New Model Bathymetry and Tectonic Boundary Beneath Ross Ice Shelf, Antarctica

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Christine Siddoway[1] (csiddoway@coloradocollege.edu), Kirsteen Tinto[2], Matthew Tankersley[1], Robin E. Bell[2] [1]Colorado College, Geology, Colorado Springs, United States, [2]Columbia University, Lamont -Doherty Earth Observatory, Palisades, United States

A new tectonic boundary has been discovered beneath the Ross Ice Shelf (RIS), a 476,000 km^2 floating icesheet that obscures the seafloor topography and crustal structure of the West Antarctic rift system. Mapping of magnetic and gravity anomalies by the ROSETTA-Ice airborne survey (2015-2017) reveals a major break between cratonic East Antarctica and accreted crust of West Antarctica, midway across the Shelf ~300 km east of the Transantarctic Mountains. The Central High, a fault-riven block formerly identified and drilled in the Ross Sea, is found to span the tectonic boundary and continue south as a basement high separating two distinct crustal regions beneath the Ice Shelf. The modeled bathymetry shows a deep, smooth Ross-EAIS sector of dense crust that displays subdued, long wavelength magnetic anomalies. This contrasts with the shallow, more complex seabed in the ROSS-WAIS sector, comprising less dense crust with high amplitude, short wavelength magnetic anomalies. Modeling of geophysical data allows the identification of glacially-carved and sediment-filled troughs, faults, and tectonic transfer zones, together with magma conduits and centers. A revision of the existing tectonic framework for the Ross Embayment is needed to accommodate these new findings from the fuller characterization of sub-RIS extended crust. The presence of shallow and deep sectors have consequences for ocean circulation beneath Ross Ice Shelf and modes of past and future ice sheet retreat.

On behalf of the Rosetta-Ice Team, Columbia University, Lamont -Doherty Earth Observatory