Precambrian Research 245 (2014) 174–185

Contents lists available at ScienceDirect

Precambrian Research

journal homepage: www.elsevier.com/locate/precamres

New detailed aeromagnetic and geological data of eastern Dronning Maud Land: Implications for refining the tectonic and structural framework of Sør Rondane, East Antarctica

Matthias Mieth[a,*], Joachim Jacobs[b], Antonia Ruppel[c], Detlef Damaske[c], Andreas Läufer[c], Wilfried Jokat[a]

[a] Alfred-Wegener-Institut Helmholtz-Zentrum für Polar- und Meeresforschung (AWI), Columbusstrasse, 27568 Bremerhaven, Germany
[b] Department of Earth Science, University of Bergen, Allégaten 41, 5007 Bergen, Norway
[c] Federal Institute for Geosciences and Natural Resources (BGR), Stilleweg 2, 30655 Hannover, Germany

ARTICLE INFO

Article history:
Received 11 November 2013
Received in revised form 12 February 2014
Accepted 17 February 2014
Available online 28 February 2014

Keywords:
Aeromagnetics
Magnetic susceptibility
Gondwana assembly
Tectonics
Sør Rondane Mountains
Dronning Maud Land

ABSTRACT

The Sør Rondane Mountains (SRM) in eastern Dronning Maud Land (DML) are located in an area, where two apparent Pan-African (650–520 Ma) orogenic mobile belts appear to intersect, the East African-Antarctic Orogen and the Kuunga Orogen. Hence, a better understanding of the tectonic structure of the Sør Rondane region is an important key for unravelling the complex geodynamic evolution of the eastern DML and adjacent regions of East Antarctica during the Late Neoproterozoic/Early Palaeozoic amalgamation of Gondwana. The SRM were recently (2011–2012) aerogeophysically investigated with a 5 km flight line spacing, covering a total area of ~140,000 km^2. The aeromagnetic data are correlated with ground-based magnetic susceptibility measurements and geological field data and allow to project tectonic terranes and individual structures into ice-covered areas. Magnetic anomalies and basement foliation trends are collinear in areas dominated by simple shear deformation, whereas an area of large-scale refolding correlates with a subdued small-scale broken magnetic anomaly pattern. The latter area can be regarded as a distinct tectonic domain, the central Sør Rondane corridor. It magnetically separates the SRM into an eastern, a central, and a western portion. This subdivision is presumably related to late Pan-African extensional tectonics and suggests that such a tectonic regime may play a larger role than previously assumed. Voluminous late Pan-African granitoids, which are mainly undeformed, correlate with positive magnetic anomalies between +30 and +80 nT, while a strong magnetic high (+680 nT) near the granitic intrusion at Dufekfjellet is caused by a highly magnetised enigmatic body. The recently discovered prominent magnetic anomaly province of southeastern DML continues into the southern part of the Sør Rondane region, where only a few outcrops are exposed. Findings at these westernmost nunataks of the SRM indicate that the subdued magnetic anomaly pattern of this southeastern DML province is most likely caused by the predominance of metasedimentary rocks of yet unknown age.

© 2014 Elsevier B.V. All rights reserved.

1. Introduction

East Antarctica underwent a complex tectonic evolution since the Archaean, especially during the Pan-African (~650–520 Ma) assembly of Gondwana (e.g. Boger, 2011 and references therein). Our study area, the Sør Rondane region, is located within two apparently overlapping Pan-African mobile belts (e.g. Satish-Kumar et al., 2013), namely, the East African-Antarctic Orogen (Jacobs et al., 1998, 2003; Jacobs and Thomas, 2004) and the Kuunga Orogen (Boger, 2011; Meert, 2003) as illustrated in Fig. 1a. The former is thought to have formed a more or less continuous orogen extending from the Arabian Peninsula to the western DML, while the latter is thought to have formed an orogen extending from Australia through western India, the Prydz Bay region, and eastern DML into Mozambique and beyond. DML is, as most of Antarctica, widely covered with a thick ice sheet, and only a few outcrops provide scattered insights into the subglacial tectonic framework. Aerogeophysical investigations have allowed several large-scale crustal domains to be distinguished in DML (Golynsky and Aleshkova, 2000; Mieth and Jokat, 2014; Riedel et al., 2012, 2013), while airborne data of higher resolution (≤5 km flight line spacing) could be correlated with geological findings on a smaller scale

* Corresponding author. Tel.: +49 47148311866.
E-mail address: Matthias.Mieth@awi.de (M. Mieth).

http://dx.doi.org/10.1016/j.precamres.2014.02.009
0301-9268/© 2014 Elsevier B.V. All rights reserved.

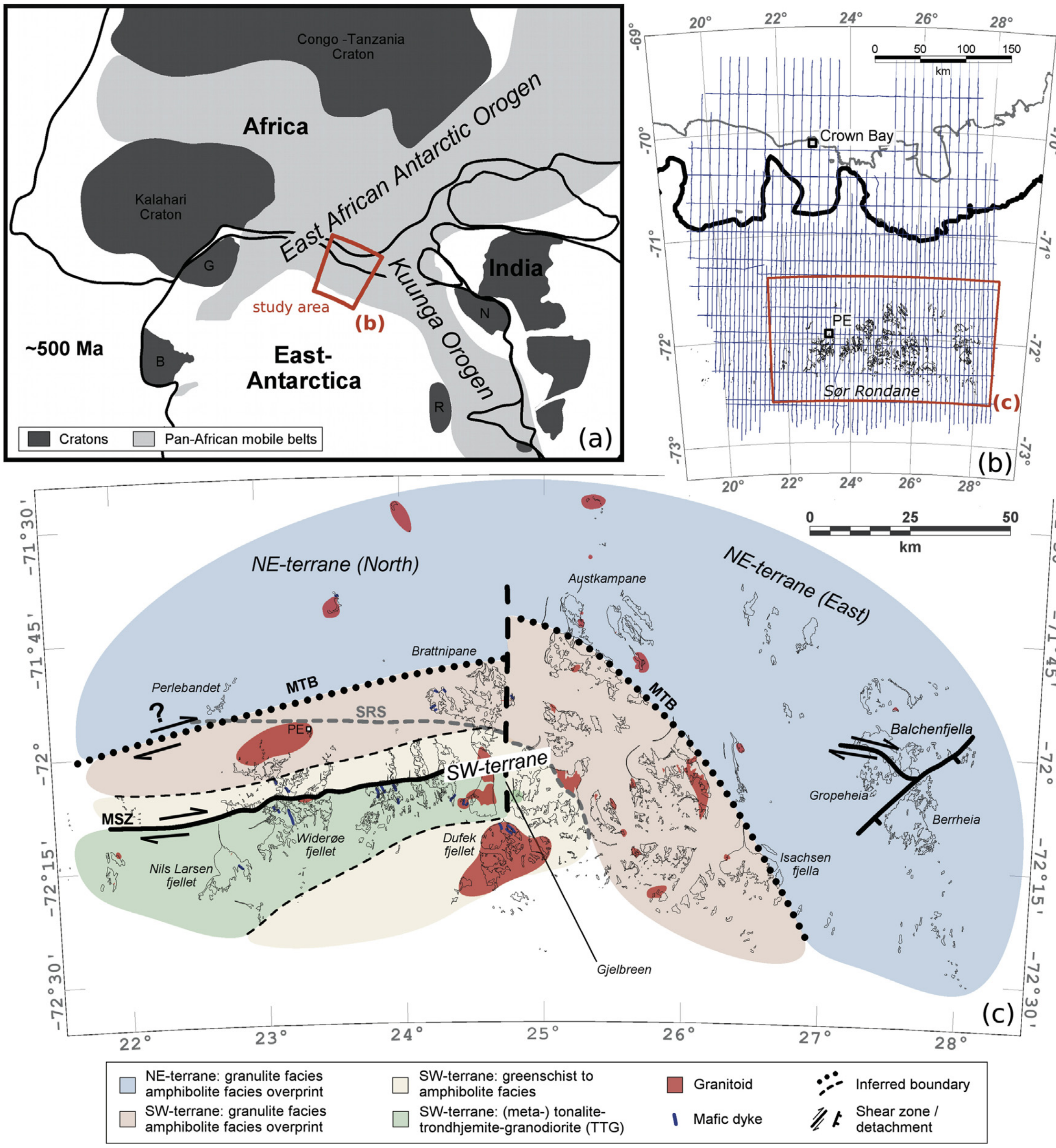

Fig. 1. Overview of study area. (a) Sketch of part of Gondwana (~500 Ma), showing the study area to be located close to the intersection of two Pan-African (650–520 Ma) mobile belts, abbreviations: B – BLM (Coats Land block), G – Grunehogna, N – Napier, R – Ruker. (b) Survey area with grounding line (thick black), ice shelf edge (grey), outcrops (thin black), and magnetic flight lines (blue). Measurement lines are 5 km separated in the onshore region, and 10 km over the ice shelf and beyond. Tie lines were flown every 30 km. Base stations for flight operation were Princess Elisabeth station (PE) and a temporary camp at Crown Bay. (c) Geological overview map of the SRM after Shiraishi et al. (2008) and Osanai et al. (2013). The SW-terrane is separated from the NE-terrane by the Main Tectonic Boundary (MTB). The SW-terrane is composed of a TTG subterrane (~995 Ma and 940–920 Ma) and a range of metamorphic rocks from greenschist to granulite facies, close to the MTB. The northern contact of the TTG subterrane is a major dextral shear zone, the Main Shear Zone (MSZ). The NE-terrane is predominated by granulite facies rocks, which were metamorphosed at ~640–600 Ma, similar to granulites within the SW-terrane, however with contrasting PTt-loops. Whilst metamorphic zircon ages of ~640–600 Ma are thought to indicate collision between the SW- and NE-terranes, metamorphic zircon ages of ~570 Ma are interpreted to indicate extensional exhumation and orogenic collapse following collision. The Sør Rondane Suture (SRS) is no longer considered an important boundary. Major volumes of late tectonic A-type granitoids and mafic dykes, dated at ~560–520 Ma, occur in the SW-terrane.

(Damaske et al., 2005; Golynsky and Jacobs, 2001; Ferraccioli et al., 2005a, 2005b). During the "Soviet Antarctic Expedition 36" in 1990, the Sør Rondane region was aerogeophysically investigated the first time with a flight line spacing of 20 km at an altitude of 4000–4500 m (Golynsky et al., 1996). However, the sparse flight line spacing and the high altitude above ground did not allow any geologically detailed interpretation of the aeromagnetic data. Therefore, the region was investigated in more detail during three geological-geophysical expeditions in the framework of the collaborative research programme "Geodynamic Evolution of East Antarctica" (GEA) of the German Federal Institute of Geosciences and Natural Resources (BGR) and the Alfred-Wegener-Institut Helmholtz-Zentrum für Polar- und Meeresforschung (AWI).

Here, we report on the newly acquired aeromagnetic data in the Sør Rondane region. Together with new ground-based susceptibility measurements and structural information, we use these data to extrapolate outcropping terrane boundaries and discontinuities into ice-covered areas to constrain the overall size of the mapped geological structures. This is a first step towards a better constraining of the geodynamic evolution of the SRM during the amalgamation of Gondwana in the Late Proterozoic and Early Palaeozoic.

Download English Version:

https://daneshyari.com/en/article/4722970

Download Persian Version:

https://daneshyari.com/article/4722970

Daneshyari.com