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The effects of subglacial volcanism on ice dynamics near the onset of the Siple Coast Ice Streams

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We examine englacial structures, reflection amplitudes, and subglacial topography imaged by ice-penetrating radar near the onset of Bindschadler and Kamb Ice Streams along the Siple Coast. These data reveal the detailed geometry of Mt. Resnik, a subglacial mountain thought to have formed through subaerial volcanism, and its influence on ice flow. Due to Mt. Resnik's position near the onset of Bindschadler and Kamb Ice Streams, localized, but significant basal melt here could play a role in the initiation of streaming ice flow in this region through its effects on the subglacial water system. This region straddles the subglacial hydrological catchment boundary between Kamb, and Bindschadler Ice Streams. Although the water sourced from the Mt. Resnik region currently flows toward Kamb Ice Stream, we show that subtle changes in surface elevation, like those associated with the stagnation of Kamb Ice Stream and the ongoing deceleration of Whillans Ice Stream, may be shifting water flow farther east, towards the Bindschadler Ice Stream catchment. Thus, water sourced from Mt. Resnik may play a role in reinforcing ice-dynamic feedbacks that result in ice-stream stagnation and reactivation cycles.

Here we use englacial structures imaged by ice-penetrating radar to assess Mt. Resnik's effect on local surface topography, which in turn affects subglacial hydropotential, and basal melt rate. We interpret a cross-cutting englacial reflector as an angular unconformity that results from enhanced wind erosion as ice flows over the top of this mountain, indicating that the mountain has a local effect on ice thickness and thus also basal water routing. We also identify a prominent internal layer downwarp over an area of locally elevated basal reflectivity. This downwarp is probably the result of local melting at the base of the ice sheet, and provides a constraint for simple ice flow models that can be used to infer the basal melt rate and water production associated with this putative subglacial volcanic system.