

Radar Studies of the Trunk and ‘Sticky Spot’ of Kamb Ice Stream

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This past field season we acquired approximately 275 km of ground-based ice penetrating radar data on the trunk of Kamb Ice Stream (KIS) as a part of a two-year program of radar and GPS studies examining the possibility of ice stream reactivation. Many of the profiles explore the region of the ‘sticky spot’ and adjacent portions of the ice stream in the vicinity of a series of camps occupied throughout the 1980’s and 1990’s, collectively referred to as “Upstream C.” We also investigated a separate area approximately 80 km upstream where a sequential pair of laser altimeter profiles indicated a localized anomalous region of surface uplift of 2 m/a over a two year period, 1998-2000 (Spikes, et al., 2003).

The radar data provide detailed depictions of bedrock and internal layer stratigraphy; in many cases the layers are present nearly to the bottom. We have identified a bright layer at about two-thirds to three-fourths of the ice thickness in all profiles that likely is the same bright layer dating to 17.5 KY that we have detected throughout West Antarctica in ITASE traverses (Jacobel and Welch, 2004). We have also produced maps of variations in bed reflectivity from the radar returns that correspond closely (but not identically) with the surface expression of the sticky spot in satellite imagery (Figure). Bright areas of the bed are found in the trunk of the ice stream both north and south of the sticky spot and along the south margin where a layer of liquid water was identified in Cal Tech bore hole 00-01.

However, the brightest bed reflections are found in the trunk region 80 km upstream where anomalous surface uplift has been noted. Also, echoes from near the bed at this location indicate the possible presence of a highly reflective surface off to the north side of our profiles. Our bed amplitude studies are augmented by two densely-spaced constant midpoint profiles that enable us to characterize attenuation and e/m wave speed within the ice (Pettersson, et al., abstract this meeting).

In addition, we have re-imaged fold features in the internal layering of the ice that correspond to structures seen in our 1988 ground-based radar studies in the UpC vicinity when the sticky spot was first identified as overlying an area of raised bedrock (Jacobel et al., 1993, Retzlaff et al., 1993). These two surveys enable us to measure components of the accumulated strain over the intervening 16 years.