G11A-0244

Airborne Laser Swath Mapping of the Erebus Volcanic Province, Antarctica: New Means to Map Structure of Volcanic Cinder Cones and Volcanic Alignments

Paulsen, T (paulsen@uwosh.edu, University of Wisconsin-Oshkosh, Dept of Geology, Oshkosh, WI 54901 United States)
*Wilson, T J (wilson.43@osu.edu, Byrd Polar Research Center Ohio State University, 108 Scott Hall 1090 Carmack Road, Columbus, OH 43210 United States)
Csatho, B (csatho.1@osu.edu, Byrd Polar Research Center Ohio State University, 108 Scott Hall 1090 Carmack Road, Columbus, OH 43210 United States)
Schenk, T (schenk.2@osu.edu
Byrd Polar Research Center Ohio State University, 108 Scott Hall 1090 Carmack Road, Columbus, OH 43210 United States)
Krabill, W (william.b.krabill@nasa.gov, NASA Laboratory for Hydrospheric Processes, Wallops Flight Facility, Wallops Island, VA 23337)

The intraplate stress field within Antarctica is largely unknown because of a lack of commercial drilling and the scarcity of recorded earthquakes with reliable focal mechanism solutions. Volcanic cone alignments are geologic indicators of the crustal stress regime, because eruptions occur above stress-controlled magmatic hydrofractures. Neogene-Quaternary volcanism occurs over large sectors of the Antarctic interior, providing an opportunity to obtain regional stress information. We are investigating the volcanic structure of the McMurdo Volcanic Group, a suite of alkaline volcanic rocks that extends from the Transantarctic Mountains to offshore localities within the West Antarctic rift system. In December, 2001, high-resolution surface elevation data were obtained by NASA's Airborne Topographic Mapper (ATM) laser altimetry system over portions of Mt Morning and Mt Discovery volcanoes in the Erebus Volcanic Province. The ATM surveys were conducted as part of a joint project of NASA and NSF to evaluate the potential of laser altimetry for topographic mapping in Antarctica. Data from the ATM system was interpolated into a regular grid with 2-4 meter resolution. The elongation of elliptical cone rims can be directly related to the trend of the subsurface fissure that controlled cone emplacement. Volcanic cone alignments are defined based on elliptical cone trends together with circular cones that are proximal and along the same trend. We initially mapped the distribution and shape of the volcanic cones using a combination of SPOT 3 panchromatic satellite imagery (10 m ground resolution), RADARSAT and JERS radar imagery and LANDSAT imagery (30 m ground resolution), aerial photography, and field work. For smaller cones, it was difficult to map the shapes of the cone rims due to the resolution limit of available imagery. The new DEM data from the laser mapping provides detailed information on the shapes of volcanic cones, including ellipticity, the symmetry of maximum/minimum elevation points, and the position of breaches on cone rims. These morphometric data yield information on the geometry of underlying magmatic fissures and/or of faults that controlled ascent and emplacement of volcanic materials. The detailed elevation information from the laser data makes it possible to quantify morphologic parameters of volcanic cones around Mt Discovery and Mt Morning and thus to obtain information on the structural kinematics and dynamics of the region in the late Cenozoic.

Keywords: Continental neotectonics, Stresses--crust and lithosphere