Abstract

The Indian summer monsoon (ISM) plays a crucial role in driving the economy and societal setup of the country. The variability of monsoon is found to be modulated by the interplay between the insolation in the northern hemisphere and the northward movement of the inter-tropical convergence zone and changes in ice extent during glacial-interglacial periods. These governing factors operate on different timescales and control decadal, centennial and millennial variability of the monsoon. This thesis reports reconstruction of monsoon variability during the Holocene and the late Pleistocene. The results are based on stable oxygen and carbon measurements carried out on new stalagmites samples from the core monsoon zone of India and a sediment core raised from the Andaman Sea.

The variability of ISM during the Holocene has been studied using three new stalagmite samples from Dandak (DAN-I and DAN-II) and Kotumsar caves, central India. The record extends from $\sim$ 10.4 ka to the present. Contrary to the earlier inference of gradual decrease in monsoon at mid-Holocene, an abrupt declining monsoon between $\sim$ 6 to 5 ka was observed. The millennial scale monsoon variability is found to be similar to the North-Atlantic climate changes (e.g. Bond events). During the 'Little Ice age', when glacier advances were noticed in the Northern hemisphere, a phase of prolonged weaker monsoon, between 600 and 150 yr BP, with severe drought-like conditions at $\sim$ 300 yr BP (1700 AD) is seen in our reconstruction. The general theory of insolation alone controlling the is debunked and instead it is observed that millennial - centennial scale changes

could have been governed by internal feedback mechanisms.

Another stalagmite from the Kailash cave was used to document the variability of monsoon during the Older Dryas period. Several episodes of decade-long mega-droughts were observed during this period. Beginning of Allerod period is marked by a sudden increase in monsoon at ~ 13.4 ka.

Monsoon between $\sim$ 70 ka to the present was reconstructed using $\delta^{18}O$ of *G.ruber* from a sediment core from the Andaman Sea. Significant decline in ISM was observed during the Last Glacial Maximum between $\sim 20 - 18$ ka. A stalagmite sample (BLM-1) collected from the Belum cave, Kurnool district of Andhra Pradesh, India, holds the longest available monsoon record reconstructed from the core monsoon region of India. The Belum cave stalagmite, which grew between $\sim 190 - 80$, ka covers the time period of last interglacial (MIS - 5e) and the onset of the last Glacial period. A gradual decrease in monsoon was observed at the onset of glaciation. The $\delta^{18}O$ time series of early glaciation, when compared with the insolation gradient and the insolation at 30°N, shows a good coherence with the gradient. This suggests that the insolation gradient between the Mascerene high and the Indian low plays an important role in controlling the monsoon variability rather than direct influence of insolation on monsoon.

Key words : Indian Summer Monsoon, Core Monsoon Zone, Stalagmites, Holocene monsoon, Pleistocene climate, Foraminifera.