ASH MOUNDS ON DECEPTION ISLAND

By JANET HAUFF*

THE eruption on Deception Island in December 1967 deposited a layer of ash about 5 cm. deep in the vicinity of the British station at Whalers Bay. By the time I arrived there on 12 February 1968 ash mounds covered an area estimated to be about 0·16 km.^{2} immediately behind the station. The station is situated just above sea-level and the land behind it rises up to 90 m. on Ronald Hill about 730 m. away; at first the slope is gentle but subsequently becomes steeper. Most of the gentle part of the slope was covered in ash mounds though in a few places the ash appeared to have slumped, leaving the snow surface uncovered. On walking over the mounds it was apparent that the underlying snow was crusted, but compaction had not proceeded far, since it was easy to break through the crust and sink to a depth of 0·5 m. or so in soft snow.

The general appearance of the landscape was as shown in Fig. 1. Superficially it looked like a field of dark brown humus covered with large molehills. The mounds were fairly

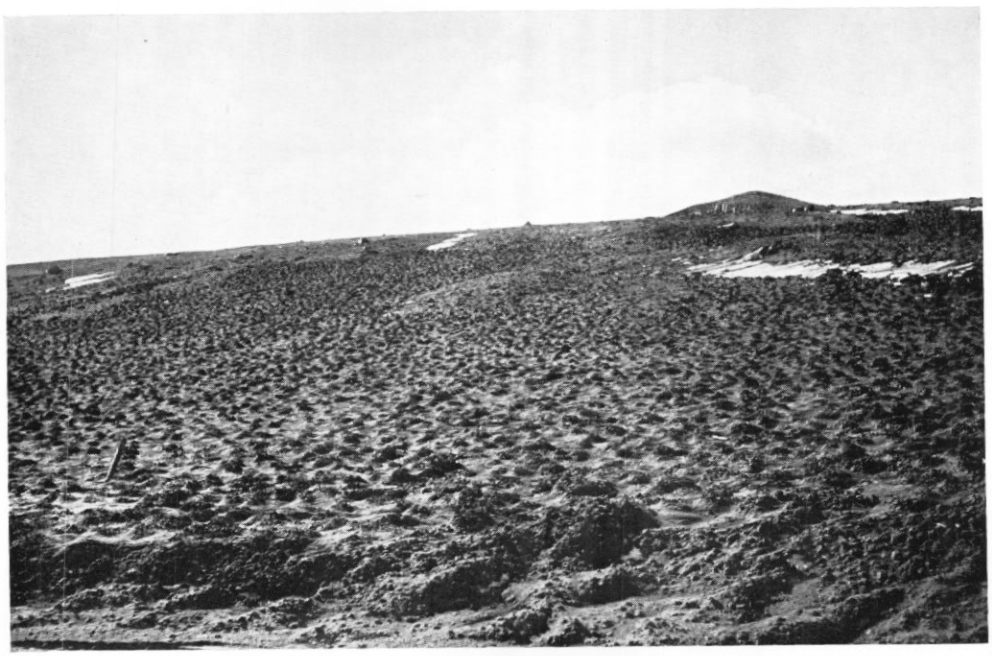

Fig. 1. General view of ash mounds on the north coast of Whalers Bay, looking towards Ronald Hill; 12 February 1968.

evenly spaced; in general they were about 15 or 20 cm. high and about 30 cm. across, though a few at the foot of the slope were larger. Although the ash itself was fine, evenly grained and homogeneous, the peaks of the mounds were covered with small, even-sized cubes formed by cracking of the ash surface, thus making each mound look like a giant ripe blackberry (Fig. 2). The ash in the depressions between mounds was smooth.

There were no other areas of these mounds in the vicinity of Whalers Bay and there was no opportunity of observing whether they occurred elsewhere, but I was told in January 1969 that there were at that time numerous similar patches in various parts of the island.

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Fig. 2. Close-up of ash mounds showing "blackberry" formation; 12 February 1968.

On 18 January 1969, I again visited Whalers Bay and some of the mounds were still extant. Those that remained, however, covered a much reduced area, about 90 m. long by 45 m. wide, at the lower edge of the slope where they had been observed in 1968. Farther up the slope which had been covered with mounds in 1968 it was completely clear of both ash and snow, the exposed surface being that of the pre-1967 volcanic material.

In 1969 the mounds varied in size from 40 cm. across and 20 cm. high to 1·2 m. across and 0·9 m. high. The larger mounds were towards the downhill edge of the patch. The general appearance of the mounds in 1969 was indistinguishable from their appearance in 1968. Presumably, they had been covered with snow at some time during the winter and, indeed, some snow overlay remained in a melting condition in the depressions between the mounds (Fig. 3). But whatever snow there had been had not in any way disturbed the delicate arrangement of the ash cubes on top of the remaining mounds which still seemed to be in pristine condition. A section was cut through a mound which was 50 cm. across and 25 cm. high. The ash cover was a uniform 5 cm. thick and the ash cubes at the top of the mound were about 5 cm. across. Unlike the year before, however, the snow core had consolidated and it would have been impossible to fall through the crust—indeed it was quite difficult to dig a section with a spade. The appearance of the mound in section was as in Fig. 4.

There was no visual difference in consistency between different parts of the snow core, but it was easier to cut the section through the crest of the mound than through the snow under the depression between one mound and the next, suggesting that melt water had drained and frozen there; much of the melt water must have drained away through the snow, down the slope and thence to the sea. In some of the mounds the snow showed through the cracks in the ash at the crest of the mound.

The even spacing of the mounds and the surface crusting of the snow in 1968 suggests that the ash must have fallen at a time when the 1967 snow had just started to melt and in so doing had formed not only a crust but a pattern of surface ridging (for example, melting snow surfaces in these latitudes sometimes ridge in polygons). Such a surface pattern could have provided the starting point for the formation of the mounds. On this assumption, if the higher parts of the underlying snow surface had a thinner cover of ash than that which settled in the then

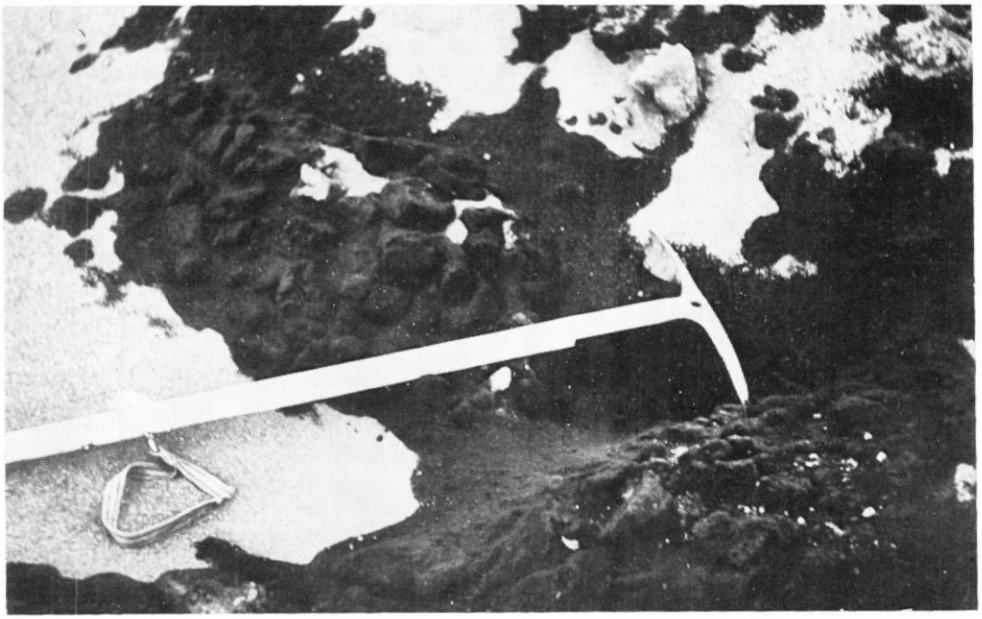

Fig. 3. Snow overlay in depressions between ash mounds; 18 January 1969.

hollows, ablation would proceed faster beneath this thinner cover and the better protected snow in the hollows would eventually become the top of the mounds. This method of ash-cone formation has been described by Swithinbank (1950), Wilson (1953) and Krenek (1958). If this had been the mechanism, the ash might be expected to be thicker at the top of the mounds than in the depressions between them. But the section through a mound (Fig. 4) shows that the ash cover was in fact a uniform 5 cm. thick by January 1969. It seems exceedingly unlikely that this uniformity could have been achieved by redistribution of ash by lateral movement in the course of differential ablation of the underlying snow, particularly since the average thickness of ashfall over the area was stated to have been 5 cm. It is less tortuous to assume that the ash, in January 1969, had not been subjected to lateral movement and was lying approximately where it had fallen in December 1967. A different mechanism must thus be postulated to account for the formation of the mounds.

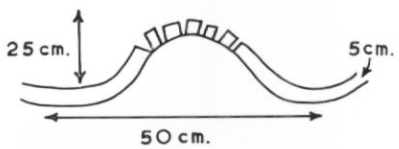

Fig. 4. Section of an ash mound; 18 January 1969.

The alternative of a uniform layer of hot ash falling in pre-existing hollows and there melting the underlying snow surface to exaggerate the existing depressions—a process suggested by Lewis (1956)—is ruled out by the fact that the ash was said to have been cold when deposited. The cracking of the surface of the ash at the top of the mounds to form the 5 cm. cubes nevertheless suggests that differential melting of the underlying snow had already taken place by February 1968, that the mounds in the form in which they then appeared post-dated the ashfall (McAllister, 1956) and that the process had been a quick one.

According to Richardson and Harper (1957), the best examples of polygons are found on snow initially quite thick and undergoing rapid ablation. If these conditions were fulfilled in

Whalers Bay in December 1967, then the process already under way of producing deeper depressions in the snow surface may not have been inhibited by the deposition of a cover of 5 cm. of volcanic ash. On this assumption the mounds could have taken on the characteristic shape observed in February 1968 within a very short period of the ashfall, though general melting beneath the ash cover during the warmer periods up till January 1969 had continued to produce further consolidation of the snow underlying the mounds at the bottom of the incline behind the station and complete melting of the underlying snow higher up the hill. Once the snow base had melted, the residual ash must have been blown away, for there was no sign of it. What was remarkable was that the ash covering the remaining mounds had remained intact despite the cover of 1968 snow (since melted) and the very high winds to which the area is constantly subjected.

It would appear to be the first occasion on which ash mounds of this kind have been observed in Antarctica.

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