SIR,   *Depth of water-filled crevasses that are closely spaced*

I agree with the conclusion of Robin's letter. Another way to reach his conclusion is as follows. Consider material that contains an infinite row of parallel cracks. Let the spacing d between the cracks be much smaller than the length L of the cracks. The stress analysis of this problem when the outer boundary of the material is subjected to a uniform stress is given in Sneddon and Lowengrub (1969 p. 57–62), in Isida (1973), and in Tada and others (1973, p. 12.1). The result of this analysis is that the stress singularity that exists at the crack tips is approximately the same as that for an isolated crack whose length is equal to the spacing d between the parallel cracks. Thus if an applied tensile stress T is applied (in a direction normal to the plane of the cracks) at the outer boundary, the stress singularity is such that the tensile stress at distance r ahead of a crack tip is of the order of $T(d/r)^{\frac{1}{2}}$ where $0 \leqslant r \ll d$. The stress singularity at the tips of the set of parallel cracks of length L and spacing d is approximately the same as that for a set of parallel cracks of length d and spacing d (or of larger spacing).

For a set of closely spaced crevasses of spacing d and length L ($d \ll L$) the stress singularity at the crevasse tips, by analogy with the results just mentioned, is approximately equal to $(T+p-\rho_i gL)(d/r)^{\frac{1}{2}}$ where ρ_i is the ice density and g is the gravitational acceleration so that $\rho_i gL$ is the ice overburden pressure at the tips of the crevasses, T is the longitudinal tensile stress present in the glacier, and p is the water pressure at the bottom of the crevasses. If no water is present ($p = 0$), a tensile stress singularity is present if L is smaller than $T/\rho_i g$. Thus because of the presence of a high tensile stress at the crevasse tips, closely-spaced water-free crevasses can penetrate a glacier until their depth reaches Nye's value of $L = T/\rho_i g$. Deeper penetration is not possible in this case because a *compressive* stress singularity then would come into existence. For completely water-filled crevasses, $P = \rho_w gL$ where ρ_w is the density of water. Since $\rho_w > \rho_i$, a tensile stress singularity exists if $T \geqslant 0$ for *all* values of L. Thus, as concluded by Robin, a set of closely spaced water-filled crevasses should be able to penetrate to the bottom of a glacier.

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8 January 1974

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SIR,   *Ice volcanoes in Ozero Baykal*

I have read with great interest the article of R. K. Fahnestock and others (1973) published in your *Journal.* My interest may be ascribed to the fact that about forty years ago I observed similar formations in Ozero Baykal (Tsurikov, 1939). At that time the first frosts and the freezing of the lake were separated by a considerable gap of time. A peculiar ice foot similar to the one described by Fahnestock and others (1973) as "shore-fast ice" formed at the lake's south-eastern shores. The local inhabitants name these ice formations "sokuy". This term has been preserved in the Russian scientific language (Botkin, 1900; Shostakovich, 1908; Tsurikov, 1939). "Sokuy" is composed of one or several ice ridges facing the lake with steeper and at times vertical slopes. The ridge heights amount to 5.5–6.5 m.

Among the ridge summits close to the lake's margin one observes the so-called "sopki" which resemble "cone-shaped ice hills which are hollow within and open to the Baykal. The outer features of these ice hills resemble ice marquees" (Tsurikov, 1939). At times the latter are spaced at a sufficient distance from one another and in other instances they are grouped together. In some areas, close to the shores where "sokuy" is not formed "sopki" are encountered as isolated hills. At times they are 6 m high.