

Glaciomorphological Studies in Parts of Schirmacher Oasis, Central Dronning Maud Land, East Antarctica

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Abstract

Schirmacher oasis in the central Dronning Maud Land is bounded by continental sheet on the South and ice shelf on the north. The southern portion of the Oasis is abutting against the continental ice sheet while the northern margin as an escarpment is in contact with ice shelf. The eastern part of Schirmacher Oasis was studied during XX Indian Antarctic Expedition and the Various land forms observed in the area briefly described. The prominent features comprise broad 'U' shaped de-glaciated valleys, rounded hills, moraines, patterned ground and numerous lakes. A zone of unconsolidated deposit of well rounded pebbles, cobbles and occasional boulders embedded in finer matrix has been observed in the eastern part of Schirmacher Oasis. The characteristics of the clasts indicate an influence of glacio-fluvial transportation in their formation.

Introduction

The Schirmacher Oasis is located between 70°46' 40" and 70° 43' 50" S Latitude and 11° 22' 40" and 11°54' 25" E Longitude within the central Dronning Maud Land region. It is an ice free area extending for about 17 km in E-W direction and has a maximum width of about 2 Km along N-S direction. It is bounded towards North by shelf ice and towards South by the continental ice sheet. The area exposes Precambrian high grade gneisses and early to late basic and acidic intrusives. **The** geomorphological Studies were initiated in 1985 - 86 to study the retreat of Antarctic ice sheet during the recent past and the resultant glaciation/ deglaciation in the area giving rise to various erosional and depositional landforms (Srivastava et al., 1986, Ravindra 1999).

Field Observations and Conclusions

During the XX Indian Antarctic Expedition, geomorphological studies have been carried out in the eastern part of Schirmacher Oasis between latitude 70° 44' to 70° 46' 35" S and longitude 11° 46' 10" to 11° 54' 25" E and an area of about 10 sq. km. was mapped (Fig. 1).

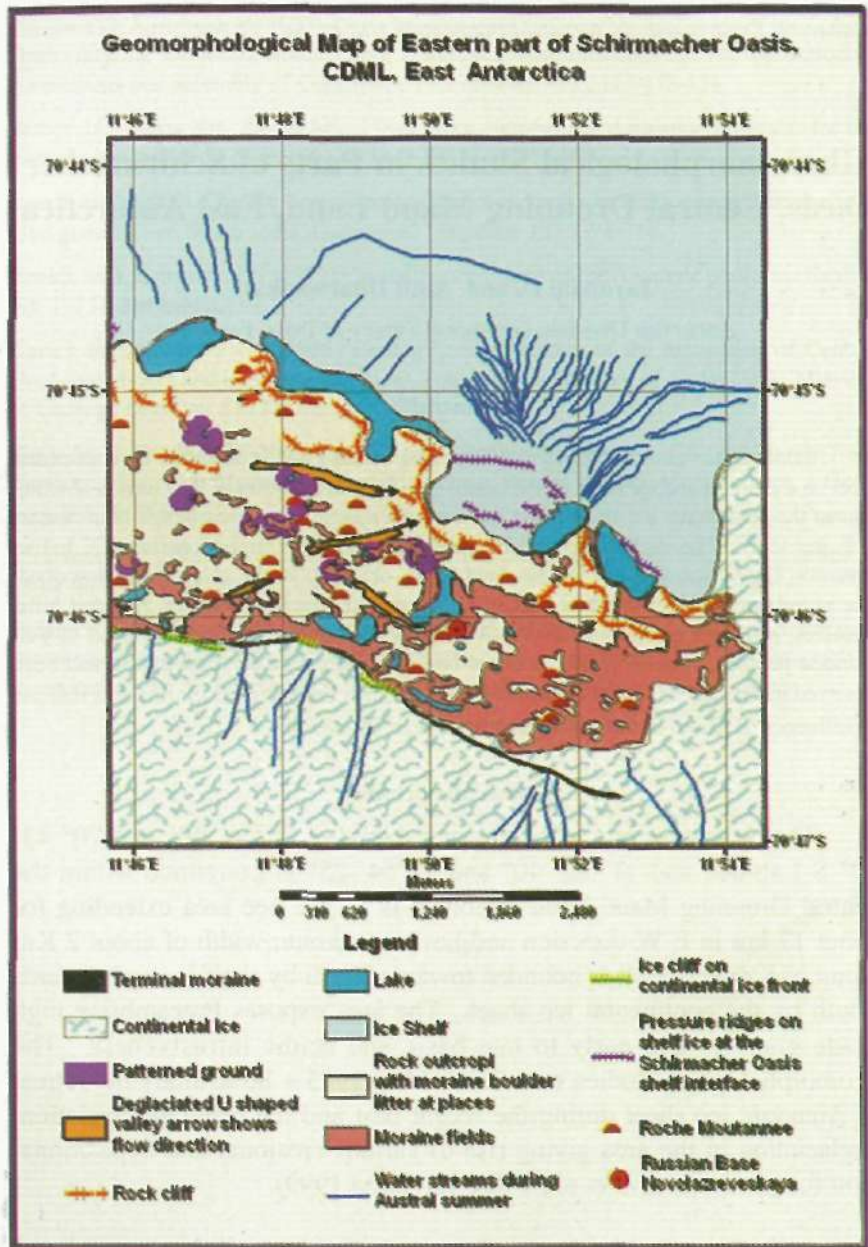


Fig.1: *Glaciomorphological map of eastern part of Schirmacher Oasis.*

The area exhibits low lying undulating topography. Periglacial features are developed on ice-free areas. Rounded hills, deglaciated valleys, patterned ground and numerous lakes are the geomorphic features observed

in the area. The different types of land forms observed are classified as given below:

Erosional land forms - Hills and valleys, cliffs/escarpment, striated surface, Roche Moutonnees.

Depositional land forms - Moraines, patterned ground, erratic, lakes and terraces.

Numerous 'U' shaped valleys are encountered in the area (Fig. 2) which crisscross each other and are in various stages of maturity. The more mature valleys show a broad 'U' shaped form with wide flat floors occupied by lakes and/or patterned ground. These are formed as a result of erosional activity of the glaciers over the bedrock. Smaller hanging valleys draining into the main valley are frequently observed. Most of the valleys show ENE trend indicating it to be the most favored movement of the glacier.



Fig.2: A broad 'U' shaped deglaciated valley.

The walls of mature valleys are steep to vertical. Most of the hills trend E-W and have subrounded to flat topped relief. The walls of the valleys occurring in the area stand out as escarpment. The cliff surfaces show glacial polish. Much of the periphery of Schirmacher Oasis is seen to occur as a cliff as high as 50m forming a very prominent geomorphic feature.



Fig. 3: Striation showing recent movement of glaciers.

Striations indicating directions of the most recent movement of ice over bedrock is mainly north to north easterly (Fig. 3). The presence of coarse sand and pebbles in the depressions and pits on the outcrops as well as the erratic boulders perched on hill tops gives evidence on the glacial regime prior to the disappearance of ice from these hills. The present location of the epishelf lakes along the northern margin of Schumacher appears to have been the depression formed by the descending glacial tongues of the ice sheet (Fig. 4). The glacial polishing on top of the escarpment above these lakes and the physiographic expression of the rocks all around them support this view. (Ravindra R, 2001).



*Fig. 4: Northern margin of Schirmacher Oasis with iceshelf
A part of epishelf lake is also seen.*

Roche Moutonnees are a conspicuous occurring geomorphic feature in the area. The glacially eroded hillocks show smooth abraded gentler flank on the upstream side (stoss) and steeper irregular and rugged flank on the lee side interspersed with patches of glacial drift. Striations are generally seen on the smooth, rocky top surfaces. Most of the Roche Moutonnees are under modification due to mechanical weathering taking place along the joint planes.

The depositional terraces consist of matrix supported semiconsolidated sediments which are characterised by their highly unsorted nature. The clasts are usually sub-angular to sub-rounded and range in size from pebble to boulder. They do not show any preferred orientation.

Patterned ground is one of the prominent land form of Schirmacher Oasis and is a result of repeated freezing and thawing of valley floors due to permafrost behavior. It is characterized by polygonal structures and formed on the flat, low lying floors of valleys. These polygons are highly irregular initially and become regular as the land form matures. These polygons are usually unsorted texturally but some show coarse 'grained clasts in the centre surrounded by finer grain size along the borders. The size of the polygons vary from place to place depending on the level / height of the patterned ground (Fig. 5)



Fig. 5: Patterned ground characterized by polygonal structures and formed on the flat low-lying floors of valley.

A number of fresh water lakes are seen in the area of study and usually occupy the valley floors (Fig. 6). These lakes are shallow and are variable in shape and depth. They freeze during the winter and thaw in



Fig. 6: A typical glacial basin lake with three recessional levels.

summer and are fed by the melt water channels originating from polar ice front. At places, sand pockets can be observed at higher levels than the present level, along the banks of some lakes suggesting that the lakes have receded in time.

Erratics are a common feature observed as perched blocks and boulders placed over smooth bedrock by the retreating glacier. Erratics of granite, basic and ultra basic rocks are quite common in Schirmacher Oasis. The rounded to subrounded boulders have travelled a considerable distance while those which are subangular to angular in shape are of local origin (Fig.7).



Fig. 7: Erratic observed as perched blocks and boulders strewn over smooth bedrock by the retreating glacier.

Moraines are seen through out the area reflecting repeated glaciation and deglaciation during the past. Lateral moraines occur along the sides of glacial valleys where as terminal moraines of various glacial episodes are sporadic in occurrence.

A zone of unconsolidated deposit comprising very well rounded pebbles, cobbles, occasional boulders embedded in final matrix was observed in the eastern part of Schirmacher about 300 m NNE of the Russian Antarctic base-Novolazerevskaya (Fig. 8). It measures about 5 m in width and 40 m in length. The nature and character of this pebble bed suggests influence of fluvio-glacial regime in their deposition.

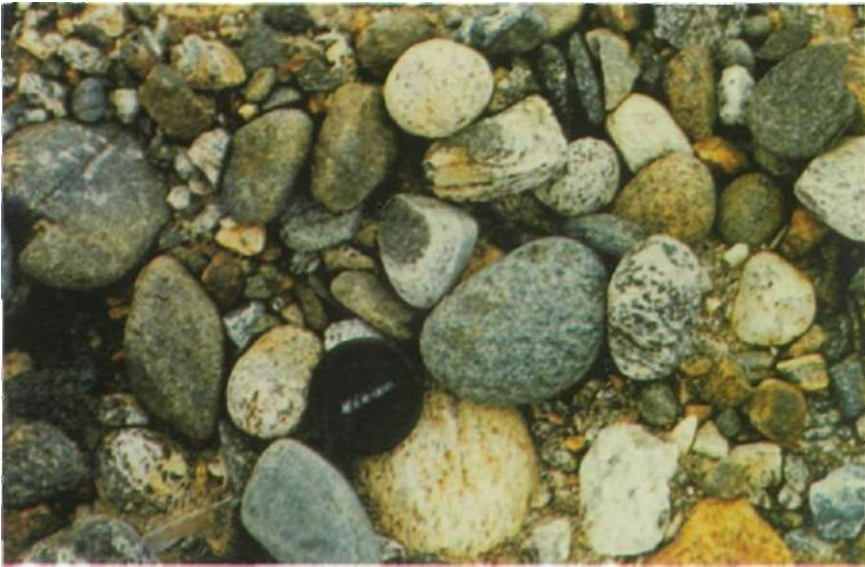


Fig. 8: Concentration of well rounded pebbles along with appreciable amounts of cobble, occasional boulders and finer matrix.

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