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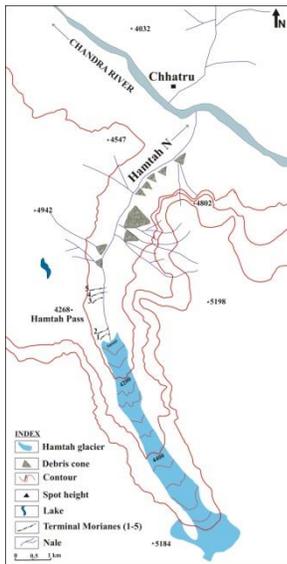
Dating of moraines by lichenometry in Hamtah glacier valley, Lahual and Spiti district, Himachal Pradesh, India: Retreat of Himalayan glacier during Little Ice Age (LIA).

Srivastav, A.¹ and Kumar, A.²

¹Geological Survey of India, NER, Shillong-793003, abhinandansri@rediffmail.com

²Geological Survey of India, NR, Lucknow-226024

Glacier and glacio-geomorphic features can provide significant information about the past and present climate changes as the glacier are sensitive to temperature fluctuation. Dating of glacial moraines is significant in reconstructing the past climate. The recessional moraines in Hamtah glacial valley has been

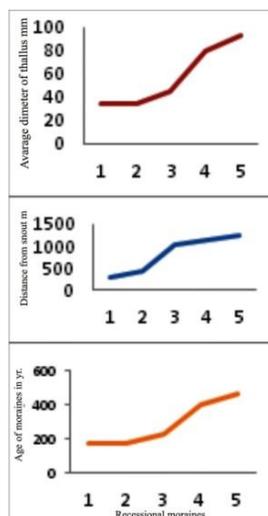


dated using Lichenometry for establishing the glacier retreat event and climate change behaviour. The average diameter of five largest lichen thallus of the crustose lichen *Rhizocarpon geographicum* growing on the moraines surface has been taken for dating, owing to its known growth rate and almost circular thallus growth. This study is significant particularly to understand the role of Himalayan glacier in global climate change.

Five recessional moraines have been mapped in the Hamtah valley at unequal distance from the snout at left side of Hamtah nala. The recessional moraines in the Hamtah valley show healthy growth of lichen and shows 60-80% coverage while the average diameter of thallus increase with the distance from the snout. The lichen having diameter of 15-20 mm have dominant population over the moraines near to the snout, located about 275 m downstream from snout while the average diameter of lichen is 33.8 mm.

Figure 1: Hamtah Glacier, Lahual and Spiti district, H.P., India

The thallus diameter of this size near the snout may possibly be only in the period known as "great period", where relative acceleration of growth rate occurs. The average lichen thalli diameter of 33.8 mm on the moraine near the snout estimates the age of moraines as 169 years. From the calibrated data of the lichenometry it is observed that the moraines-5 located about 1.25 km from the glacier snout having average lichen thallus diameter of 92.5 mm resulted in calibration of minimum age of moraine as 462.5 years. The estimated minimum exposure age of the moraine-4, the second oldest moraine and about 1.15 km from snout in Hamtah valley is 400 year. From these data it is revealed that the glacier was in state of recession but the average rate of recession was slow during the 15th century which is also onset of Little Ice Age. During Little Ice Age, from 15th-19th century decrease in temperature (about 0.6 °C) recorded in northern hemisphere. The large span between moraine-3 and 2 in pro glacial regime (LIA) maximum, during which the glacier advance the earlier moraines. A correlation between the lichen thallus with the distance from the glacier exposed surface of moraines suggest that the glacier recession after LIA maximum. The recession of the supported by negative mass balance record, recent glacier snout as well as exposed faces of the lateral that during the last thirteen years since 2000 to



2013, the glacier has receded by 148.0 m, vacating an area of 0.03871 sq km Chaturvedi, A. [1]. During this period the glacier has receded with an average recession rate of 11.38 m/year. From these data and minimum exposure age of moraines it is revealed that the average rate of glacier recession has been increased drastically after the Little Ice Age (LIA) in the Himalayan terrain.

Figure 2: A correlation chart of diameter of the lichen thallus with the age of the exposed surface of moraines

Reference:

[1] Chaturvedi, A. (2015) Extended abstract of progress reports, Geological Survey of India, Vol. 148, Pt. 8 p231

