Subglacial conditions of inland West Antarctica from US-ITASE deep radar reflection analysis

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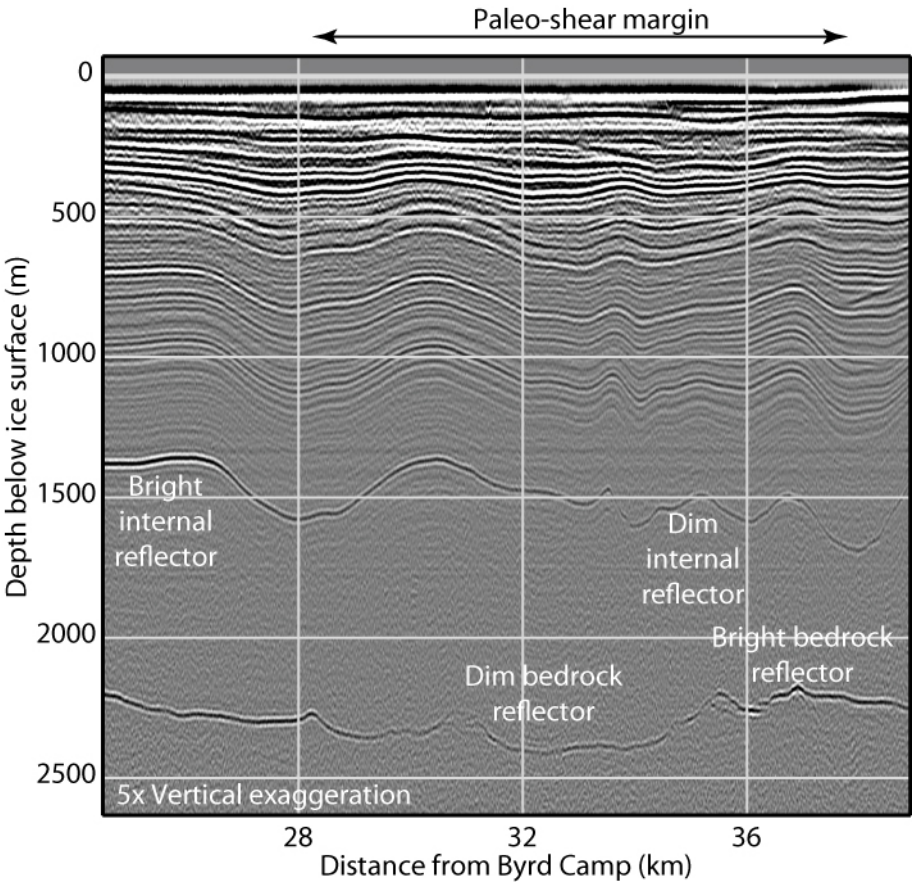
Conditions beneath ice sheets, particularly the presence of water, have significant impact on ice flow behavior. Numerous studies have discussed in the dramatic influence of water on the shear strength of the till beneath the WAIS ice streams compared to the nearly stagnant inter-ice stream ridges. Ice-penetrating radar observations provide a method for observing changes in basal conditions over large areas based on the strength of the subglacial reflection.

We present here the results of applying a method similar to that used by Gades et al. (2000) with data from Siple Dome to calculate a depth-attenuation function for the 2002 US-ITASE deep radar profiles in the central WAIS. Challenges arise because of the variability of ice-bed interface as well as within the ice itself. The traverse covers 1,400 km in length including: ice stream tributaries, mountain ranges, nearly stagnant ice, isolated subglacial melt events, and ice thickness up to 3.5 km. We examine the strength of the bedrock reflector as well as a particularly bright internal layer to determine the variation in reflector strength as a function of depth. Using the attenuation curves, we calculate the relative strength of the basal and internal reflections along the traverse. We find a different behavior in the bed reflectivity of the interior regions of WAIS than is seen in regions of the Ross Sea ice streams.


Paleo-shear margin
0
500
1000
1500
2000
2500
Depth below ice surface (m)
Bright internal reflector
Dim internal reflector
Bright bedrock reflector
Dim bedrock reflector
5x Vertical exaggeration
28
32
36
Distance from Byrd Camp (km)