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The Bertrab, Littlewood and Moltke Nunataks of Prinz-Regent-Luitpold-Land (Coats Land) – Enigma of East Antarctic Geology

by Georg Kleinschmidt[1] and Steven D. Boger[2]

Abstract: Bertrab, Littlewood and Moltke nunataks (BLM) are three small groups of small nunataks in Coats Land (actually Prinz-Regent-Luitpold-Land) consisting of undeformed and unmetamorphosed rhyolites and granophyres (Bertrab, Littlewood) and deformed metasedimentary rocks (Moltke). The geotectonic significane of these rock exposures remains under debate. Mainly as the rhyolites and granophyres show ages of ~1.1 Ga, BLM have been interpreted as westward continuation of the Grenvillian Maud Belt of western Dronning Maud Land. The ages of Moltke's rocks and structures are unknown, but they should be older than 1.1 Ga according to the simplest interpretation. Thus BLM seem to represent a cratonic area. We suggest that the BLM cratonic terrain has been incorporated into Gondwana by a dual Pan-African orogeny continuing from eastern Dronning Maud Land / Mac.Robertson Land: Firstly BLM have been attached to West Gondwana during a Pan-African orogeny streching from Lützow Holm Bukta to western Dronning Maud Land, secondly BLM have been squeezed between West and East Gondwana during another Pan-African orogeny extending from the Prince Charles Mountains to the Shackleton Range.

Zusammenfasung: Bertrab-, Littlewood- und Moltke-Nunatakker (BLM) sind drei kleine Nunatak-Gruppen in Coats Land (eigentlich: Prinz-Regent-Luitpold-Land), die aus nicht deformierten und nicht metamorphen Rhyolithen und Granophyren (Bertrab, Littlewood) bzw. aus Metasedimenten (Moltke) bestehen. Ihre geotektonische Bedeutung ist unbekannt bzw. umstritten. So werden sie als westliche Fortsetzung des grenvillischen Maud-Belts im westlichen Dronning Maud Land interpretiert, da die Rhyolithe und Granophyre ca. 1,1 Ga alt sind. Alter von Sedimentation, Strukturprägung und Metamorphose der Moltke-Gesteine sind unbekannt, sollten aber nach der einfachsten Vorstellung älter als 1,1 Ga sein. Deshalb könnten Bertrab, Littlewood und vielleicht auch Moltke kratonisch sein. Wir schlagen ein Modell vor, in dem das kratonische BLM-Terrain durch eine zweifache, quasi doppelgleisige, panafrikanische Orogenese in Gondwana eingebaut wurde: Zuerst dockte BLM im Zuge eines früh-panafrikanischen Orogens, das sich von der Lützow Holm Bukta bis West-Dronning-Maud-Land zieht, an Westgondwana an; in einem zweiten Schritt wurde BLM zwischen West- und Ostgondwana im Zuge eines jung-panafrikanischen Orogens, das von den Prince Charles Mountains bis zur Shackleton Range verläuft, eingeklemmt.

INTRODUCTION

The region east of the Weddell Sea between ~75°S and ~79°S is nearly completely ice-covered. Rock esposures are limited to three small groups of nunataks that penetrate the East Antarctic ice sheet. These nunataks are the three Bertrab, the four Littlewood and the two Moltke nunataks (BLM) that are located at 77°52'S, 34°38'W, at 77°53'S, 34°20'W and at 77°58'S, 35°30'W, respectively (Figs. 1, 2, 3, 4). The Bertrab and Littlewood nunataks are located some distance inland (Bertrab ca. 18 km, Littlewood ca. 25 km) from the coast and form relatively flat and slightly elevated hummocks (Fig. 1). In contrast, Moltke-Nunatakker form steep windows in the coastal ice cliff facing the Filchner Shelf Ice. Above these windows there is a 25-30 m thick overhang of solid ice, the reason why they are inaccessible (Fig. 2).

All three groups of nunataks were discovered by Wilhelm Filchner during the second Deutsche Südpolarexpedition (1911/12) in 1912 (Fig. 4). Bertrab- and Moltke-Nunatakker were named by Filchner (Filchner 1922). The Bertrab-Nunatakker were named after lieutenant general (Generalleutnant) Hermann Karl Josef Ludwig Wilhelm von Bertrab (1857-1940) who was head of the trigonometrical department of the Prussian survey, president of the supreme military survey of Germany ("Oberste militärische Vermessungstelle im Deutschen Reich") and "Reichskommissar" for the reorganization of the German Survey after World War I. The Moltke-Nunatakker were named after both the Prussian general and head of the general staff (Generalstabschef) Helmuth von Moltke (1848-1916) and the Prussian minister of the interior Friedrich von Moltke (1852-1927). Littlewood Nunataks were named in 1959 by the American geophysicist John Behrendt after the US oceanographer William H. Littlewood (Behrendt 1998). Filchner also named the region around these nunataks "Prinz-Regent-Luitpold-Land" concerning the area from ca. 77°S to ca. 78°15'S. It forms the southern continuation of Coats Land which extends north of 77°S to ca. 75°S. Although common practice, the incorporation of BLM into Coats Land is not entirely correct.

KNOWN FACTS

Rock types – Petrology – Structure

Bertrab and Littlewood nunataks consist of undeformed and unmetamorphosed acidic igneous rocks. These are miarolithic granophyres at Bertrab-Nunatakker (Fig. 5a) and felsitic rhyolites at Littlewood Nunataks. At both localities, the main rocks are cross-cut by mafic and felsic dykes (Fig. 5b) that vary from 0.25 to 5 m in width. These rocks have been petrographically described in detail and classified by Kleinschmidt (2002) taking into account and critically judging all previous descriptions (Capurro 1955, Cordini 1959, Aughenbaugh et al. 1965, Toubes Spinelli 1983, Marsh & Thomson 1984, Raina et al. 1995, Gose et al. 1997). Our petrological and the available geochemical data (Raina et al. 1995, Storey et al. 1994) does not allow a clear assignment to a certain plate tectonic scenario (Kleinschmidt 2002): The ratio Al/(Na+K+Ca/2) is >1.1 indicating "S-type". The average of Na_2O is 3.58 %, which also points to "S-type". $(Na_2O+K_2O)/Al_2O_3$ *versus* $Al_2O_3/(CaO+Na_2O+K_2O)$ argues for

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Fig. 1: The three Bertrab (B) und four Littlewood (L) nunataks.

Abb. 1: Die drei Bertrab- (B) und vier Littlewood-Nunatakker (L).

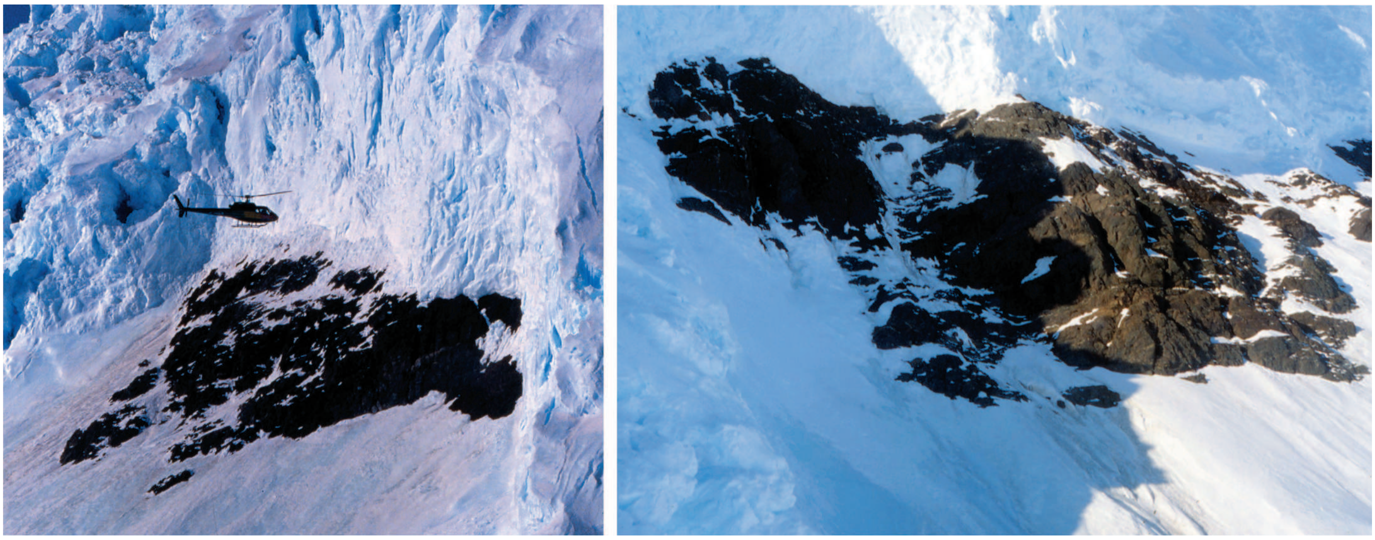


Fig. 2: The two Moltke nunataks (the northern to the left, the southern to the right) - both inaccessible!

Abb. 2: Die beiden Moltke-Nunatakker (links der nördliche, rechts der südliche), beide unzugänglich.

either S- or A-type. The $^{87}Sr/^{86}Sr$ ratio is between 0.702 and 0.705 indicating I-, M- or A-type. Normative corundum is >>1 % meaning "S-type". The contents of hornblende, titanite, zircon and apatite and the lack of fluorite are pointing to I-type. Rb *versus* Yb+Nb argues for post-collisional or within-plate magmatism. Therefore, I-, A-, or S-type magmatism is not excluded, and as the deformation of the rocks is restricted to jointing (Fig. 6) and minor brittle faulting, a post-collisional or a within-plate situation is possible.

Data from Moltke-Nunatakker is limited. RAINA et al. (1995) collected a few samples from the northern nunatak and described them as consisting of "low-grade metamorphic limestone" and „lithic arkose". Our aerial observations from the northern Moltke-Nunatak suggest that the predominant rock types consist of very low-grade to low-grade slate, meta-siltstone and metagraywacke. At southern Moltke-Nunatak similar rock types occur, but there are possible intercalations of greenstones or similar mafic metavolcanic rocks. At both locations, folding of the rocks is open to tight. Structures are most clearly exposed at the southern end of the northern Moltke-Nunatak (Fig. 7) showing bedding (so), cleavage (s1), and en-echelon quartz veins due to flexural slip.

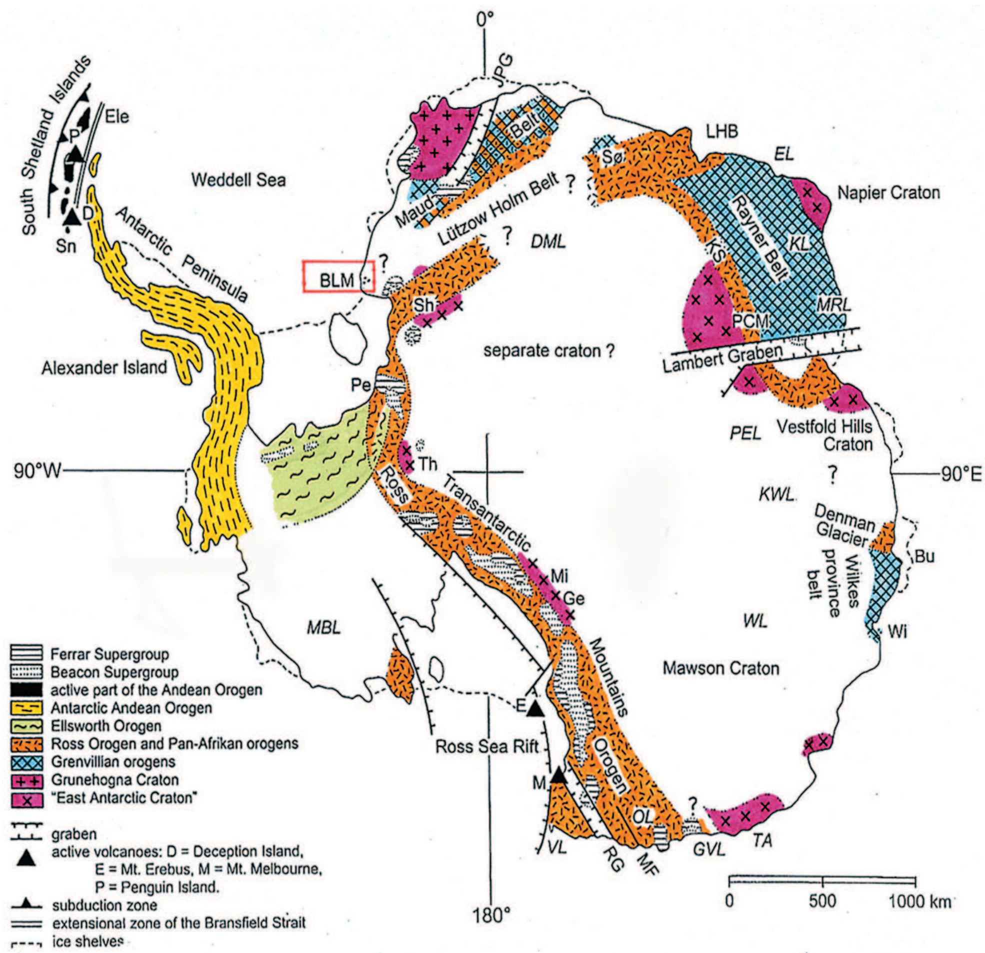


Fig. 3: Position of BLM within the geological structure of Antarctica. H = Heimefrontfjella, K = Kirwanveggen, Sh = Shackleton Range. Marked: Fig. 4. (modified after KLEINSCHMIDT 2007).

Abb. 3: Die Lage der BLM-Nunatakker innerhalb des geologischen Baus der Antarktis. H = Heimefrontfjella, K = Kirwanveggen, Sh = Shackleton Range; rot umrahmt: Abb. 4. (verändert nach KLEINSCHMIDT 2007).

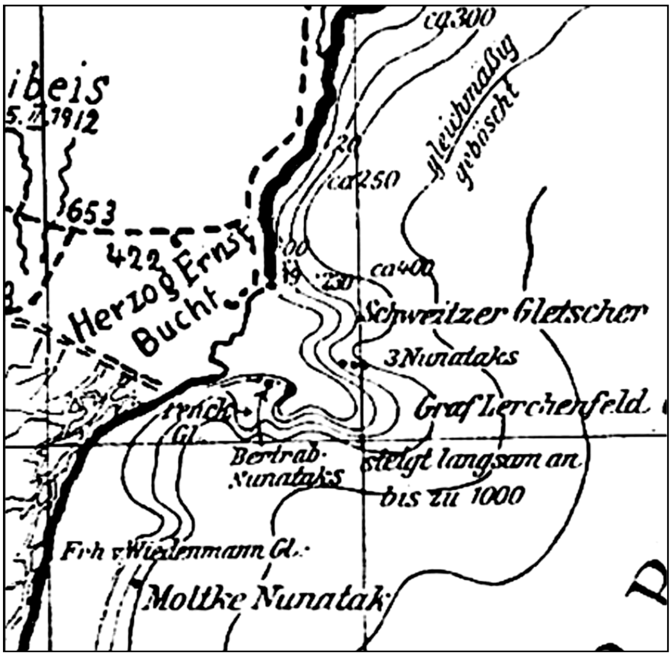


Fig. 4: Section of Filchner's original map from 1922.

Abb. 4: Ausschnitt aus Filchners Originalkarte von 1922.

Ages of the BLM rocks

The newest and most reliable age dates from Bertrab and Littlewood nunataks have been published by STOREY et al. (1994) and GOSE et al. (1997). STOREY et al. (1994) presented a 9-point Rb-Sr isochron age of 1076 ±7 Ma for the granophyres from Bertrab-Nunatakker (Fig. 8a). Slightly older U-Pb zircon and titanite ages were obtained by GOSE et al. (1997) from both Bertrab and Littlewood nunataks. The zircons yielded ages of 1113 +18/-4 Ma for Bertrab- and 1112 ±4 Ma for Littlewood Nunatak (Fig. 8b,c). Titanite from the Bertrab rocks shows effectively age (1106 ±3 Ma). The similarity in zircon, titanite and the Rb-Sr data indicates the absence of any significant tectono-thermal overprint (GOSE et al. 1997).

The ages of sedimentation, deformation and metamorphism of the rocks at Moltke-Nunatakker are unknown. However, these rocks are geographically close to the flat-lying volcanics at Bertrab and Littlewood nunataks – the distance between Moltke and Bertrab nunataks is ~22 km and between Moltke and Littlewood nunataks ~28 km. On the assumption that there are no significant subglacial structures between Moltke and Bertrab/Littlewood, it can be argued that the folding and low-grade metamorphism observed at Moltke-Nunatakker must be older than the undeformed volcanics observed at Bertrab and Littlewood. Thus the depositional age and the structural evolution of the metasediments at the Moltke rocks should be older than 1.1 Ga. This seems to be the simplest interpretation of the local situation; for problematical aspects see Discussion below.

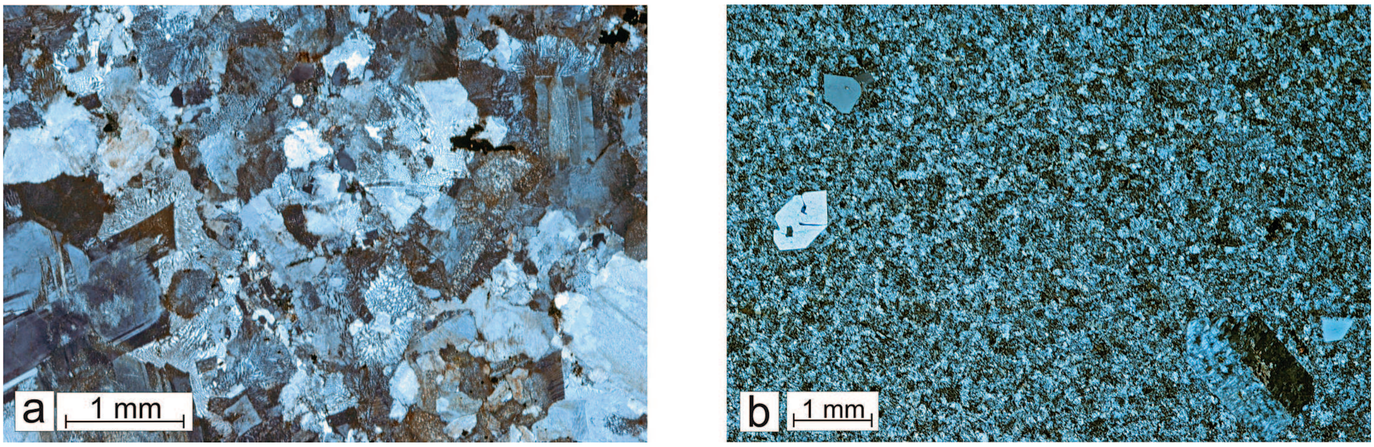


Fig. 5: Microphotographs of rocks of Bertrab Nunataks: (a) = granophyre containig mainly micrographic quartz-K-feldspar intergrowth and oligoclase. (b) = quartz and K-feldspar phenocrysts within the matrix of rhyolite dike.

Abb. 5: Dünnschliffe der Gesteine der Bertrab-Nunatakker: (a) = Granophyr, hauptsächlich mikrographische Quarz-K-Feldspat-Verwachsungen und Oligoklas. (b) = Quarz- und K-Feldspat-Einsprenglinge in der Grundmasse eines Rhyolithganges.

Fig. 6: Jointed rhyolites of Littlewood Nunataks.

Abb. 6: Die geklüfteten Rhyolithe der Littlewood Nunatakker.

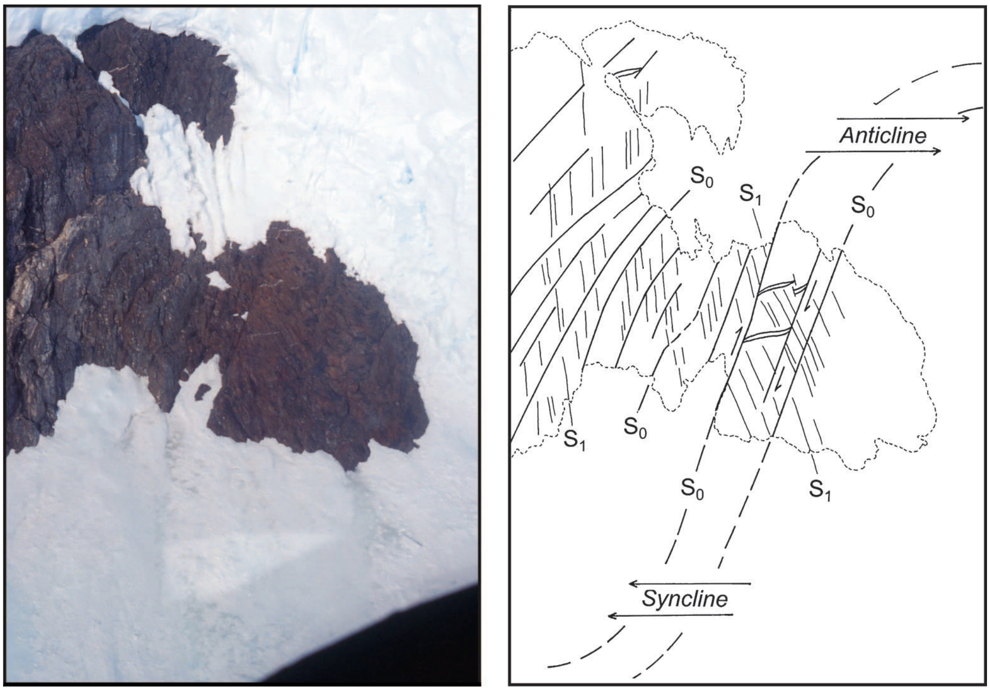


Fig. 7: The metasedimentary rocks of the Moltke nunataks: southern end of northern Moltke nunatak showing bedding (S_0), cleavage (S_1) and en echelon quartz veins due to flexural slip. They are apparently of (very) low-grade metamorphism.

Abb. 7: Die Metasedimente der Moltke-Nunatakker: Südende des nördlichen Moltke-Nunataks mit Schichtung (S_0), Schieferung (S_1) und auf Faltenvorschub beruhende Quarz-Fiederspalten (Doppellinien). Die Gesteine sind offensichtlich (sehr) schwach metamorph.

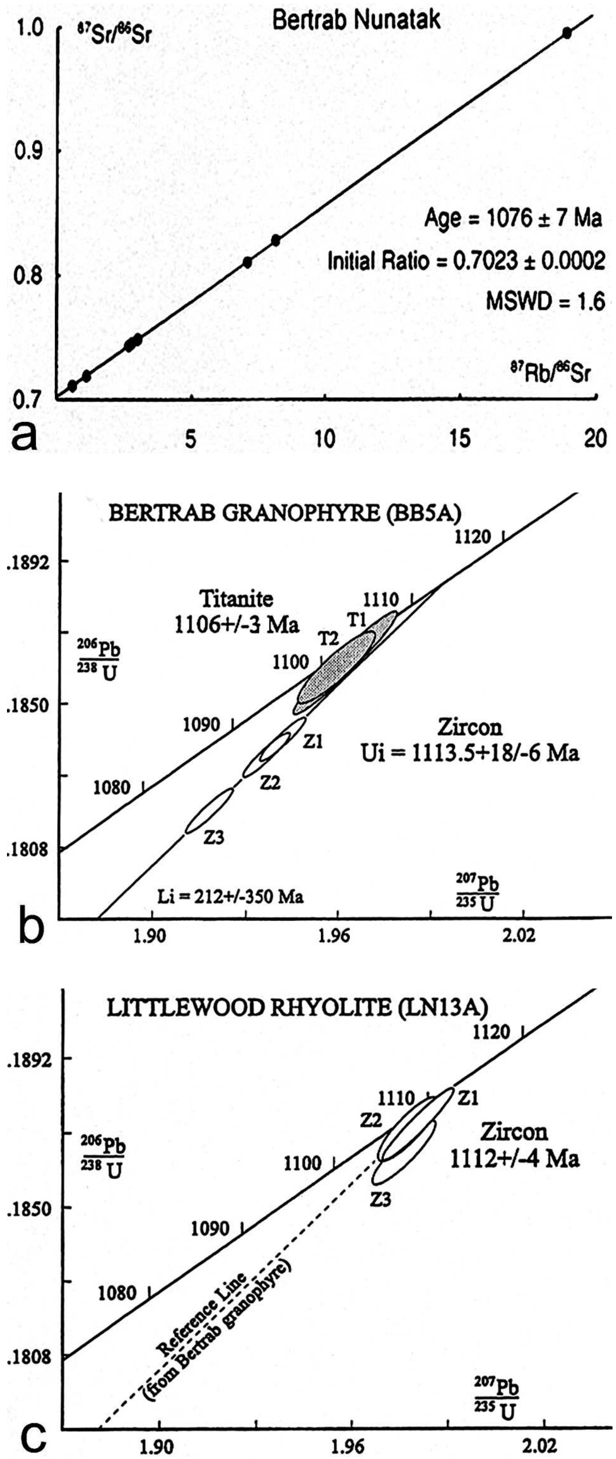


Fig. 8: Ages of igneous rocks of Bertrab and Littlewood nunataks. (a) = Bertrab: 1076 ±7 Ma (Rb-Sr isochron, STOREY et al. 1994); (b) = Bertrab: 1113 +18/-4 Ma (concordia diagram for zircon, GOSE et al. 1997); (c) = Littlewood: 1112 ±4 Ma (concordia diagram for zircon, GOSE et al. 1997).

Abb. 8: Die Alter der Gesteine der Bertrab- und Littlewood-Nunatakker. (a) = Bertrab, 1076 ±7 Ma (Rb-Sr-Isochrone, STOREY et al. 1994); (b) = Bertrab, 1113 +18/-4 Ma (Concordia-Diagramm für Zirkon, GOSE et al. 1997); (c) = Littlwood, 1112 ±4 Ma (Concordia-Diagramm für Zirkon, GOSE et al. 1997).

THE GEODYNAMIC PROBLEM OF BLM AND UP TO NOW HYPOTHESES

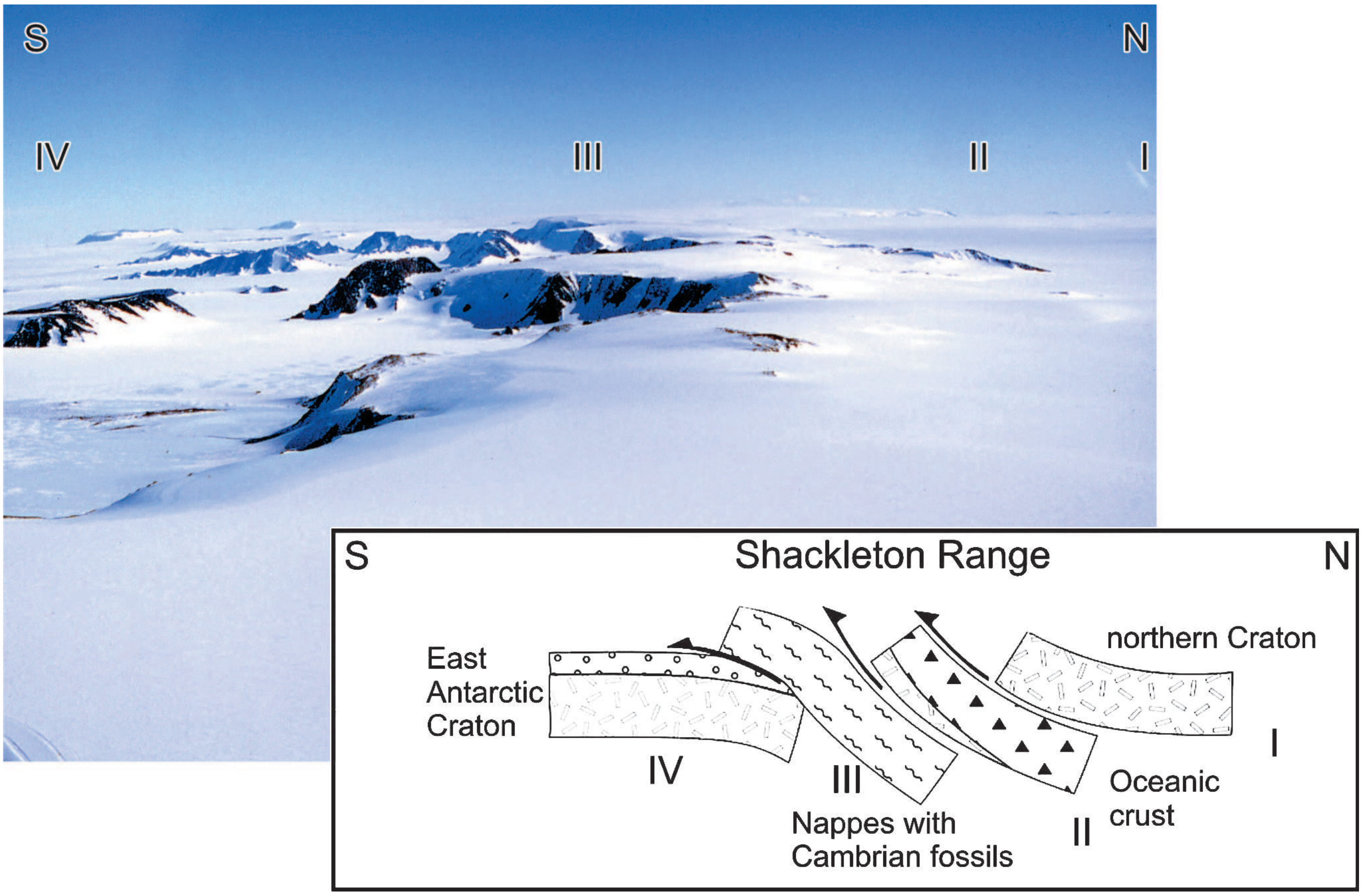
The nearest geodynamically relevant exposures are located ~300 km to the SE (Shackleton Range) and ~800 km to the NE (Heimefrontfjella and Kirwanveggen) (Fig. 3). The Shackleton Range forms a Pan-African dominated fold-and-thrust belt (e.g. BUGGISCH et al. 1990) (Fig. 9). Heimefrontfjella and Kirwanveggen represent the western part of the Grenville-aged orogen of Dronning Maud Land, the so-called "Maud Belt" characterized by a Pan-African overprint (e.g. JACOBS et al. 2003a) (Fig. 10).

Based on the Mesoproterozoic (c. 1110 Ma) ages of the rhyolites and granophyres from Bertrab and Littlewood nunataks (STOREY et al. 1994, Gose et al. 1997), on palaeomagnetic data (GOSE et al. 1997) and on the airborne structural data from the Moltke Nunatakker (KLEINSCHMIDT 2002), several studies integrated BLM into the Grenvillian Maud Belt (Fig. 11; STOREY et al. 1994, GOSE et al. 1997, KLEINSCHMIDT 2002). But a precise look at the available age data reveals a certain inconsistency with this interpretation: Although the rocks are of similar age, the deformation history observed in Dronning Maud Land is younger than the extrusion ages of the volcanic rocks at Bertrab and Littlewood nunataks. The Maud Belt consists of juvenile arc and back-arc related rocks with protolith ages near 1170 Ma that were deformed and metmorphosed at granulite facies conditions between 1090 and 1060 Ma (ARNDT et al. 1991, JACOBS et al. 1998, 2003a, BAUER et al. 2003, PAULSSON & AUSTRHEIM 2003, HELFERICH et al. 2004). In contrast, the undeformed Bertrab and Littlewood volcanics have ages near 1110 Ma. Although orogenesis in the Maud Belt reached granulite-facies, this event did not leave a structural or thermal imprint in the Bertrab and Littlewood rocks. The deformation observed at Moltke-Nunatakker is thus probably older and unrelated to that observed in the Maud Belt; see Discussion below.

Even more enigmatic is the absence of any Pan-African imprint in Bertrab, Littlewood and presumably Moltke nuntaks in view of the adjacent Pan-African domains to the NE (Heimefrontfjella, Kirwanveggen) and to the SE (Shackleton Range).

The ~500 Ma old Pan-African orogenesis in the Shackleton Range is characterized by convergent thrust and nappe tectonics. They affected and mixed Palaeo- and Neoproterozoic basement rocks, partly eclogised Neoproterozoic ophiolites, Neoproterozoic sediments and Early to Middle Cambrian low-grade metasediments (Fig. 9; BUGGISCH et al. 1994a,b, TALARICO et al. 1999, TESSENSOHN et al. 1999, KLEINSCHMIDT et al. 2001, 2002, SCHMÄDICKE & WILL 2006, BUGGISCH & KLEINSCHMIDT 2007).

The ages of these rocks, their metamorphism and convergent deformation is constrained by U-Pb zircon ages, Sm-Nd model ages, Rb-Sr and K-Ar mineral ages (BUGGISCH et al. 1994b, BROMMER & HENJES-KUNST 1999, BROMMER et al. 1999, TALARICO et al. 1999, ZEH et al. 1999) and even fossils (BUGGISCH et al. 1990, 1994a, BUGGISCH & HENJES-KUNST 1999), resulting in a timing of the orogenesis between 530 and 500 Ma.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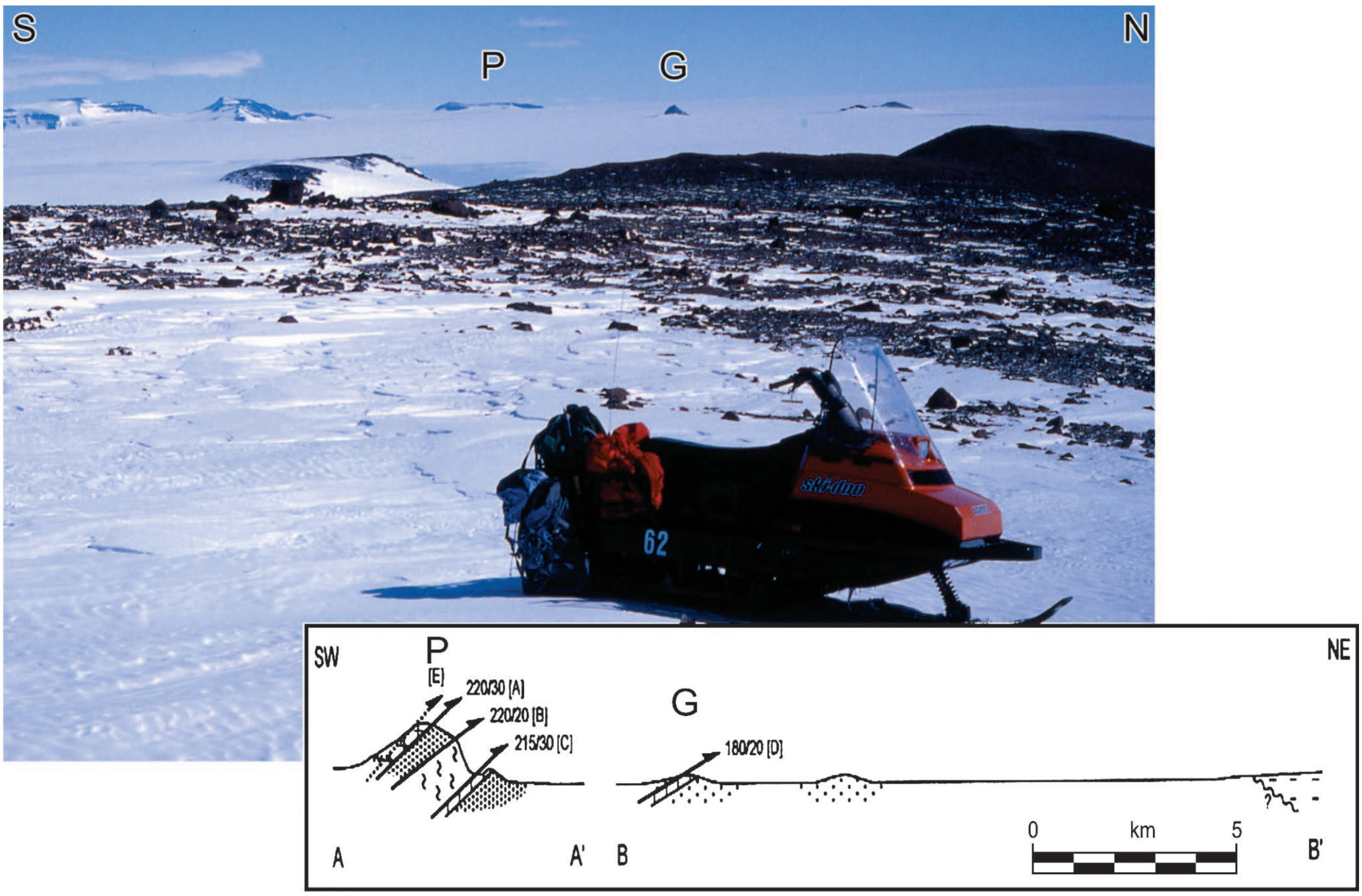
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Fig. 9: The Shackleton Range and its Pan-African nappe tectonics of ~500 Ma (e.g. TESSENSOHN et al. 1999, I-IV = tectonic units).

Abb. 9: Die Shackleton Range und ihr panafrikanischer Deckenbau, ca. 500 Ma alt (z.B. TESSENSOHN et al. 1999, I-IV = tektonische Einheiten).

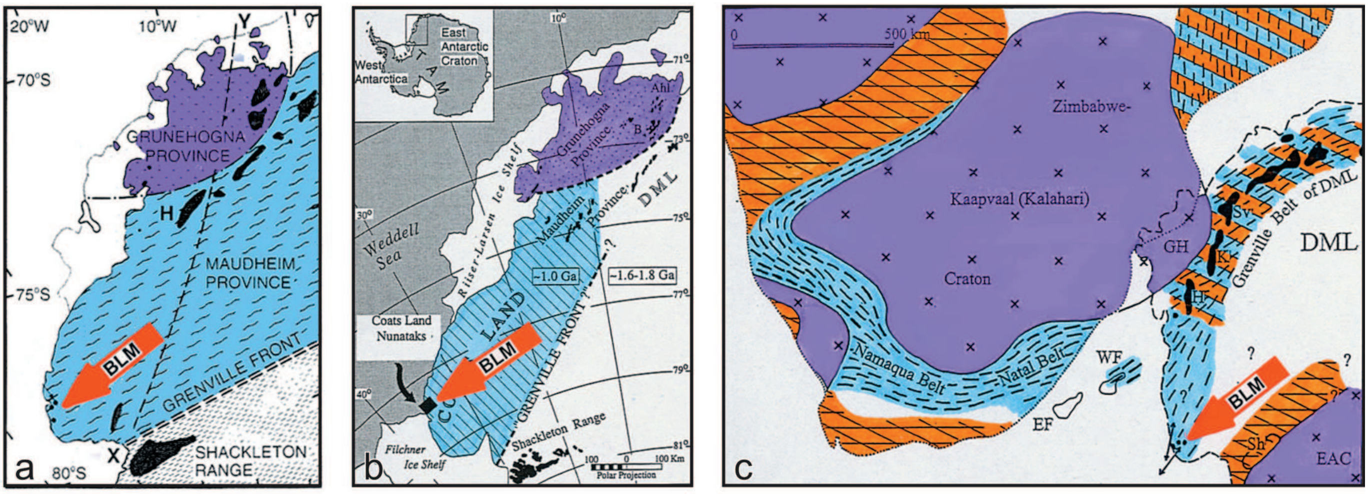

Fig. 11: BLM terrain interpreted as western continuation of the Grenvillian Maud Belt in Dronning Maud Land. (a) from STOREY et al. 1994, (b) from GOSE et al. 1997, (c) from KLEINSCHMIDT 2002. Orange striped = Pan-African overprint, orange = Pan-African, light blue = Grenvillian, violet = craton.

Abb. 11: BLM-Umfeld als hypothetische Westfortsetzung des grenvillischen Maud Belt in Dronning Maud Land. (a) nach STOREY et al. 1994, (b) nach GOSE et al. 1997, (c) nach KLEINSCHMIDT 2002. Orange gestreift = panafrikanische Überprägung, orange = panafrikanisch, hellblau = grenvillisch, violett = kratonisch.

Pan-African tectonics of western Dronning Maud Land are dominated by ~N to ~NE verging thrusting of ~550 Ma in Kirwanveggen (Fig. 10; HELFERICH et al. 2004) and by dextral transpression resulting in ~NW verging crustal thickening and intense folding especially in the southeastern part of Heimefrontfjella (JACOBS et al. 2003a, JACOBS & THOMAS 2004). There, the age of the Pan-African overprint is constrained by $^{206}Pb/^{238}U$ zircon ages of 555 ±8 Ma and 496.5 ±6.5 Ma and by numerous Kr-Ar and Ar-Ar mineral ages of ~500 Ma interpreted as cooling ages (JACOBS et al. 2003a). Particularly instructive age relations of the Pan-African overprint of the Maud Belt have been reported from about 500 to 700 km further ENE in central Dronning Maud Land. There the main compressional Pan-African orogenic phase is dated between approximately 580 to 550 Ma, followed by a late- to post-tectonic phase of extension and orogenic collapse at 530 to 500 Ma (JACOBS et al. 2003b, JACOBS & THOMAS 2004).

It is interesting and significant to note, that this late Pan-African extensional collapse observed in central Dronning Maud Land coincides temporally with the Pan-African compressional phase tectonics observed in the Shackleton Range.

All these dilemmas of the geodynamic situation of BLM – the at least partial lack of Grenville-aged and Pan-African imprints and the position between two different Pan-African orogens – were recognized by several authors (KLEINSCHMIDT 2002, BAUER et al. 2003, JACOBS et al. 2003a,b,c, JACOBS & THOMAS 2004, Dalziel pers. com.).

The first step to resolve these problems is obvious: BLM is (possibly) "cratonic". This has been expressed by BAUER et al. (2003) and JACOBS et al. (2003a,c) by including BLM into an otherwise unexposed "Coats Land Block". At first they regarded BLM (the Coats Land Block) as a pre-Grenvillian region saved from and wrapped by Pan-African orogeneses (Fig. 12a), then they interpreted the BLM region additionally as a wedge of lateral escape (JACOBS & THOMAS (2004); Fig. 12b).

A cratonic nature of the BLM region, but without lateral extrusion as proposed by JACOBS & THOMAS (2004), has recently also been considered by Ian W.D. Dalziel (pers. com.).

Additionally, a cratonic interpretation of the BLM region is supported by the fact, that the closest parts of the Shackleton Range, i.e. its northern edge (Fig. 9), consists of Palaeoproterozoic basement (with a Pan-African overprint, BROMMER et al. 1999), which encouraged TESSENSOHN et al. (1999) to add the northern Shackleton Range to the Kalahari Craton (= Kaapvaal-Grunehogna Craton).

ALTERNATIVE HYPOHESIS

Accepting the pre-Grenvillian "cratonic" character of BLM, possibly as constituent of a "Coats Land Block" à la BAUER et al. (2003) and JACOBS et al. (2003a,c) – we propose a modification of their model.

The contrast between Dronning Maud Land and Shackleton

Fig. 10: Southern Kirwanveggen at the western end of the Maud Belt and its Pan-African overprint (thrusting) of ~550 Ma (e.g. HELFERICH et al. 2004). P = Polaris Ridge, G = Gavlpiggen.

Abb. 10: Südliches Kirwanveggen am Westende des Maud Belt und seine panafrikanische Überprägung (Überschiebungstektonik), ca. 550 Ma alt (z.B. HELFERICH et al. 2004). P = Polaris Ridge, G = Gavlpiggen.

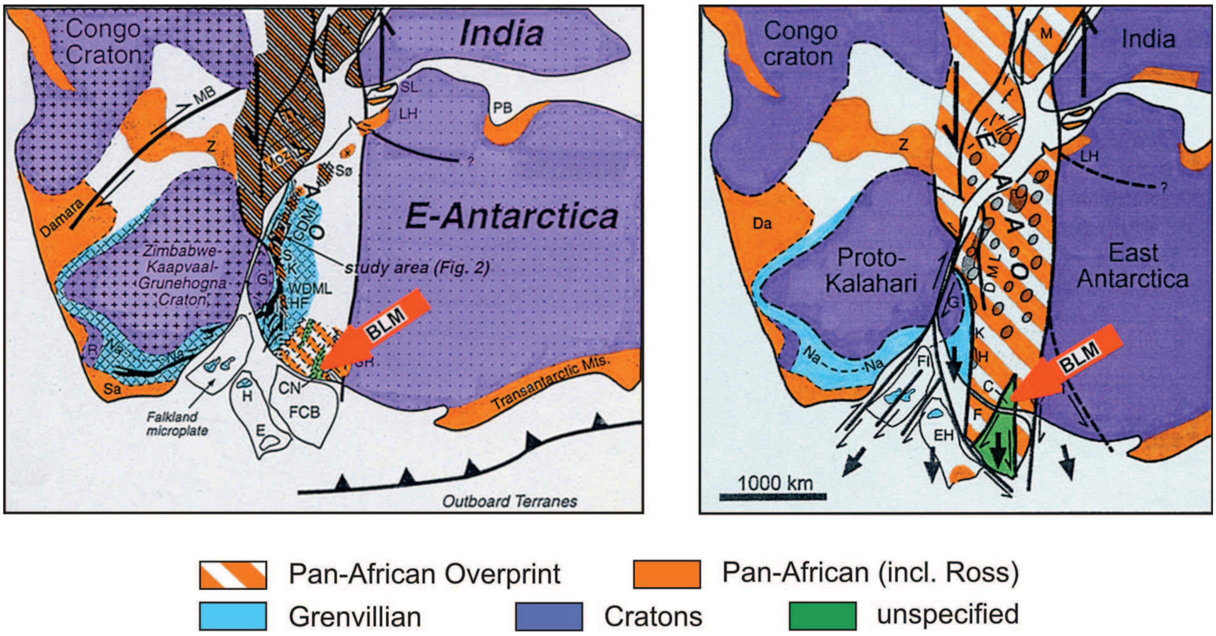

Fig. 12: BLM terrain interpreted (a) as part of the pre-Grenvillian Coats Land Block (left, acc. to JACOBS et al. 2003), (b) as a cratonic wedge due to lateral escape (right, acc. to JACOBS & THOMAS 2004).

Abb. 12: Das BLM-Umfeld (a) als Teil eines prägrenvillischen Coats-Land-Blocks (links nach JACOBS et al. 2003), (b) als Kratonkeil aufgrund seitlichen Ausweichens (lateral ecsape) (rechts nach JACOBS & THOMAS 2004).

Range suggests, that the Pan-African orogen in the Antarctic sector between 15°W and 40°E is not one uniform orogen. This "East Antarctic Orogen" (JACOBS et al. 1998) or "Lützow Holm Belt" (FITZSIMONS 2000) more likely consists of two orogens of different ages – in a way analogous to the European Variscides (e.g. MATTE 2001). Here and there, parallel orogenies and their products (orogens, sutures) followed each other concertina-like. During the late- to post-orogenic collapse of the first orogen (Dronning Maud Land), the second orogen formed roughly parallel by convergent tectonism further south (Shackleton Range).

BOGER et al. (2001, 2002) and BOGER & MILLER (2004) proposed a similar model for the Antarctic region more than 1000 km further to the east, where a similar dualism exists in the regions of Lützow Holm Bukta and Prince Charles Mountains / Prydz Bay. The Pan-African orogeny of the Lützow Holm Bukta region took place in the period ~550 to 520 Ma (SHIRAISHI et al. 1994), the Pan-African orogeny of the Prince Charles Mountains in the period between c. 540 and 490 with a peak around 510 Ma (BOGER et al. 2001, 2008).

The younger Pan-African orogen has been assigned to the Kuunga Suture (Kuunga Belt) (BOGER 2001, 2002) and is represented in the nearly 100 km wide „Lambert Province" of the Prince Charles Mountains (e.g. BOGER & WILSON 2005, BOGER et al. 2006, 2008). It consists of Palaeo- to Neoproterozoic gneisses, schists, marble, quartzite and minor metabasites overprinted by the Cambrian orogeny (BOGER & WILSON 2005). It is surrounded by much older Archaean, Palaeo- or Mesoproterozoic provinces (BOGER et al. 2006).

It is an obvious step to connect the two cases of dualism and to extend Boger's and co-authors model (BOGER et al. 2001, 2002, BOGER & MILLER 2004) up to c. 40°W (Fig. 13). Thus, the solution of the BLM enigma may be provided by the results of Boger and co-authors. Consequently, Gondwana amalgamated in two steps (Fig. 13):
(i) At about 550 Ma ago, West Gondwana and "Indo-Antarctica" (i.e. India plus main Mac.Robertson, Kemp and Enderby lands) merged along the Mozambique Suture.
(ii) At about 500 Ma ago, East Gondwana sensu strictu (i.e. Australia plus main part of East Antarctica) was added along the Kuunga Suture.

Accordingly, BLM were attached first to West Gondwana during the earlier Pan-African orogeny stretching from the Lützow Holm Bukta to western Dronning Maud Land. Then BLM were squeezed between West and East Gondwana during the slightly younger Pan-African orogeny stretching from the Prince Charles Mountains to the Shackleton Range (Fig. 13). The curved trend of this younger Pan-African orogen is supported by the subglacial structural grain obtained from aeromagnetic data in southwestern Mac.Robertson Land (DAMASKE & MCLEAN 2005).

BLM has to be regarded as either an independent pre-Gondwana micro-craton or as an extension of Indo-Antarctica. Our proposal is not inconsistent with the palaeomagnetic data of GOSE et al. (1997).

CONCLUDING DISCUSSION

Our proposed model of the structural evolution of East Antarctica between 40°W and 40°E starts from the assumption, that BLM form an integrated whole of pre-Grenvillian age; i.e. represent a microcontinent or a cratonic fragment. This is supported by aeromagnetic data: The admittedly relatively small-scale maps and their interpretation by GOLYNSKY & ALESHKOVA (2000) show no magnetic discontinuity within the BLM region.

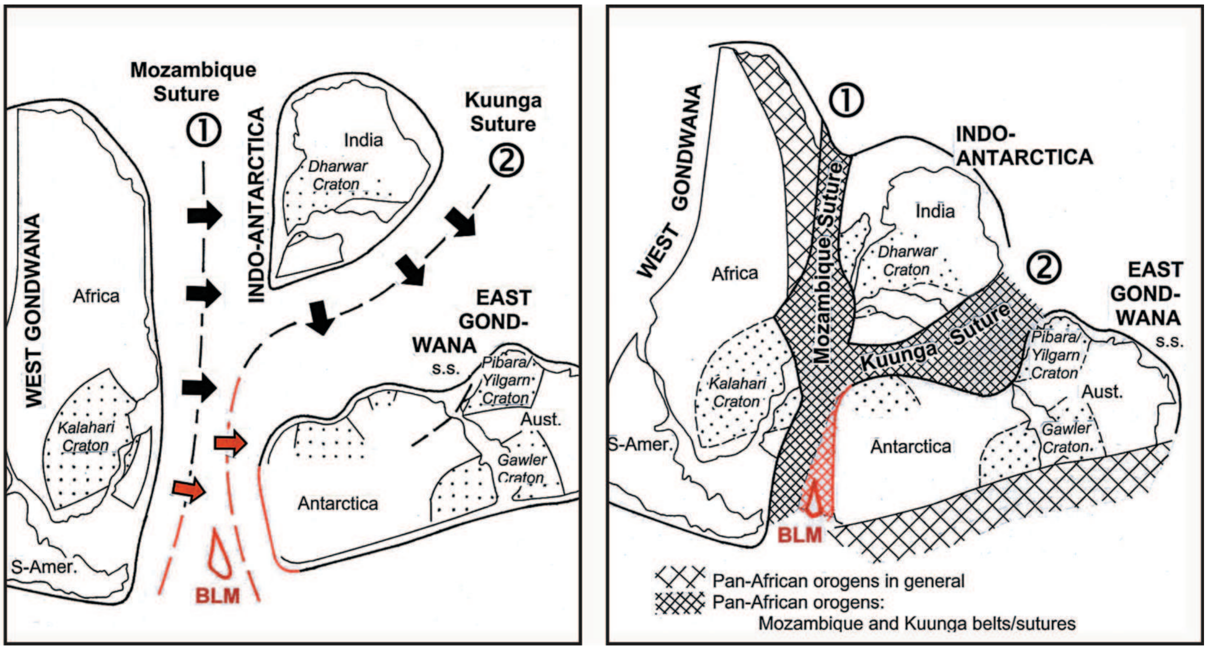

Fig. 13: The two steps of Gondwana's amalgamation according to BOGER et al. (2001, 2002) and BOGER & MILLER (2004) taking into account BLM (red!). Left = before amalgamation (based on BOGER et al. 2001), right = after amalgamation (based on BOGER & MILLER 2004).

Abb. 13: Die beiden Vereinigungsschritte Gondwanas nach BOGER et al. (2001, 2002) und BOGER & MILLER (2004) unter Einbeziehung von BLM (rot!). Links = vor dem Zusammenschluss (basierend auf BOGER et al. 2001), rechts = nach dem Zusammenschluss (basierend auf BOGER & MILLER 2004).

On the other hand, the (very) low grade of metamorphism of the rocks at Moltke-Nunatakker and their relatively simple structural style resemble certain Palaeozoic fold belts, e.g. the main parts of the Variscides in Central Europe (e.g. LANGHEINRICH 1976) and the Ross Orogen of northeasternmost Victoria Land (KLEINSCHMIDT & SKINNER 1981). Such a structural style seems to be unusual for a cratonic area. Even if the assumed (pre-)Proterozoic age of Moltke is daring, it is not excluded in principle. And even a Grenvillian age of Moltke-Nunatakker would admit the proposed duality of the Pan-African Orogen around Prinzregent-Luitpold-, Coates- and Dronning Maud lands. In contrast, a younger, i.e. a post-Grenvillian age of Moltke would imply a much more complicated and up to now incomprehensible story for the entire region.

A final decision depends on the age determination of the Moltke rocks and because of that first of all on getting suitable samples, either by collecting at risk of life or by drilling just east of the Moltke-Nunatakker.

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