LARISSA: Using integrated system science to understand the impact of climate change on an ice shelf system.

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LARISSA (LARsen Ice Shelf System, Antarctica) is an international research program that brings together an interdisciplinary team that transcends the boundaries of Marine and Quaternary Geology, Cryospheric Studies, Oceanography and Marine Ecology. Using the Larsen Ice Shelf System as a microcosm, LARISSA is focused on the impact of climate change on an ice shelf system from its source to its terminus, and the oceanographic and ecosystem responses to ice shelf retreat and collapse.

During the 2009-2010 Antarctic field season a coordinated logistical effort was supported by the RVIB NB Palmer, two ship-based helicopters, and fixed wing aircraft based out of Rothera. The ice core team deployed to the Bruce Plateau, Antarctic Peninsula and collected an ice core to bedrock, while glaciologists installed AMIGOS stations, which continue to monitor the ice. Concurrently a team of marine geologists and Quaternary geologists, physical oceanographers and marine ecologists conducted field studies along the margins of the Antarctic Peninsula, in the reaches of the Bruce Plateau ice drainage.

Initial analyses of the ice core indicate very high accumulation rates with very few melt layers. The core is currently being continuously analyzed for stable isotopic ratios, insoluble dust flux, anions, cations, MSA, and net mass accumulation rates. Heat flow measurements are being used to determine ice divide behavior and basal ice conditions on the Bruce Plateau. AMIGOS and automated GPS stations deployed are monitoring surface atmospheric and ice conditions. High resolution bottom photography and sediment-community samples indicate substantially higher benthic abundance and biodiversity in fjords versus the open shelf. Oceanographic and primary productivity gradients vary in the Larsen (LIS) and western Antarctic Peninsula (WAP) regions with sediment proxies indicating significant temporal variability. Holocene sediments recovered show temporal and spatial variability within the LIS, from Larsen-A (LIS-A) and Larsen-B (LIS-B) embayments, and variability along an east-west transect across the Antarctic Peninsula. Deglaciation of the WAP and LIS regions is consistent, occurring at approximately 11-11.5 ka, and both regions show mid-Holocene primary productivity highs. However, behavior of the WAP and LIS shows significant lag in ice shelf retreat coupled with atmospheric and oceanographic differences. Forthcoming data from ice cores, glaciological modeling and planktonic and benthic ecosystems will provide the information necessary to better understand atmosphere/ice/ocean/ecosystem dynamics in order to help predict future changes in the larger ice shelf systems of the Antarctic. To date, our results

indicate similarities and differences between WAP and LIS that highlight the importance of regional vs local forcing in deglaciation.