RELEASE AND MOTION OF ARCTIC SLUSHFLOWS

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Two types of slushflows studied during the spring of 1981 and 1982 in the Philip Smith Mountains, central Brooks Range, Alaska, were (l) point failures of water-saturated snow in wide gullies of less than 10° gradient, and (2) slab, or "plug," releases in constricted 15° to 20° gullies. The plug-release slushflows were the larger, more energetic and potentially destructive form. Plug fracture boundaries consisted of a proximal crown, distal stauchwall, lateral flanks, and a bed surface· within a rapidly discharging snowmelt-runoff stream. Crown surfaces were 2.7 to 6.6 m thick, 10 to 18 m wide, and 590 to 710 kg/m^3 density. The crown-to-stauchwall distance was 40 to 60 m, and plug volumes ranged from 1000 to 5000 m^3.

After release, the plug quickly liquefied and slid up over the stauchwall. Rapid acceleration would follow on slopes of 10° to 15° as the plug entrained nearly all of the snow, stream water, and a considerable rock load estimated as 10 to 15% of the slushflow volume. In some cases, entrained boulders, more than 2 m long, were transported to the distal margin of the flow, more than 1 km from the crown. Slushflow mass would increase quickly; the final volume of the flow would be roughly 10 times the released plug volume, but at any instant the moving mass would be confmed to less than 10% of the total path length. Velocities observed in two moderate-sized flows were 15 to 20 m/s. Indirect methods used to compute velocities of two very large 1982 slushflows include (1) energy calculations at an adverse slope runup, (2) application of a rigid-block model with a constant friction coefficient equal to the tangent of the mean path slope (tan *ex)*, and (3) application of a two-component model assuming a constant sliding friction coefficient less than tan ex and an inertial velocitysquared term. All three methods yield maximum velocities of 23 to 25 m/s for the two large 1982 flows. Large slushflows had ex - angles of 7° to 9°, approximately half the ex - angles of the flattest snow avalanches. Large alluvial deposits produced by slushflows are as' much as 800 m long with mean gradients of 5° to 6°. These deposits are widespread throughout Brooks Range valleys and attest to the importance of slushflows as an Arctic erosion process.