Roosevelt Island – a good place for an ice core

Howard Conway[1], Nancy Bertler[2], David Bromwich[3], Ed Brook[4], Dorthe Dahl-Jensen[5], Karl Kreutz[6], Andrei Kurbatov[6], Paul Mayewski[6], Eric Steig[1], Ken Taylor[7], Ed Waddington[1], and Jim White[8]

[1]*Dept. of Earth and Space Sciences, University of Washington, Seattle, WA 98195. USA*
[2]*Antarctic Research Center, Victoria University of Wellington, N.Z*
[3]*Byrd Polar Research Center, The Ohio State University, Columbus, OH 43210, USA*
[4]*Dept. Geology, Oregon State University, Corvallis, OR, USA*
[5]*Ice and Climate, Niels Bohr Institute, University of Copenhagen, Copenhagen, Denmark*
[6]*Climate Change Institute, University of Maine, Orono, ME 04469, USA*
[7]*Desert Research Center, University of Nevada, Reno, NV 89512, USA*
[8]*Inst. of Arctic and Alpine Research, University of Colorado, Boulder, CO 80309, USA*

Observations and models indicate that Roosevelt Island in the eastern Ross Sea (Fig.1) is an ideal site for investigating both regional climate variations and Holocene deglaciation of the Ross Embayment. Here we synthesize geophysical observations and models of conditions on the island. Roosevelt Island is grounded 200 m below present-day sea level and rises to 550 m above sea level (Fig.1). Geophysical investigations carried out during the 1960's measured profiles of surface elevation, motion, temperature and accumulation (Clapp, 1965), and ice thickness and bedrock geology (unpublished reports by Clapp, Hochstein and Bentley). Shallow cores (up to 70 m), extracted in the 1970s were used to measure depth-profiles of density and chemistry (Langway, 1975; Langway and Herron, 1977), accumulation rate and stable isotopes (Claussen et al., 1979). We revisited the island during the 1997-98 field season and measured spatial patterns of accumulation (using 16-m firn cores and high frequency radar), and ice sheet geometry and internal stratigraphy using low-frequency radar (Fig.1).

An ice core from Roosevelt Island will help constrain past glacial changes in West Antarctica, necessary for understanding how the ice sheet will respond to future environmental change. Most reconstructions of the Ross Sea Embayment place thick ice over Roosevelt Island during the last glacial maximum (Bentley, 1999; Denton and Hughes, 2002). Depth profiles of age, stable isotopes and temperature from an ice core at Roosevelt Island will contain a record of climate and thickness histories [see Waddington et al. (2004) and Price et al., (submitted) for related investigations at Siple Dome], which can be used to establish the timing of grounding-line retreat (Conway et al., 1999).

The island is subject to strong cyclonic incursions from the Southern ocean. Both atmospheric models (Bromwich et al., 2000) and field observations (Kreutz et al., 2000) suggest that Holocene climate variations, and in particular the El Nino-Southern Oscillation (ENSO) and the Southern Annular Mode (SAM) phenomena, should be well preserved at Roosevelt Island. Preliminary ice-flow models suggest that a record of 40 ka could be obtainable; a core from Roosevelt Island would form a component of the International Partnerships in Ice Core Sciences (IPICS) 40-ka array and would contribute to the science goals of several SCAR programs including ACE (Antarctic Climate Evolution) and AGCS (Antarctic and Global Climate System).

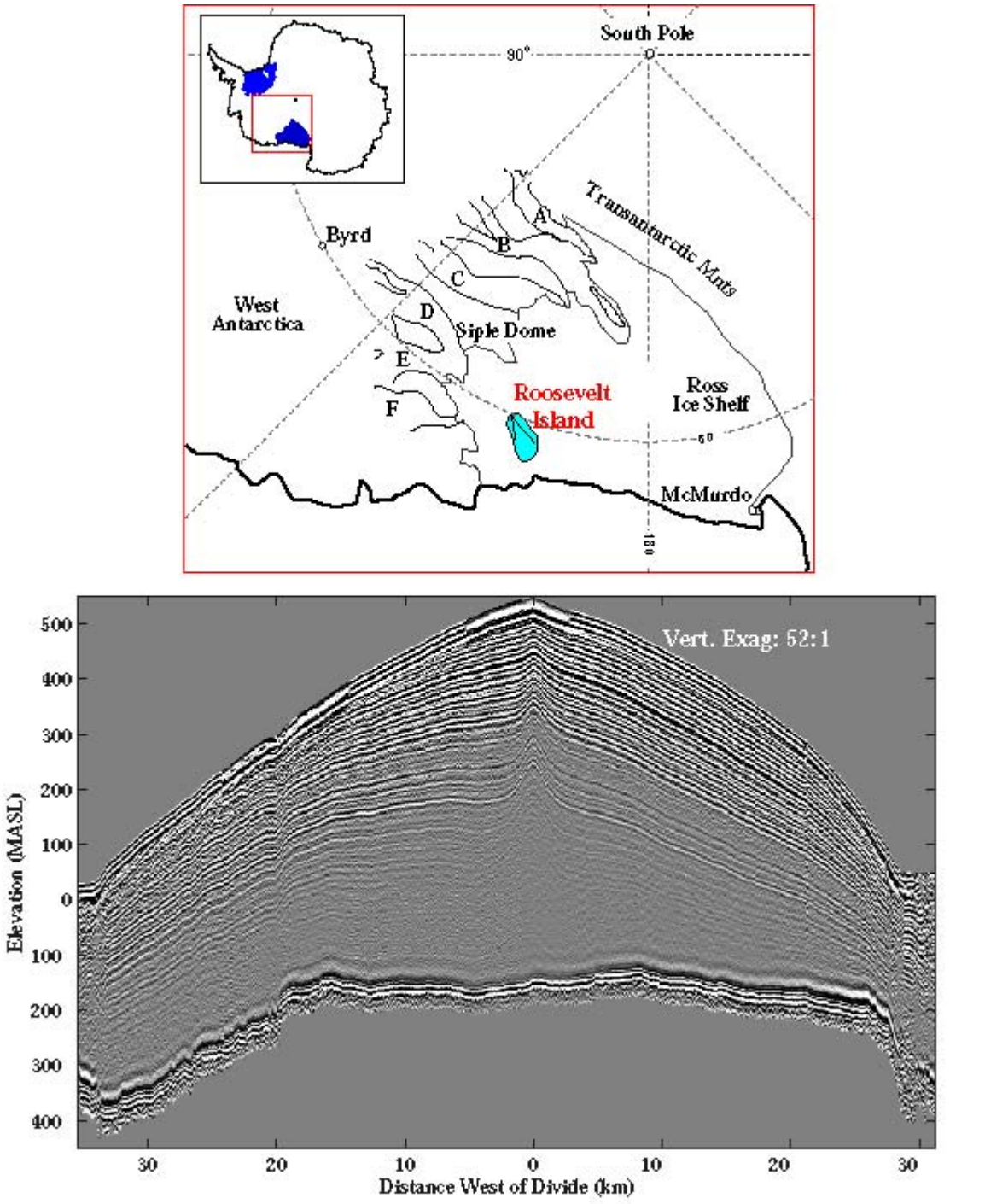

Fig. 1: Location map and 7MHz radar profile across Roosevelt Roosevelt Island. The profile extends onto the surrounding iceshelf on both sides of the island.