The paper by Dr. J. W. Glen[4] appears to substantiate the relation between the formation of ogives and the mechanism of movement within the ice fall, and surely any theory must take into account the formation of ogives under the different conditions mentioned above.

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SIR,

Mr. Ives is, of course, correct in pointing out that ogives which form below a severed ice fall cannot be related to the original stratification in the ice field above, but the new stratification—predominantly seasonal—developed in the avalanche fan must surely be present in these ogives. The most helpful studies which Dr. King and Mr. Ives made of ogives in Iceland certainly point to the reality of overthrusting and shearing in rotating the ice layers at the foot of the steep Morsárjökull avalanche fan, and probably at the foot of the ice fall on the same glacier system.

Having at first mistaken sedimentary layering in Norwegian cirque glaciers for tectonic layering, I may now be underestimating the frequency of purely tectonic layering below an ice fall, but I can assure Mr. Ives that I am not underestimating the reality of rotation at the foot of ice falls or other steep slopes on glaciers. This may involve overthrusting along discrete surfaces and also shearing without such discrete fractures. However, I still think that the major problem remains of distinguishing between the contribution of sedimentary layering—primary or secondary—and of tectonic layering to these structures. The complete obliteration of the seasonal layers formed in the *névé* must, I think, be very rare except at a severed ice fall or on a glacier with very complex and active overthrusting and shearing.

I am grateful to Mr. Ives for reminding me that, in thinking too much of Austerdalsbreen in what perhaps should have been a more general discussion, I over-simplified the matter.

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SIR,

The Correct Rammsonde Formula

In his derivation of the theory of the Rammsonde, Haefeli[1] gave two formulae for the ram resistance:

$$W_1 = \frac{Rh}{s} + (R+Q) \text{ for a completely elastic impact,}$$

and

$$W_2 = \frac{Rh}{s} \cdot \frac{R}{R+Q} + (R+Q) \text{ for a completely inelastic impact.}$$

He proceeded to use the first formula, because it is somewhat simpler, and everyone since has followed his example.

However, impacts in snow or firn are almost completely inelastic. When the weight strikes the top of the tube, an elastic wave travels down it. A completely elastic impact would occur only if the

https://doi.org/10.3189/S0022143000024576 Published online by Cambridge University Press