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Chronology of relict lake deposits in the upper Alakananda basin: Implication to paleoclimate and variability of chemical weathering intensity

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Climatic fluctuation during Late Quaternary significantly oscillated the extent of valley glaciers in the Himalayan range. Imprints of these oscillations preserved up to various extent in the different segments of the Himalaya [1]. Glacial landforms such as moraines, valley fills and relict proglacial lake deposits are preserved in the higher altitude of the upper Alakananda basin [2]. Studying these landforms will help to estimate the extent and timing of paleo-glaciation, debated for most part of the Himalaya due to lack of preservation of glacial landforms [1]. In this work relict proglacial lake sediments preserved in the bank of upper Alakananda River (south of Badrinath Temple, N30°43', E79°30', altitude ~3000m msl, thickness ~120 m) were analyzed to reconstruct the timing of glacial retreat and climatic variability during the Late Glacial to early Holocene. Samples were analyzed for grain size distribution of the sediments, geochemical analysis and optically stimulated luminescence (OSL) measurements for dating.

This deposit can be divided into four units based on the field observations where unit I is the bottom most and unit IV is the top layer. Total five OSL dates were obtained from different layers. From OSL dating it is inferred that the sedimentation in the lake was occurred between 20.8±4 ka to 10.5±1.4 ka. The sedimentation rate was higher in the unit II and IV of the deposits compare to other part indicating higher sediment influx to the lake due to high precipitation and glacial retreat. Field observation, sedimentary structure observed in this deposit indicating the fluctuating inflow to the lake producing varve, rhythmites and thick sand layers at different horizons. Convolute and fragmented sedimentary structures are also observed near to the bottom of unit II indicating post deposition deformation. Grain size analysis of the sediment shows moderate to poorly sorted sediments and the textural group lies between fine-silt to slightly-fine-gravelly medium-sand, indicating mixed sediment sizes. The CIA value of the sediments varies from 63.9 to 72.6 indicating low to moderate degree of chemical weathering. Based on the major and trace elemental analysis it is inferred that the combination of weathering and sorting might have progressively changed the geochemistry of the sediment from the source rock. The ternary diagram of La, Th, Sc of sediments and different major oxide ratio plots indicate granitic to granodioritic source rocks mainly found in the Higher Himalayan Crystalline Series (HHCS). From the above observation it is inferred that the upper Alakananda basin responded to the fluctuation of Indian summer monsoon during Last Glacial to Early Holocene period. Warmer period correspond to higher

sedimentation rate and thick layers of the sandy deposits whereas rhythemite and varve correspond to the colder period [4].

Reference:

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