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Cryptic sub-ice geology revealed by a U-Pb zircon study of glacial till in Dronning Maud Land, East Antarctica

Joachim Jacobs (1,2), Birgitte Opås (1), Marlina Elburg (3), Andreas Läufer (4), Solveig Estrada (4), Anna K. Ksienzyk (1), Detlef Damaske (4), and Mandy Hofmann (5)

(1) University of Bergen, Department of Earth Science, Bergen, Norway (joachim.jacobs@uib.no), (2) Norwegian Polar Institute, Fram Centre, N-9296 Tromsø, Norway, (3) Department of Geology, University of Johannesburg, Auckland Park 2006, Johannesburg, South Africa, (4) Federal Institute for Geosciences and Natural Resources (BGR), Stilleweg 2, 30655 Hannover, Germany, (5) Senckenberg Naturhistorische Sammlungen Dresden, Museum für Mineralogie und Geologie, Königsbrücker Landstraße 159, 01109 Dresden, Germany

We have targeted the southern side of the Dronning Maud Land (DML) Mountains, East Antarctica, in search of moraine material that might reveal the presence and nature of any cryptic terranes in the ice-covered region of the East Antarctic polar plateau. Nine samples of unconsolidated glacial till, carried by the northward flowing East Antarctic Ice Sheet to the southern side of the DML escarpment, were collected and processed for U-Pb zircon analyses. The samples resulted in ca. 1100 new U-Pb zircon ages between ca. 2000 and 500 Ma. The oldest Palaeoproterozoic zircons come from the easternmost localities with a probable source region in the western part of the Ruker Craton. Major Stenian and Tonian age peaks are recognised. Tonian rocks are well known from the SW terrane in the Sør Rondane Mountains and characterise a major Tonian Oceanic Arc Super Terrane. Stenian ages of ca. 1080 Ma on the other hand are far less common in the outcropping region. Although Late Mesoproterozoic ages are common in both the Maud Province of western-central DML as well as in the Rayner Complex, the Stenian rocks in this study differ with respect to composition and/or isotope geochemistry; they are juvenile, subduction-related and resemble an early phase of oceanic arcs that was so far unknown in this region. In the W, the oldest age peak is ca. 800-720 Ma with possible counterparts in the Schirmacher Oasis. All samples show a protracted Late Neoproterozoic/Early Palaeozoic overprint, accompanied by igneous addition, most likely related to the East African-Antarctic Orogen. This overprint appears most intense in the westernmost locality, in the vicinity of the Forster Magnetic Anomaly and lasted for ca. 150 Ma; an E-ward younging of metamorphic ages is observed. The new moraine samples together with previous outcrop studies reveal that this region has undergone two major phases of oceanic arc/terrane accretion; the first one from ca. 1100-900 Ma is probably related to accretion tectonics outboard of Rodinia, the second one from ca. 850 – 580 Ma occurred as a result of ocean closure and finally Gondwana amalgamation.