the usual expectation when continentality increases!) The amount of meridional (north–south) development of this trough is important and differs in different years. Its position was over north-western Europe, with the axis lying between longs. 0° and 10° E. in the summers of both 1962 and 1965: in 1962 the trough was largely confined to latitudes north of 50° N., and only the Scandinavian glaciers were directly affected, whereas Central Europe had a rather warm summer; but in 1965 the trough axis was well marked as far south as Spain, so that Central Europe not only experienced some of the cold air but also the repeated cyclogenesis characteristic of the forward side of an upper cold trough. Thus the Alpine glaciers were well nourished in the summer of 1965 but not in 1962.

Computations by J. M. Mitchell, U.S. Weather Bureau, of changes in world temperature since 1880 show very much the same trend as the vigour of the westerlies. World temperatures attained a maximum in the early 1940's of the order of 0.5 deg above the temperatures generally prevailing around 1880 and subsequently fell again. The cooling since the early 1940's has been sharpest in the Arctic, where the sea ice has increased again, but by the 1950's the area of cooling showed long extensions into middle latitudes in certain sectors—presumably the sectors affected most by the changed positions of the upper cold troughs. In the 1960's so far, average temperatures over the Arctic and in Britain and Scandinavia, especially in the summers, are believed to be lower than at any time since well back in the last century. In the 1950's Central Europe, like the eastern U.S.A., European Russia and parts of Central Asia, was experiencing higher temperatures than before, i.e. a change of temperature out of phase with that going on over most of the world and notably out of phase with that going on over neighbouring sectors of the northern hemisphere. This presumably means that Central Europe, European Russia and Central Asia were more affected than formerly by upper warm ridges owing to the longitude shift of the waves in the upper westerlies. In view of the cooling tendency of recent years in neighbouring sectors of that same latitude zone, and over most other parts of the world, it may be premature to conclude that the prospects for the Alpine glaciers at the present time are far from favouring fresh growth—though any growth would probably come only after an appropriate lapse of years for increased accumulation at the glacier heads to affect the lower reaches.

In studying the effects of the atmospheric circulation it will be essential to study details of the position and north–south amplitude of the upper cold troughs and ridges, as well as the layout of regions of change of vorticity in the flow of the upper westerlies favouring cyclogenesis. These items are not necessarily revealed by such measures as the zonal index however defined.

Apart from relationships between glacier changes and the general wind circulation, I believe it is necessary to consider the effects of occasional volcanic dust veils such as the great one which covered most of the world in 1963–65 after the eruption of Mount Agung in Bali early in 1963. There is unmistakable evidence of a (doubtless temporary) additional reduction of world temperature for those years amounting to about 0.5 deg at its strongest. It may also be desirable to keep a continuous record of variations of the albedo of glaciers, from month to month and from year to year, in case pollution of the glacier surface by industrial smoke or wind-blown dust should have important consequences in the ablation season.

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REFERENCE

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Sir, *Primary and secondary polygons*

During a visit to Iceland in the summer of 1966 a species of patterned ground, possibly hitherto undescribed, was observed. It was discovered on the small summit plateau of the 998 m peak on the Thingeyri peninsula, Vestfirthir, north-west Iceland. A large area of this plateau was covered with large sorted polygons inside each of which several smaller sorted polygons were situated. The primary polygons measured 5–6 ft (1.5–1.8 m) and the secondary polygons 1–2 ft (0.3–0.6 m), respectively, across their internal diameters (Figs. 1 and 2).

Fig. 1. A single primary polygon containing many secondary polygons, north-west Iceland

Fig. 2. Several secondary polygons within a primary polygon, north-west Iceland

According to Washburn (1956), secondary sorted circles within large primary ones have been described by Poser, but such secondary *polygon* development is not mentioned in Washburn's review.

If any readers are acquainted with further records of such patterned ground or have suggestions as to its origin, I should be pleased to hear of them.

In addition, a simple laboratory experiment was devised to demonstrate stone stripe formation. This illustrated that forces analogous to alternating contraction and expansion could result in stripes.

A large polythene bag (2 ft 6 in by 4 ft; 0.76 by 1.2 m) was anchored at the base. It was filled to a depth of about 1 ft 9 in (0.53 m) with soil containing a number of small flat stones up to 0.5 in (1.25 cm) across. The neck was gently pulled up about 6 in (15 cm) and allowed to descend repeatedly (Fig. 3a and b).

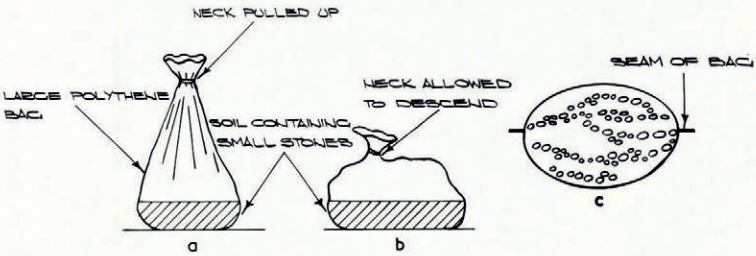

Fig. 3. Experiment devised to produce stone patterns in a polythene bag (a, b). Surface view of stone patterns after about 50 oscillations (c)

This compressed and relaxed the soil round the edges, simulating contraction and expansion. Since the bag was a simple one consisting of two polythene sheets sealed together, the forces were only operative perpendicular to the sides of the bag. After about 20 elevations, lines of stones appeared, trending parallel to the sides of the bag (Fig. 3c), and perpendicular to the applied force. A round-bottomed bag would yield polygons.

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Sir,

Errors in the determination of ablation using stakes

It seems that most mass balance determinations with a net of ablation stakes have been made without taking into account the fact that, when the lines of flow are not parallel, the emergence $-e$ (variation of the length l of the stake immersed in ice) of the stakes is not equal to the ablation $-b$. This is perhaps one of the causes of the curious undulations shown by curves of ablation versus altitude.

Ice being incompressible $\partial w/\partial z = -(\partial u/\partial x + \partial v/\partial y)$ (evident notation; Oz vertical, positive downwards).

For a stationary glacier w on the surface is $-b$; at the lower end of a stake of length l, w is $-b + l\,\partial w/\partial z$.

When short stakes are used it is generally their feet which are linked to the ice (in temperate glaciers, where holes are full of water and do not close, an anchorage at the foot is necessary when wooden stakes