Evidence for Major Miocene/Pliocene Glacial Incision in the Erosional History of Wilkes Subglacial Basin

[1]Sam Kodama, [2]Stephen Cox, [2]Sidney Hemming, [3]Pete Reiners, [3]Stuart Thomson, [4]Kathy Licht

[1]Columbia University, [2]Lamont Doherty Earth Observatory, [3]University of Arizona, [4]Indiana University-Purdue University Indianapolis

The thermal sensitivity of the Apatite (U-Th)/He (AHe) system to exhumation through shallow crust allows for applications to interrogate the evolution of glacial landscape under the East Antarctic Ice Sheet. We analyzed granitic, and mafic pebbles sampled from Integrated Ocean Drilling Program Cruise 318 near the Adélie Coast of the Wilkes Subglacial Basin with AHe dating to reconstruct the evolution of the subglacial landscape which produced these pebbles. The pebbles were ice rafted dropstones with depositional ages ranging from Oligocene to Pliocene. This allowed us to reconstruct the evolution of the Wilkes Subglacial Basin after the onset of Antarctic glaciation. AHe ages taken from pebbles deposited with Oligocene sediment ranged from ~300-400 Ma with an outlier age of 143 Ma. A Miocene pebble showed AHe ages around 190 Ma while several Pliocene pebbles produced a spectrum of AHe ages with age populations as young as 30-50 Ma and as old as ~350 Ma. If early phases of East Antarctic glaciation led to significant glacial incision, AHe ages would be expected to decrease after the onset of glaciation of Antarctica around 34 Ma. Rapid glacial incision would expose rocks that were previously at or below the AHe partial retention zone of ~50-80°C. This appears to be expressed through the decrease in AHe ages across the transition from the Oligocene to the Miocene and Pliocene. The wide range of AHe ages found in the Pliocene, the young 30-50 Ma ages in particular, supports localized deep glacial incision in some areas of the Wilkes Subglacial Basin in the late-Miocene and Pliocene. This timing is consistent with inferred development of subglacial fjords found in the neighboring Aurora Subglacial Basin. Ongoing U/Pb and 40Ar/39Ar biotite or hornblende analysis of the pebbles will be used to compare the thermochronology of specific source terrains to provenance the pebbles. Preliminary results agree with Grenville and Ross Orogeny ages seen in the subglacial basin. The AHe analysis of these pebbles begin our understanding of the glacial landscape evolution of Wilkes Subglacial Basin and will help shed light on the inception of some of the major features of this landscape providing valuable information for future ice sheet models.