Jour. Geol. Soc. India (2023) 99:1780-1781
https://doi.org/10.1007/s12594-023-2534-3

NEWS AND NOTES

Indian Endeavour in Antarctic Geoscience

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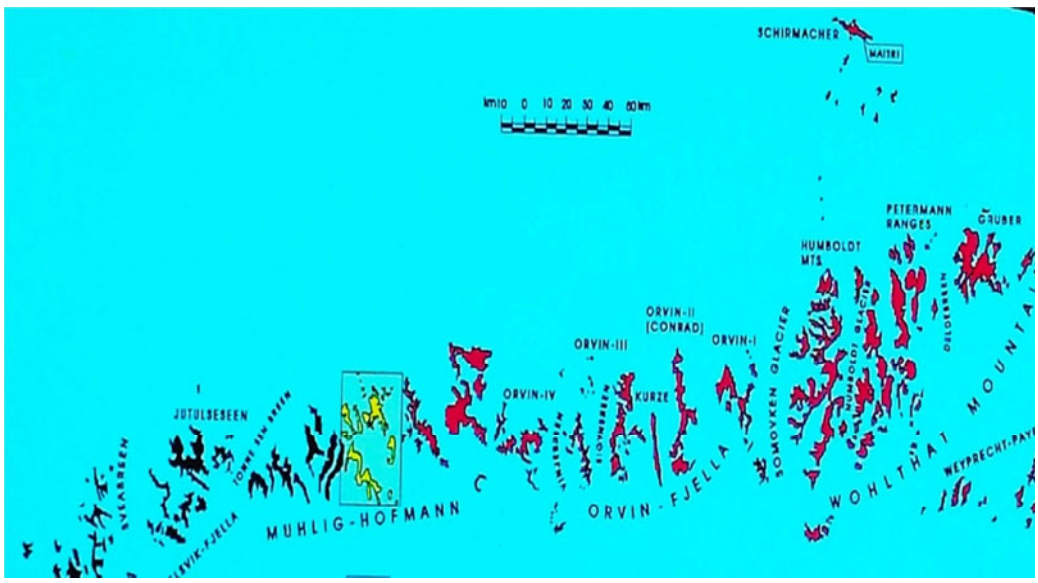
Received: 18 October 2023 / Accepted: 22 October 2023

Antarctica, the fifth largest continent of our Earth with over 14.1 million sq. km area, lies at the centre stage of the assembly and break-up of the Gondwanaland, offering thereby vital links in the reconstruction of Gondwanaland and establishing the links between Eastern Ghat Mobile Belt (EGMB) of India and the Prydz Bay area of eastern Antarctica. The geoscience studies, that include – solid earth geology, geophysics, glaciology, geomorphology, limnology, paleo-climate etc. were initiated over Schirmacher Oasis and Wohlthat Mountain chain in parts of Central Dronning Maud Land (cDML) in early eighties. The studies were later extended to Larsemann Hills sector, Prydz bay area including Wilkes Land and are currently under progress in the other parts of Princess Elizabeth land and in the Amery Ice Shelf Region.

The deformation and metamorphic history of Schirmacher Oasis has been worked out in great detail by several workers from GSI, JU, WIHG, NGRI (Singh, 1986; Sengupta, 1988; Ravikant and Kundu, 1998) that show a poly-metamorphic deformed terrain comprising gneisses, interbanded mafic granulite, khondalite, calc-silicates, charnockite, etc. The main mountain chain of cDML exposed from west to east and comprising Gjelsvkfjella, Muhlig—Hoffmannfjella, Orvin, Humboldt-Petermann ranges – Gruber massif of Wohlthat Mountains, that was mapped by GSI (2006a,b, 2010), exposes dominant Meso-Neoproterozoic rock types of high grade granulie to amphibolite facies para-gneisses, calc gneisses, orthogneisses, anorthosite and foliated charnockite, magmatic suite, alkali granites with rafts of country rocks and late intrusives of dolerite, lamprophyres and norites. Granites of Humboldt and Payer-Weyprecht Mountains have given Rb-Sr isochoron ages of 514±59 Ma (Ravindra and Pandit, 2000) and 749±61 Ma (Ravikant et al, 1997). The H ≈ 640 Ma granulites of Humboldt have been considered representing the extension of East African Orogen (Pant et al., 2013).

Since 2003-04 when the reconnaissance survey to select site of India's third Antarctic base was launched, a new sector namely - Princess Elizabeth Land (PEL) encompassing Lambert Glacier, Prydz Bay region of the Amery Ice shelf was opened for scientific research for Indian scientists. The Larsemann Hills of this region expose Archean rocks in Vestfold Hills while the adjoining Rauer Group exposes both Archean as well as Proterozoic rocks with distinct geological history and old ages as compared to other blocks of PEL. The Larsemann Hills and adjoining areas offer strong points for correlation between the PEL and parts of eastern India. The Grenvillian (H ≈ 1000 Ma) –pan African (H ≈ 500 Ma) high grade tectono-metamorphic evolutionary history of the exposures in Prydz Bay is significant in the present day reconstruction and correlation with India and eastern Antarctica (Pant et al., 2017a; Arora et al., 2020; Saibai et al., 2021 and several others). In this context, occurrence of coal seams in the Permo-Triassic sedimentary sequence exposed in the Beaver Lake area of Prince Charles Mountain is significant and offer excellent proxy for correlation with Mahanadi-Godavari coal belts.

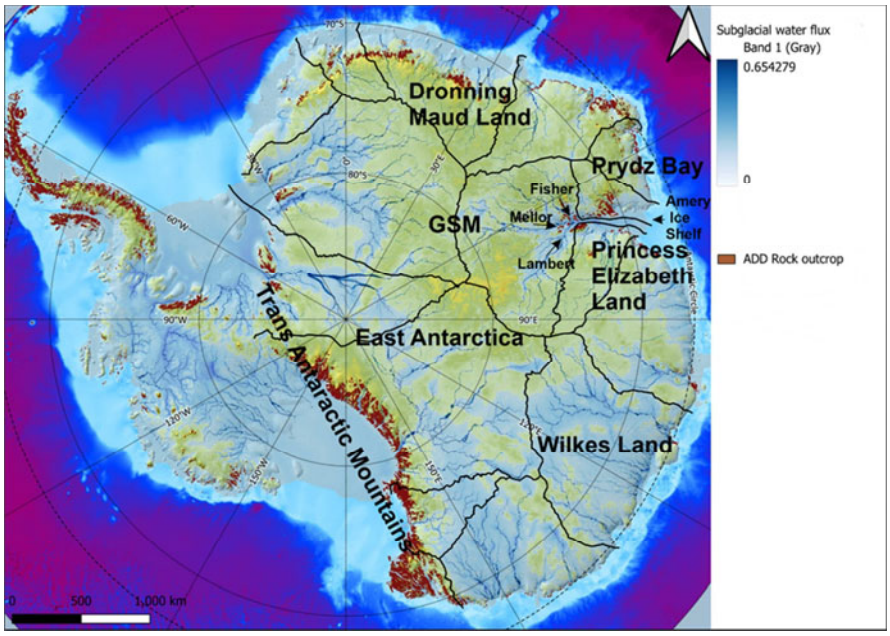
The geophysical studies by NGRI and IIG, including seismic, magneto-telluric and geomagnetic, have greatly helped in deciphering the sub-surface geology and tectonic configuration, apart from the movement velocity of Antarctic plate.



Wohlthat Mountain chain of the Central Dronning Maud land, east Antarctica (after GSI)

The Polar ice sheet covering nearly 98 percent of the Antarctica along with the enveloping sea ice, plays a significant role in modulating and influencing the atmospheric and ocean circulations. GPR surveys, sediment coring from lakes and Ice core drilling at several locations, especially in the shelf regions of Ice Rises, has given insights into dynamics of ice sheet and high resolution Paleoclimate data (Asthana, 2013; Mahesh et al., 2019; Goel

et al., 2020; Thamban, et al., 2012). Varied geomorphic landforms along the coast of eastern Antarctica suggest that the most recent phase of ice retreat was spatially heterogeneous. Ice retreat here comprised; thinning of the East Antarctic Ice Sheet by up to 500 m and the recession of the ice wall in kms. This retreat deposited moraines over the Schirmacher Oasis in cDML with minimal reworking. The optical dating of the recessional moraines to determine the timing of their final emplacement (Shrivastava et al., 2018) has revealed three phases of moraine deposition, during 158–125 ka; 76–50 ka and 22 ka to present (Roy et al., 2023). It has been suggested that decreased sea surface temperatures and increased sea ice cover of the surrounding oceans limited the moisture supply and led to the retreat of ice. By ~ 35 ka the SO became ice-free and has remained so, ever since. Antarctic Paleoclimate reconstruction using ice core and lake sediment cores has been worked out in details by Thamban, (2012), Phartiyal (2014), etc.



Bed rock map with subglacial drainage in East Antarctica (Ferraccioli et al., 2015)

The Schirmacher Oasis and Larsemann Hills are among the few significant ice free areas of East Antarctica that are conspicuous due to presence of large number of melt water lakes, preserving the signatures of climatic variation and deglaciation history since Last Glacial Maximum (19 to 24 Ky BP) and beyond. There are evidences, recorded in the lake sediments of low lying Larsemann Hills, of marine transgression (Govil et al., 2012, etc.) due to variation in sea level, isotactic upliftment and close vicinity of the Hills to the marine environment. The Schirmacher Oasis, on the other hand has preserved various landforms–both erosional and depositional–typical of a periglacial environment (Asthana et al., 2013; Ray, 2021; Ravindra et al., 2022) along with proglacial lakes (incorporating signals of ice-sheet dynamics) and epishelf lakes (signatures of marine influence).

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