



# The geological composition of the hidden Wilhelm II Land in East Antarctica: SHRIMP zircon, Nd isotopic and geochemical studies with implications for Proterozoic supercontinent reconstructions

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## ABSTRACT

In this paper we present new U–Pb zircon age, Sm–Nd isotopic and chemical composition data for rocks cropping out in a few isolated nunataks in Wilhelm II Land in East Antarctica, namely Mirny oasis, Mt Brown and Gaussberg volcano, which contains xenogenic crustal material. These outcrops were subjects of geological investigations during the Soviet Antarctic Expedition of 1956–1957. Our data show that this region is underlain by a uniform crust which experienced a high-grade metamorphic event at ca 980–920 Ma, co-eval with the Rayner Orogeny in Kemp Land and the northern Prince Charles Mountains. Extensive indications of a ca 500 Ma event in coastal areas (granitoid intrusions in Mirny oasis and inherited zircons found in Gaussberg volcano), together with the lack of indications of this age in Mt Brown, point to a concentration of ca 500 Ma processes (roughly co-eval with the Prydz Orogeny) in the coastal part of Wilhelm II Land and their attenuation inland. We also determined a ca 1480 Ma age for a mafic magmatic protolith in Mt Brown which may be correlated with roughly co-eval orthogneiss in the Bunger Hills area. These observations suggest the conjugate positions of these crustal blocks in the early Mesoproterozoic and argue against a Cambrian suture running between them. In Gaussberg volcano a range of zircon <sup>206</sup>Pb/<sup>238</sup>U ages of ca 320 Ma, ca 500 Ma, ca 980 Ma, and ca 2000–1800 Ma has been determined. The presence of ca 2000–1800 Ma zircons indicates involvement of mid-Palaeoproterozoic rocks in the structure of Wilhelm II Land. This argues for possible conjugation of this region with other East Antarctic blocks experienced the Palaeoproterozoic tectonic evolution and which have been considered to comprise the Mawson palaeocontinent.

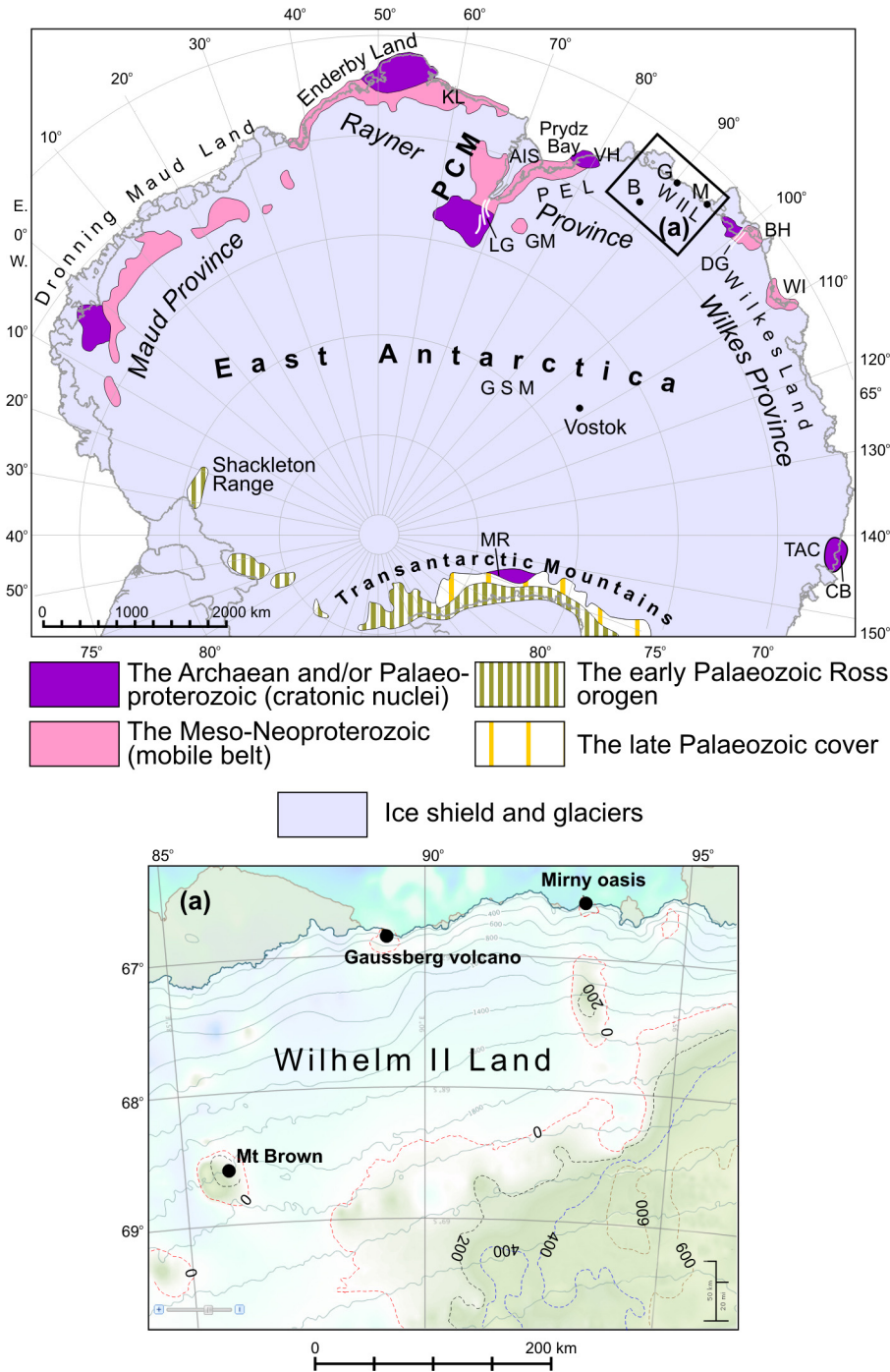
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## 1. Introduction

Wilhelm II Land is a mostly ice-covered coastal area of East Antarctica and actually includes only three tiny exposed pieces of land surface, namely coastal Mirny station area, Gaussberg volcano, and inland Mt Brown (Fig. 1). In the west, the relatively well-exposed Prydz Bay coast and Lambert Glacier area, including the Prince Charles Mountains, were subject to extensive geological investigations since the early 1970s. To the east, the rocks exposed

in the Bunger Hills and Denman Glacier area were also investigated in considerable detail by several expeditions to this region. Those works yielded much valuable geological knowledge for both regions in terms of lithology and geochronology, with some features in common between them, and some important distinctions (e.g., Fitzsimons, 2000a,b, 2003; Boger, 2011). These distinctions enabled two separate tectonic units, the Rayner Province and Wilkes Province, to be identified within these regions (Fig. 1; Fitzsimons, 2000a,b). The nearly completely ice-covered terrain of Wilhelm II Land straddles the boundary between these provinces, but due to poor outcrop was little investigated. However, information on the age and geological nature of rocks cropping out in this area is important for interregional correlations and to test the

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**Fig. 1.** A general tectonic grid of East Antarctica and locality map with subice topography (a). Maud, Rayner and Wilkes tectonic provinces after Fitzsimons (2000). AIS, Amery Ice Shelf; B, Mt Brown; BH, Bunge Hills; CB, Commonwealth Bay; DG, Denman Glacier; G, Gaussberg volcano; GM, Grove Mountains; GSM, Gamburtsev Subglacial Mountains; KL, Kemp Land; LG, Lambert Glacier; M, Mirny oasis; MR, Miller Range; PEL, Princess Elizabeth Land; TAC, Terre Adélie Craton; VH, Vestfold Hills; W II L, Wilhelm II Land; WI, Windmill Islands. Inset (a) provides a topographic chart showing localities examined in this study. Subice topography in (a) from the Antarctic Digital Database ([www.add.scar.org](http://www.add.scar.org)). Dotted lines show subice relief, solid lines – ice surface.

various models of the Gondwana supercontinent assembly in the course of several continental collisions (I. Fitzsimons, S. Boger, op. cit).

In this study we examined specimens collected by P.S. Voronov and L.V. Klimov, who were pioneers of Soviet Antarctic geological investigations, in 1956–1957. They studied the outcrops on the vicinity of Mirny station (hereafter Mirny oasis) and briefly visited Mt Brown and Gaussberg volcano. The studied exposures in

the Mirny oasis have subsequently been covered with snow, and further study of them is currently impossible (except islands near the coast). Since that time Gaussberg volcano, composed of Cenozoic lamproites, was investigated by Australian geologists who did some of detailed petrological and isotopic studies on these rocks (Murphy et al., 2002 and references therein). Mt Brown was apparently also visited by Australian scientists, but no geological data have yet been published.

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