MINIATURE NIVATION CIRQUES NEAR MARBLE POINT, McMURDO SOUND, ANTARCTICA

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Elevated marine deposits near the mouth of the melt-water stream that enters Bernacchi Bay approximately 2 miles (3·2 km.) south-west of Marble Point, McMurdo Sound, Antarctica (lat. 77° 27′ S., long. 163° 43′ E.) have been cut by the stream into mesas 10–20 ft. (3·05–6·10 m.) high. The deposits, mainly sand but also silt and gravel, are frozen except for an active layer 1–3 ft. (0·30–0·91 m.) thick.

The writer studied small nivation cirques (Russell, 1933; Lewis, 1939; McCabe, 1939) on the slopes of the mesas early in the summer of 1958–59 when small snow slabs still occupied them (Fig. 1). The snow slab in one was 27 ft. (8·2 m.) long, 22 ft. (6·7 m.) wide, 2·5 ft. (0·76 m.) thick, and had a surface gradient of about 10 degrees. The headwall is a talus slope 5 or 6 ft. (1·52 or 1·83 m.) high. As much as 5 or 6 ft. (1·52 or 1·83 m.) of sediment had been

Fig. 1. A snow slab in a miniature nivation cirque cut in unconsolidated uplifted marine deposits near Marble Point, McMurdo Sound

removed in places near the snow slab (Fig. 2). In another nivation cirque with a snow slab of about the same size as much as 3 ft. (0·91 m.) of sediment had been removed. Excellently developed sand flows, fans and miniature ravines occur immediately below the slab in an area which earlier in the season had been covered with snow (Fig. 3). The sand flows extend approximately 10 ft. (3·05 m.) up and down the slope and 3 ft. (0·91 m.) across it. They are several feet long and about 1 in. (2·54 cm.) wide and are characterized by channels, levees, and bulbous and lobate termini (Fig. 4). They are superimposed one upon another and some have been buried by the fans. The coalescing fans cover an area about 20 ft. (6·1 m.) long across the slope and approximately 5 ft. (1·52 m.) wide up and down the slope. They have a surface gradient of about 13 degrees. Almost every fan has a steep-walled ravine 1–6 in. (2·54–15·24 cm.) wide immediately above its apex. The snow in the cirques is dirty because wind-blown material has been deposited on it and sand has slid down onto it. A thin moraine is present where the snow slab has melted away recently.

The material beneath a snow slab is frozen and protected from denudation. When the lower part of a snow slab melts, the uncovered material begins to thaw. Water dripping and running from the snow slab can then erode it. If the supply of melt water is small, sand flows

Fig. 2. A small nivation cirque approximately 40 ft. (12·2 m.) wide which has been cut 5 or 6 ft. (1·52 or 1·83 m.) into unconsolidated deposits near Marble Point, McMurdo Sound. The shovel gives the scale

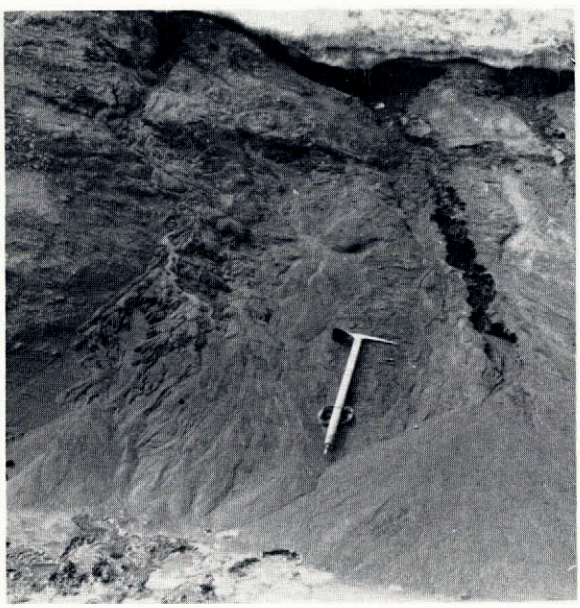

Fig. 3. Fans and sand flows in a miniature nivation cirque cut in unconsolidated deposits. The lower edge of the snow slab in the cirque can be seen in the upper part of the photograph

form but, if a greater supply of melt water is available, fans form. As the lower edge of the snow slab continues to melt, the area which can be eroded grows upward and with time the cirque increases in size. The process is relatively rapid because the deposits are unconsolidated.

The first cirque floor is flatter than the second; therefore, it represents a more advanced stage in the cirque-forming cycle.

It seems likely that snow accumulated where the cirques are because here the stream eroded the bottom of the mesa more than elsewhere. The sliding resulting from this erosion produced a valley in which snow tended to accumulate. However, snow could have accumulated originally where the cirques are now found not because of any unique characteristic of these areas but because more snow was funnelled and drifted to these places than elsewhere. As nivation continued and the cirques continued to grow, a more favored place for the accumulation of snow was developed.

Fig. 4. Sand flows characterized by channels, levees, and bulbous and lobate termini in a small nivation cirque. The lower part of the snow slab in the cirque is seen in the upper right-hand corner of the photograph

Nivation cirques are found on the walls of a ravine cut through a moraine, near the eastern end of Taylor Valley, by a melt-water stream from the Commonwealth Glacier, Taylor Valley (lat. 77° 34′ S., long. 163° 25′ E.). One cirque was approximately 100 ft. (30·5 m.) wide and 100 ft. (30·5 m.) long. Fans, solifluction lobes and sand flows with channels and levees were located below the snowbank that occupied the cirque. A nivation cirque cut 5–10 ft. (1·52–3·05 m.) into mantle rock is located near the summit of Flatiron Mountain, Granite Harbour (lat. 77° 00′ S., long. 162° 25′ E.). Three nivation cirques hundreds of yards wide and cut in bedrock are located approximately 1 mile (1·6 km.) west of Marble Point, McMurdo Sound (lat. 77° 27′ S., long. 163° 44′ E.).

Nivation, however, is only a minor process in the McMurdo Sound area. Much more geologic work is being done by aeolian, fluviatile, marine and glacial processes, and by mass-wasting not related to nivation.

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