Antarctica: A Keystone in a Changing World

10th International Symposium on Antarctic Earth Sciences; Santa Barbara, California, 26 August to 1 September 2007

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The 10th International Symposium on Antarctic Earth Sciences was convened at the University of California, Santa Barbara, where 350 researchers presented talks and posters on topics including climate change, biotic evolution, magmatic processes, surface processes, tectonics, geodynamics, and the cryosphere. The symposium resulted in 335 peer-reviewed papers, 225 of which are published online (http://pubs.usgs.gov/of/2007/1047/). A proceedings book will also be published by the National Academies Press.

Advances in our understanding of Antarctic tectonics were many, often involving techniques that provide information under ice sheets or from proxies such as glacial till to provide clues on provenance. John Goodge (University of Minnesota-Duluth) and coworkers reported a 1440-million-year-old granite boulder from glacial till from the Nimrod Glacier that can be matched to North American Laurentian province granites, supporting the postulated (Southwest U.S.–East Antarctica (SWEAT) hypothesis) fit of East Antarctica and North America more than 1 billion years ago. Considerable debate concerned the formation of the Transantarctic Mountains and the role of plateau collapse.

It was proposed that collapse of a plateau during Cretaceous (65–145 million years ago) East-West Antarctic extension left a remnant edge forming the proto-mountains, since enhanced by Cenozoic rift-flank uplift. Rob Bialas (Lamont-Doherty Earth Observatory, Columbia University, Palisades, N. Y.) and colleagues presented the concept and numerical model, Paul Fitzgerald (Syracuse University, N. Y.) and colleagues presented the geological evidence, and Audrey Huerta, (Pennsylvania State University, University Park) presented some geomorphic evidence. Christine Siddoway, (Colorado College, Colorado Springs) demonstrated that elevated crustal temperatures from the exposed portion of the rift in Marie Byrd Land were attained as of 140 million years ago, causing voluminous melting and aiding the rapid evolution of the Cretaceous rift.

Definitive new findings emerged on the evolution of life in Antarctica. Insights into Gondwana ecosystem dynamics are being gleaned from fossilized tracks of animals found in strata (between 415 and 355 million years old); the climate records in Permian, Triassic, and Jurassic floras (which date to between 290 and 145 years ago); and the fossilized reptiles and dinosaurs of the Transantarctic Mountains, which date to the Triassic and Jurassic (between 250 and 145 million years ago). The newly identified fossil plant record shows that even during the Antarctic icehouse, the continent supported a diverse ecosystem.

Recent discoveries of fossil plants and insects by Jane Francis (University of Leeds, U.K.), Allan Ashworth (North Dakota State University, Fargo), and coworkers showed that small *Nothofagus* bushes, mosses, and beetles persisted in Antarctica during the mid-Miocene. Joseph Kirschvinck (California Institute of Technology, Pasadena) examined the biochemical role of early ice sheets and the development of Earth's atmosphere, linking intense global glaciations and atmospheric oxygen generation suggesting that ice sheets serve as an inorganic mechanism driving the evolution of oxygen-mediating enzymes.

Significant progress has been made regarding climate dating from Antarctica's Neogene-Pleistocene (24 million to 10 thousand years ago) and its role in the global climate system. Studies of geologic proxies at various timescales are under way to resolve the paleoclimatic events. Several different initiatives are ongoing, including Antarctic Geological Drilling (ANDRILL), Shallow Drilling (SHALDRIL), and a Wilkes Land margin IODP cruise. Tim Naish (Victoria University of Wellington, N. Z.), Ross Powell (Northern Illinois University, DeKalb), and the ANDRILL scientists presented the results of the first drilling season, a novel record of at least 60 ice sheet fluctuations in the past 13 million years, with indications of both warmer-than-present climate and ice sheets in the pre-Pleistocene period (prior to ~2 million years ago).

In addition, new discoveries on subglacial lakes were presented at the symposium, including outlining tectonic controls for formation of the lakes, documenting the interconnection of lakes, and describing the recent discovery that subglacial lakes beneath ice streams discharge water into the oceans. German Leitchenkov (VNIIOkeangeologia, St. Petersburg, Russia) presented the first dates from the interior of East Antarctica, a detrital zircon recovered from the Vostok ice core that clustered at ages between 0.8–1.2 and 1.6–1.8 billion years old.

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ABOUT AGU

Solomon Receives 2007 William Bowie Medal

Susan Solomon was awarded the 2007 William Bowie Medal at the AGU Fall Meeting Honors Ceremony, which was held on 12 December 2007 in San Francisco, Calif. The medal is for "outstanding contributions to fundamental geophysics and for unselfish cooperation in research."

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I am particularly pleased tonight to present Susan Solomon, who will receive one of the most prestigious AGU awards: the William Bowie Medal.

As early as the late 1970s, Susan was preparing her Ph.D. thesis at National Center for Atmospheric Research under the scientific supervision of Paul Crutzen and Harold Johnston. Susan became fascinated by the mechanisms that affect ozone and other chemical compounds in the upper atmosphere. She assessed the vulnerability of upper atmosphere ozone to energetic particles of solar origin, and showed how thermospheric perturbations associated with solar activity could propagate down to the middle and even the lower polar atmosphere. When the springtime Antarctic ozone hole was reported in 1984, Susan realized that no known mechanism could explain this dramatic and unpredicted perturbation. She provided a possible explanation: Chlorine atoms originating from the industrially manufactured chlorofluorocarbons, if activated on the surface of ice particles present in polar regions, could destroy most of the lower stratospheric ozone in only a few weeks. This theory was challenged. Atmospheric dynamicists had suggested that changes in the atmospheric circulation were a more likely cause for this observed ozone depletion, while several chemists were invoking the role of the nitrogen oxides produced during high solar activity periods. The solution came a few years later, after the completion of an Antarctic expedition led by Susan: Chlorine was the culprit. Its concentration was indeed elevated in regions where polar stratospheric clouds were present, and ozone was depleted in just a few weeks. Susan pro-