM and $Soft_{IRM}$ revealed predominant soft ferrimagnetic mineralogy. The S-ratio showing a mean value of -0.69 within a range of -0.77 to -0.57 depicted majority of PSD-SD ferrimagnetic grains. The χ_{lf} versus χ_{fd} % biplot suggest the presence of mixture of SP and coarser magnetic grains controlling the magnetic susceptibility signals in the lake bottom sediments. The magnetic parameters and heavy metal constituents in particular S-ratio, $SIRM/\chi_{lf}$, χ_{ARM}/χ_{lf} and χ_{ARM} exhibit significant correlation with Cr, Cu, Ni and Zn. Furthermore, spatial variability of these parameters depicts a complex of detritus influx, anthropogenic inputs, and the domain size of minerals reflecting oxidizing and reducing conditions with sharp changes in the peripheral part and gradual mixing towards the central and deeper parts of the lake basin. Multivariate statistical analyses (Pearson correlation, cluster and factor analyses) attest direct relation of the heavy metals with mineral magnetic assemblages. Overall, the results reflect heterogeneity in the record within the lake basin at the scales of 10's of meters attributed to basin lacustrine conditions.

Keywords Anchar Lake · Environmental assessment · Mineral magnetism · Heavy metals · Spatial distribution · Multivariate analysis

Introduction

Freshwater lakes are one of the most important natural sedimentary archives that preserve proxy signatures of the changing catchment environment. Mineral magnetic and heavy metal assemblages in lake sediments provide a good combination of tools to estimate changes in catchment source, erosional and depositional processes as well as the anthropogenic inputs (Oldfield et al. 1983; Yang et al. 2009; Khan et al. 2012). Such studies on surficial sediments provide useful information on modern lake and catchment processes and thus help researchers to interpret magnetic proxies for paleoenvironment reconstruction in different environmental settings (Thompson et al. 1975; Bali et al. 2011; Hayashida et al. 2015). As a result, several significant inferences are drawn from mineral magnetic assemblages and their signatures in lake sediments to

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