

the poor expression of glacierization to-day and of glacial erosion in the past. That this factor is not the only one, is shown by the existence of two good cirques not fed from the summit ice, one on the north-east and one on the north-west (B). Other factors must be sought and they would seem to be climatological. Thus shading from the sun of the north-east, north and north-west slopes favours the preservation and activity of glaciers there. Wind-drifting of snow might be expected to be another significant factor. No local wind and precipitation data are available and consequently it can only be inferred on general climatological grounds that the most frequent winds bringing snow will reach Snaefell between east and south, *i.e.* from the nearest coasts and warm sea water. If this is so, wind-drifting of snow to lee sides would favour glaciers on western and northern slopes.\* Thus in interaction, three factors—relief trendlines dependent on structure, shading and snow-drifting—may combine to account for the varied aspects Snaefell presents to the different points of the compass.

Mr. W. V. Lewis generously lent his field notebooks and photographs for the preparation of this note. I thank him and Professor G. Manley for valuable criticisms. The 1937 Expedition is grateful to Mr. F. George for putting his 1936 survey results at its disposal.

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\* The mapping of snow-patches in Fig. 1 does not help very much in this matter, since the eastern and southern slopes on the whole were mapped first and the western and northern slopes mapped later in the melting season. The map is therefore unfavourable to the amount of snow lying on western and northern slopes. Movement round the mountain group soon after our arrival gave a clear impression of there being more snow on the western slopes.

## GLACIER RECESSION AND PERIGLACIAL PHENOMENA IN THE RUWENZORI RANGE (BELGIAN CONGO)

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### INTRODUCTION

The Ruwenzori Range is composed of Precambrian (granitic and metamorphic) rocks, whereas the other glaciated central African mountains are the result of volcanic processes. Their morphologies are also different, Ruwenzori being decidedly more alpine. Mount Stanley is the most western ridge and, with the highest peaks of the range, forms the boundary of the Belgian Congo.



## EXPLORATIONS AND CARTOGRAPHY

The summits of Mount Stanley were reached for the first time in 1906 from Uganda by the Duke of Abruzzi's expedition.<sup>1</sup> Stuhlmann had previously approached them in 1891<sup>2</sup> from the Semliki valley but a track to the glaciers was not open on this side before 1932 and the advent of the Mission Scientifique Belge au Ruwenzori.<sup>3a, b</sup> About the same time N. Humphreys<sup>4</sup> carried out numerous explorations and reconnaissance flights. Many travellers followed later but the published accounts are very scarce and concern Uganda only.<sup>5a, b</sup> The cartography of Mount Stanley's glaciers is practically restricted to the rough contour maps of the 1906 and 1932 expeditions. The sketch map on p. 139 is based on Colonel Hoier's survey made for the Institut des Parcs Nationaux du Congo Belge.

## COMPARISON OF RECORDS

In July 1950 the writer was able to travel on the western slope of Mount Stanley and the evidences of glacial retreat appeared so fresh and extensive that a close comparison with the previous observations promised interesting results. Considerable help was given by the Directors of the Institut des Parcs Nationaux du Congo Belge, who kindly permitted the use of its copious and well classified records. Among them the photographs taken by De Grunne's expedition (July 1932), J. H. Bredo (July 1935) and A. Gilliard (July 1939) require special notice. In the last sixty years the snow capping the highest peaks has been slightly reduced. This may be due to purely local causes. The larger ice mass of the Stanley Plateau and Stanley Pass has not apparently altered its outline. On the other hand, its margins have receded in places and every tongue nourished by this accumulation of ice has been considerably shortened. From north to south, one can observe:

- (i) Alexandra Glacier: no records for comparison.
- (ii) Western Stanley Glacier: this is the best known glacier and its retreat has been established by numerous observations since 1932. In that year the tongue was stationary near Lac Gris, almost damming the transverse trough and enclosing therein the greatest part of a rocky threshold. In 1935, the tip of the tongue sloped downwards and began to clear the rocky threshold. It was still in contact with the rock in 1939 but crevasses opened in the glacier margin. The recession greatly increased until 1950. Lac Gris is now surrounded up-stream only by bare rocks and stony debris. The glacier vanishes halfway down the slope, its front is carved up by melting processes and looks almost like dead ice. The profile from Stanley Plateau down to the front was smooth and steady in 1932 but it is now broken and truncated at the base. These facts show a recent raising of the snow line, estimated at 4450 m. in 1932. A small new lake appeared above Lac Gris between 1935 and 1939: it is called Lac Blanc. During the last fifteen years, vegetation has become rapidly established. The region between Lac Gris and Lac Blanc was practically barren in 1935 but now senecios and everlasting flowers are to be found there. Above Lac Blanc only lichens flourish.
- (iii) Southern margin of Stanley Glacier; this already appears on Stuhlmann's photograph of 1891. It looked rather thick at that time; in 1932 it had not yet greatly altered but now large patches of bare bedrock have appeared.
- (iv) Moebius Glacier: on Stuhlmann's photograph of 1891 it has a long tongue descending low into the trough. By 1932 this tongue had evolved into a hanging glacier and it is still thinner to-day. Outcrops of bedrock have appeared recently.
- (v) Western Elena Glacier: no records for comparison. In 1933, P. Michot<sup>6a, b</sup> had noted: ". . . régression certainement récente puisque les appareils édifiés, particulièrement fragiles, sont parfaitement conservés."

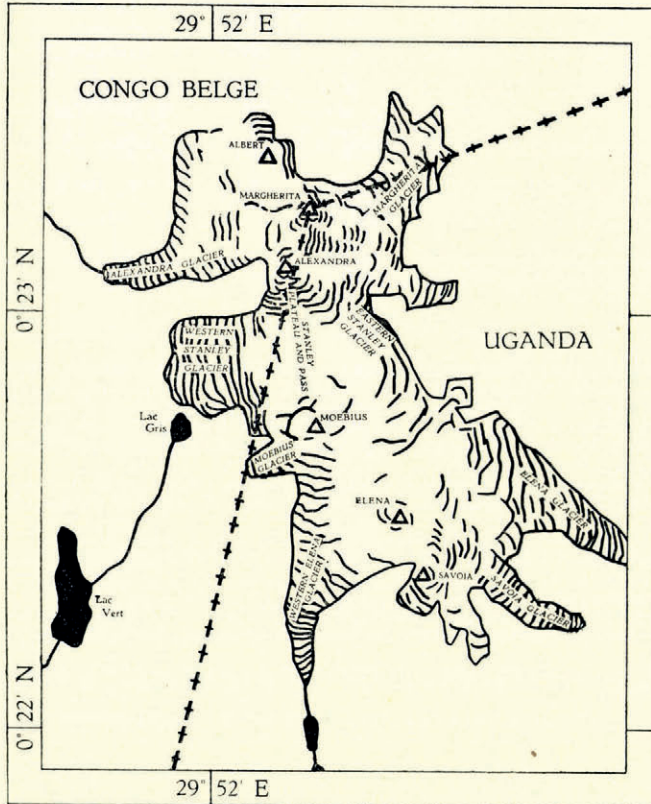
## OLDER FEATURES

The conditions described above constitute the last and shortest phase of a longer evolution. Lac Gris is dammed by a moraine which still looks fresh and is only moderately colonized by



plants. Up-stream, traces of the corresponding basin can be seen with abrasion and discolouration of bedrock, *roches moutonnées*, erratics and little patches of ground moraine not completely dispersed. The age of this glacial extension is certainly not in the remote past; it has probably been completed, say, in historic times.

On its whole length, the Ruwenzori Range bears the traces of Pleistocene glaciations of a much greater extent, and of which many lakes are still now the most spectacular remnants. It would be more than conjectural to try a correlation between those stages and the general chronology of Pleistocene deposits without accurate morphological mapping, and careful investigation of the tor-  
rential fans deposited lower in the plains.



#### GENERAL EVOLUTION

To summarize, the glacier tongues of Mount Stanley have undergone the following evolution:—very old Pleistocene stages; historic basin and terminal moraines; retreat; possible advance slightly before 1890; retreat, accelerated since 1939.

Those dates correspond with details reported from other central African glaciers, Kilimanjaro and Kenya,<sup>7a-i</sup> which have been more fully investigated than Ruwenzori.

#### PERIGLACIAL PHENOMENA

C. Troll<sup>8a, b</sup> has written a very full and detailed paper about the comparison of various soil structures and periglacial phenomena in every kind of cold climate. From Kenya and Kilimanjaro he brought illustrations of features that looked typical for high mountains of low latitudes.



Nevertheless these facts were never quoted in connection with the Ruwenzori Range where they appear with remarkable diversity and intensity. Here we find polygonal networks of 'floating type,' more or less deformed on sloping ground, stone stripes, solifluxion flows and several vegetation patterns such as hummocks, thurfur, tundra ponds and "cousins." The terrain in the neighbourhood of Lac Gris and Lac Blanc are quite representative in their aspects and, as a whole, one can point to a surprising similarity with the periglacial areas of the Icelandic glaciers, especially along the south coast of the island in summer. The soil structures they both show are quite different from those caused by frost action on the perennially frozen subsoil existing in periarctic countries.<sup>9</sup>

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## GLACIER WASTING AND RETREAT IN THE SOUTHERN ALPS OF NEW ZEALAND

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ANSTRACT. Down-wasting has affected southern glaciers in New Zealand later than northern glaciers under the influence of a southward rising snow line which is attributed to a southerly shift in prevailing wind belts. Evidence from the Hooker Glacier indicates that the present period of wasting is the fourth of a series which began about 200 years ago.

As the firm line rises a glacier is planed in the ablation zone so that successive surfaces are parallel to the original surface, which shows that ablation is more active for a short distance below the firm line than near the terminal face. A period of accelerated terminal retreat can result from parallel down-wasting without a correlative acceleration in the rate of climatic change.