

MULTI-ARCHIVE, MULTI-PROXY PALAEOCLIMATIC STUDIES IN THE CENTRAL DRONNING MAUD LAND, EAST ANTARCTICA: INDIAN INITIATIVES

R Ravindra

National Centre for Antarctic and Ocean Research, Vasco-da-Gama, Goa, India

Indian scientists have been actively exploring the various climate archives that are present in the Central Dronning Maud Land region of East Antarctica, so as to reconstruct and evaluate the major changes in Antarctic environment in the past. The most significant palaeoclimatic archives studied so far include ice, lake sediments, coastal sediments, land deposits, etc. Several short sediment cores were collected by the BSIP from the Zub (Priyadarshini) and Long lake and have been analysed for various sedimentological, palynological and geochemical studies. Records from the Long Lake revealed the existence of both the 'Little Ice Age' and 'Medieval Warm Period' within the past ~2000 years data. The ~8000 year Zub Lake sediment record suggested distinct three fold climatic oscillations with an early cold and dry period, followed by a warm and humid interval. The late Holocene was again characterised by a warm and more humid climatic condition. Presence of exotic pollen taxa like *Larix*, *Ulmus*, etc. along with the local moss spores and other cryptogams within the lake sediments suggests the possibility of long distance transport from other continents in the past. The sedimentological and clay mineralogical studies using sediment cores and varve deposits revealed the presence of illite, chlorite and minor amount of mixed-layer minerals that were attributed to the weathering of catchment rocks. Although there had been certain climatic oscillations in the past, the depositional environment remained cold throughout the Holocene with presence of clay mineral assemblages that are typical of reduced hydrolysis under glacial conditions. Shallow to medium depth ice core drilling was carried out by Indian scientists during the 12th, 15th and 22nd expeditions, between the Vetehiea and Tallaksenverden nunataks. The annual accumulation rate at these cores sites varied between 10 and 20 cm ice equivalent. The glacio-chemical (SO_4^{2-} , NO_3^- , Cl^- , Na^+ , K^+ , Ca^+ , NH_4^+ , Mg^+ and trace elements) and isotopic (stable and radiogenic) studies of these cores revealed distinct variations during the past few centuries. All records revealed the presence of several distinct peaks of enhanced conductivity and/or sulphate content that were attributed to important volcanic eruptions recorded in the history. Most important volcanic eruptions that have been identified include the Pinatubo (1991), Agung (1963), Krakatau/Tarawera (1883/1886), Tambora (1815) and Huaynaputina (1600). The oxygen isotope records of the ice revealed that the beginning of 19th century was cooler by 2°C, compared to the recent past.

Additionally the long-term monitoring of the *Dakshin Gangotri* in western Schirmacher snout provided extremely useful data on the recent climate change in the region. It was observed that not only the glacier snout, but also the entire ice margin is drastically receding, implying dramatic climatic effects on Antarctic ice. The snout of the glacier has recorded a recession at the rate of ~7 m per decade. This is sharply in contrast with the observation that the sea ice is drastically increasing all around the continent. Such long-term observations on the vulnerability of ice sheets suggest the extreme importance of studying the available ice sheets for its past environmental and climatic imprints before they are lost into the history.