Tracing past Antarctic ice flow paths and modern transport processes with TAM till

Kathy Licht, Emerson Palmer and Jeff Swope

IUPUI Department of Earth Sciences, 723 W. Michigan St., Indianapolis, IN 46202

G. Lang Farmer

Department of Geological Sciences and Cooperative Institute for Research in the Environmental Sciences, University of Colorado, Boulder, 80309

Ross Embayment till provenance was investigated by comparing the coarse sand composition, as well as the Nd and Sr isotopic composition, of East and West Antarctic source area tills with till samples from across the Ross Sea. Western Ross Sea tills exhibit mineralogic and lithological similarities to East Antarctic tills, whereas eastern Ross Sea tills are compositionally similar to West Antarctic tills, particularly in their dearth of mafic components. Tills from the eastern Ross Sea have Nd and Sr isotopic compositions similar to West Antarctic tills and in the western Ross Sea, the till samples have higher εNd values (-4 to –7). Central Ross Sea tills have εNd values ranging from –7.1 to –12.5, and a mixed source sand composition. Thus, the central Ross Sea trough contains components of both East and West Antarctic derived till, marking the confluence of the East and West Antarctic Ice Sheets during the LGM.

To build a more robust dataset of till composition from East Antarctic outlet glaciers that discharge into the Ross Embayment, samples were collected from sixteen moraines at the head and along the length of the Byrd and Nimrod Glaciers in 2005. Bulk sediment (till) and >300 pebbles were collected at each site in order to assess changes in particle size and composition during transport. Sites at the head of both glaciers contain more abundant silt and clay (fines) than downstream sites. In particular till from the Lonewolf Nunataks at the head of the Byrd Glacier contains >50% fines. Till collected from active lateral moraines along the trunk of both glaciers typically has <10% fines. The presence of abundant fine sediment in upstream and midstream Byrd and Nimrod Glacier till indicates a subglacial component whereas lateral moraines lack fines and are dominated by locally eroded bedrock. This observation is supported by preliminary analysis of the pebble composition. Pebble composition reflects local bedrock outcrops in all lateral moraines from the trunk of both glaciers, whereas upstream sites contain a component of non-locally derived material. These data support the model of debris transport described by Whillans and Cassidy (1983).

The available data indicate that the East Antarctic ice sheet provided a significant flux of ice to the Ross Sea, overcoming the barrier imposed by the Transantarctic Mountains, and despite the apparent lack of an increase in the thickness of the EAIS during the last glacial maximum. This observation supports LGM ice sheet reconstructions in which significant amounts of ice are delivered to the Ross Sea from both the WAIS and EAIS,

which implies that the current configuration of the ice streams in the WAIS was formed during deglaciation and thus represent a substantial change in ice flow since the LGM.

Whillans, I.M., and Cassidy, W.A., 1983. Catch a Falling Star: Meteorites and Old Ice. Science v.222, p. 55-57.