SIR, *Structural or glacial benches?*

During the 1960–61 field season, I was the geologist with the New Zealand Southern Party, which carried out topographic and geologic mapping in the western part of the mountains between the Beardmore and Axel Heiberg Glaciers, Antarctica.

The rocks in this area consist of sediments belonging to the Beacon Group and Ferrar Dolerites which have been intruded as very extensive thick sills in the lower part of the sequence, but which are much less regular in the upper part. Where regular sills are present they often exercise a very strong control over the physiography. Beacon Group sediments are very susceptible to erosion and are readily stripped from above the resistant dolerites which consequently form broad flat structural benches and terraces. The vertically joined sills tend to preserve steep scarp faces which slowly retreat. This is particularly evident on the south-west side of the Shackleton Glacier where ice from the Polar Plateau spills down over a series of sharp ice falls separated by broad flat terraces (Fig. 1). The steps on which

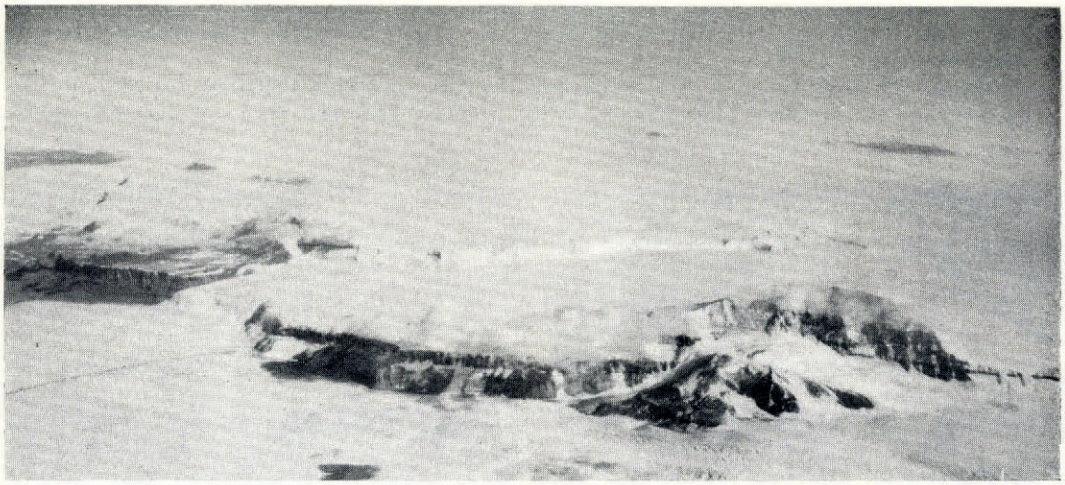

Fig. 1. Structural terraces determined by dolerite sills near Mount Rosenwald, south-west side of the Shackleton Glacier. (Official U.S. Navy photograph)

the ice falls are located can be traced laterally into dry areas where they are seen to be scarps marking the edges of dolerite sills. Much smaller structural benches border the Shackleton and Beardmore Glaciers in places, at the bases of high ranges. They have been stripped when the glaciers were higher, but their levels are again determined by the positions of dolerite sills and cannot be interpreted as indicating earlier valley profiles. The Beacon Group sediments and the dolerite sills dip gently south-west towards the plateau and so the terraces typically slope up-glacier (Fig. 2).

Structural terraces of this kind are common in other Antarctic areas where dolerite sills are present, and in the dry areas of southern Victoria Land they appear to have been misinterpreted by Bull and others (1962) as glacial shoulders and benches carved during their first glaciation (the "1,500 m. benches"). Comparison of their map with geological maps of the same area published by McKelvey and Webb (1962), and Allen and Gibson (1962) shows that in the western half of the area the benches coincide with the surface of a dolerite sill. This appears to be so at the head of Wright Valley, on the flanks of the Olympus Range west of Bull Pass and on the flat-topped Insel Range. In the upper Wright Valley where one might expect to find valley-in-valley form extending back to the plateau, the North Fork, at least, heads in a small cirque rimmed by retreating dolerite cliffs; this clearly indicates a structural origin for benches farther east on the Olympus Range (Bull and others, 1962, fig. 3). In the lower Wright Valley the bench appears to be structurally controlled, formed by stripping of the peneplain above the Basement Complex (Bull and others, 1962, fig. 5). The dolerite sill that is commonly present just above the peneplain is often separated from it by a thin layer of basal Beacon

Group sediments. Differential erosion of this layer would be expected to undercut the sill and cause rapid retreat of the scarp. McKelvey and Webb (1962) indicate on their map that such a layer is present in the eastern Olympus Range. The bench here appears, from the figure, to have a gentle up-valley slope, which seems to confirm its origin as structural rather than glacial, for as Bull and others (1962, p. 66) state "the peneplain surface, the bedding of the *Beacon Sandstone* and the *Ferrar Dolerite* sills all dip regionally westwards below the ice plateau at a low angle (3–5°)".

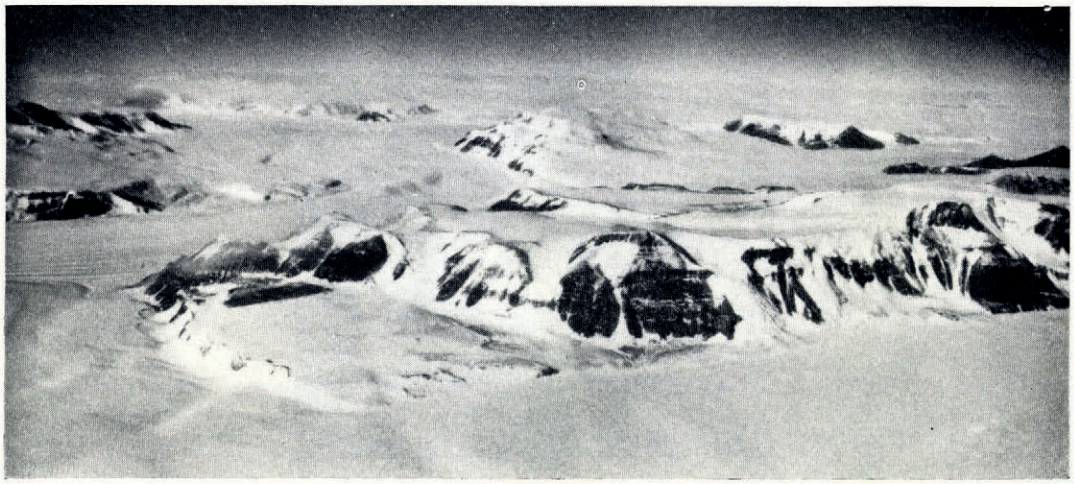

Fig. 2. Structural bench (lower left) on the east side of the Beardmore Glacier between the Mill and Keltie Glaciers. A further bench formed on a sill can be seen on the far side of Keltie Glacier (extreme left). (Official U.S. Navy photograph)

Although 1,500 m. benches in other parts of the dry valley area are not figured I would suspect that all are structural benches of one of the above two types. As the interpretation of such benches as glacial seems to be the sole evidence on which Bull, McKelvey and Webb base their first glaciation, this should be regarded with some caution.

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