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TITLE: Glacier-Volcano interactions: With special consideration of Mt. Wrangell and Mt. Redoubt, Alaska

ABSTRACT

Volcanoes are hazardous enough without millions of tons of ice on them, but with ice they become especially interesting, and potentially destructive, mixtures of fire and ice. Alaska is an exciting place because it has 90% of the U.S. explosive volcanoes, many of which are glacier-covered. On glacier-covered volcanoes large amounts of water, snow, ice and water-saturated rock can be mobilized during an eruption to produce rapidly moving mudflows or "Lahars". Recent, forceful reminders of this were provided by Mt. Redoubt, Alaska in 1966, Mt. St. Helens, Washington in 1980 and Nuevo de Ruiz in Columbia in 1985.

It is important to recognize that the effects of volcanism on glaciers are not limited to spectacular eruptions. Recovery from perturbations in glacier flow caused by an eruption may take decades. For example, a kinematic wave moving down Mt. Redoubt's Drift Glacier can still be observed 20 years after the eruption. During the early 1980's it looked as if this glacier terminus could advance enough to dam the Drift River which would pose a new hazard. Such glacier dammed lakes have formed here in the past.

Volcanic heat flux under glaciers produces basal melt water, often at high altitudes. If this water accumulates in reservoirs, failure of the conditions of confinement can produce spectacular jökulhlaups (glacier outburst floods). Saturation of the rocks adjacent to, and underlying such reservoirs helps set the stage for massive lahars when eruptions do occur. Excellent examples of such lahars exist on the flanks of Mt. Wrangell and Mt. Redoubt.

Basal melt water may also provide the fluid for convective heat transfer beneath "hot spots"; this situation apparently exists in convection cells beneath active craters along the rim of Mt. Wrangell's summit caldera. Basal melt water perturbs glacier, flow by providing a year-round source of water at the rock-ice interface and has apparently maintained anamolous advances of glacier termini along the north east flank of Mt. Wrangell since 1965. In some cases, such as at the summit of Mt. Wrangell, the loss of ice volume can be measured systematically over a period of several years to serve as a "large calorimeter" from which one can estimate magnitude and variability of the volcanic heat flux.