The Editor,
The Journal of Glaciology

SIR,

Calorimetry

I have read with interest the paper by Mr. I. G. Halliday on "The liquid water content of snow" in the March 1950 issue of your *Journal*. It is a very good paper but there are two little mistakes. First, I did not propose "to use a heating coil to bring the calorimeter and melted sample back to the temperature of the original hot water "(page 358, line 10). Secondly, I do not "distrust voltmeters and ammeters for power measurements" (page 360, 12th line from the bottom). Probably these mistakes come from translation which is always very difficult in scientific works.

I am very interested in the private communication from S. Sigurdsson. I should be pleased if you would lend it to me.

KARL CROCE

(13*b*) *Inzell*,
Germany
20 *March* 1950

[Mr. Halliday writes that he acknowledges Dr. Croce's first correction, due, as the latter suggests, to a misunderstanding of the German. On the second point Mr. Halliday had based his statement on what he had taken to be Dr. Croce's preference for the calorimetric method of measuring current.—*Ed.*]

SIR,

Submerged Ice Crystals in Glaciers

I can inform you of the presence of crystals such as those described by Dr. A. Schneider in your Journal (Vol. 1, No. 4, p. 190–91 and 177). I have seen them for instance in the ablation zones of the Variegated, the East Twin and the Tyndall Glaciers of Alaska; on the Granite, the Silvertip and the Deville Glaciers in British Columbia and on a glacier on Monte Canin in Italy. In each case they were growing from the edges of the holes towards the centers, and appeared to be equally well developed on all sides of the holes, even under overhangs and on the flat portions. They are always elongated in the direction of growth, and occasionally show, as Dr. Schneider has said, a twinned appearance.

In a few cases I have observed these crystals where the water is no longer in the hole. And of the holes in this category there appear to be two types; those from which the water has been drained away due to glacial movements, and those in which the crystals have grown so large that there is no further room for the water.

These holes seem to be due to crevasses which have opened and then melted differentially while open, thus allowing a groove to develop along one side. Subsequent closing has left a hole or cavity which fills with surface melted water. The holes are inclined at various angles, some as little as forty-five degrees from the horizontal. They always appear fairly well down in the ablation zone, since there is no chance for this type of situation to arise where ablation is not the order of the year.

It is my opinion that these crystals are derived by the following process. Water in the hole soon reaches a temperature very close to that of the ice, but not quite as low since the water is able to circulate somewhat and thus avoid freezing solidly. However, since the ice is below freezing, the water in immediate contact with the ice will be lowered below the freezing point and will crystallize. The crystals will develop on the axes of the already existing crystals within the ice itself, which are exposed along the edges of the hole. Thus they occasionally become twinned and interfere with the growth each of the other. The crystals slowly become larger and hinder the circulation of the water within the hole so that eventually the whole mass will freeze, providing the process is allowed to go on to its natural completion.

WILLIAM L. PUTNAM

Department of Geology,
Tufts College,
Medford 55,
Massachusetts
2 *February* 1950