



SHRIMP zircon dating and Nd isotopic systematics of Palaeoproterozoic migmatitic orthogneisses in the Epupa Metamorphic Complex of northwestern Namibia

A. Kröner^{a,b,*}, Y. Rojas-Agramonte^{a,b,c}, E. Hegner^d, K.-H. Hoffmann^e, M.T.D. Wingate^{f,g}

^a Institut für Geowissenschaften, Universität Mainz, 55099 Mainz, Germany

^b SHRIMP Centre, Chinese Academy of Geological Sciences, Beijing 100037, China

^c Instituto Superior Politécnico José Antonio Echeverría, Avenida 114 No 11901 entre 119 y 127, Marianao, CP 19390, Habana, Cuba

^d Department für Geo- und Umweltwissenschaften, Universität München, Theresienstraße 41, 80323 München, Germany

^e Geological Survey of Namibia, Private Bag 13297, Windhoek, Namibia

^f Tectonics Special Research Centre, University of Western Australia, Crawley, WA 6009, Australia

^g Geological Survey of Western Australia, 100 Plain Street, East Perth, WA 6004, Australia

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ABSTRACT

The Epupa Metamorphic Complex constitutes the southwestern margin of the Congo Craton and is exposed in a hilly to mountainous terrain of northwestern Namibia, bordering the Kunene River and extending into southern Angola. It consists predominantly of granitoid gneisses which are migmatized over large areas. This migmatization locally led to anatexis and produced crustal-melt granites such as the Otjitanda Granite. We have undertaken reconnaissance geochemical studies and single zircon U–Pb SHRIMP and Pb–Pb evaporation dating of rocks of the Epupa Complex. The granitoid gneisses, migmatites and anatectic melts are similar in composition and constitute a suite of metaluminous to peraluminous, calc-alkaline granitoids, predominantly with volcanic arc geochemical signatures. The zircon protolith ages for the orthogneisses range from 1861 ± 3 to 1758 ± 3 Ma. Anatexis in the migmatitic Epupa gneisses was dated from a melt patch at 1762 ± 4 Ma, and the anatectic Otjitanda Granite has a zircon age of 1757 ± 4 Ma. Migmatization and anatexis therefore occurred almost immediately after granitoid emplacement and date a widespread high-temperature Palaeoproterozoic event at ~ 1760 Ma which has not been recorded elsewhere in northern Namibia. The Nd isotopic systematics of all dated samples are surprisingly similar and suggest formation of the protolith from a source region that probably separated from the depleted mantle about 2.4–2.0 Ga ago. A major Archaean component in the source area is unlikely.

Structural reworking of the Epupa gneisses during the transpressional Neoproterozoic to early Palaeozoic Kaoko orogeny led to partial or complete obliteration of the older structures and resulted in spectacular low- to high-grade shear and mylonite zones. This reworking did not affect the U–Pb isotopic system in the zircons but documents partial destruction of the Congo cratonic margin. The Epupa granitoid rocks formed during an event generally referred to in Africa as the Eburnian orogeny, but the nature and tectonic setting of the Congo craton of southwestern Africa during this time remain largely unknown.

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1. Introduction

The Epupa Metamorphic Complex, located in Kaokoland, NW Namibia (Miller, 2008), is a general term for a widespread assemblage of mostly amphibolite-grade granitoid orthogneisses with rare interlayered paragneisses and minor gabbroic intrusions.

* Corresponding author at: Institut für Geowissenschaften, Universität Mainz, 55099 Mainz, Germany. Tel.: +49 6131 3922163; fax: +49 6131 3924769.

E-mail address: kroener@uni-mainz.de (A. Kröner).

It constitutes the southwestern margin of the Congo craton and is exposed in a hilly to mountainous terrain extending from the Hoanib River near Sesfontein in the south to the Kunene River and beyond into Angola in the north (Fig. 1). Martin (1965) originally proposed the name Epupa Formation for these rocks and correlated them with other pre-Neoproterozoic assemblages farther south in Namibia. In southern Angola the unit is known as the Gneiss–Migmatite–Granite Complex (Carvalho, 1982; Carvalho and Alves, 1993). The complex is poorly mapped and constitutes the geologically least known terrain in southern Africa, due to its remoteness and poor

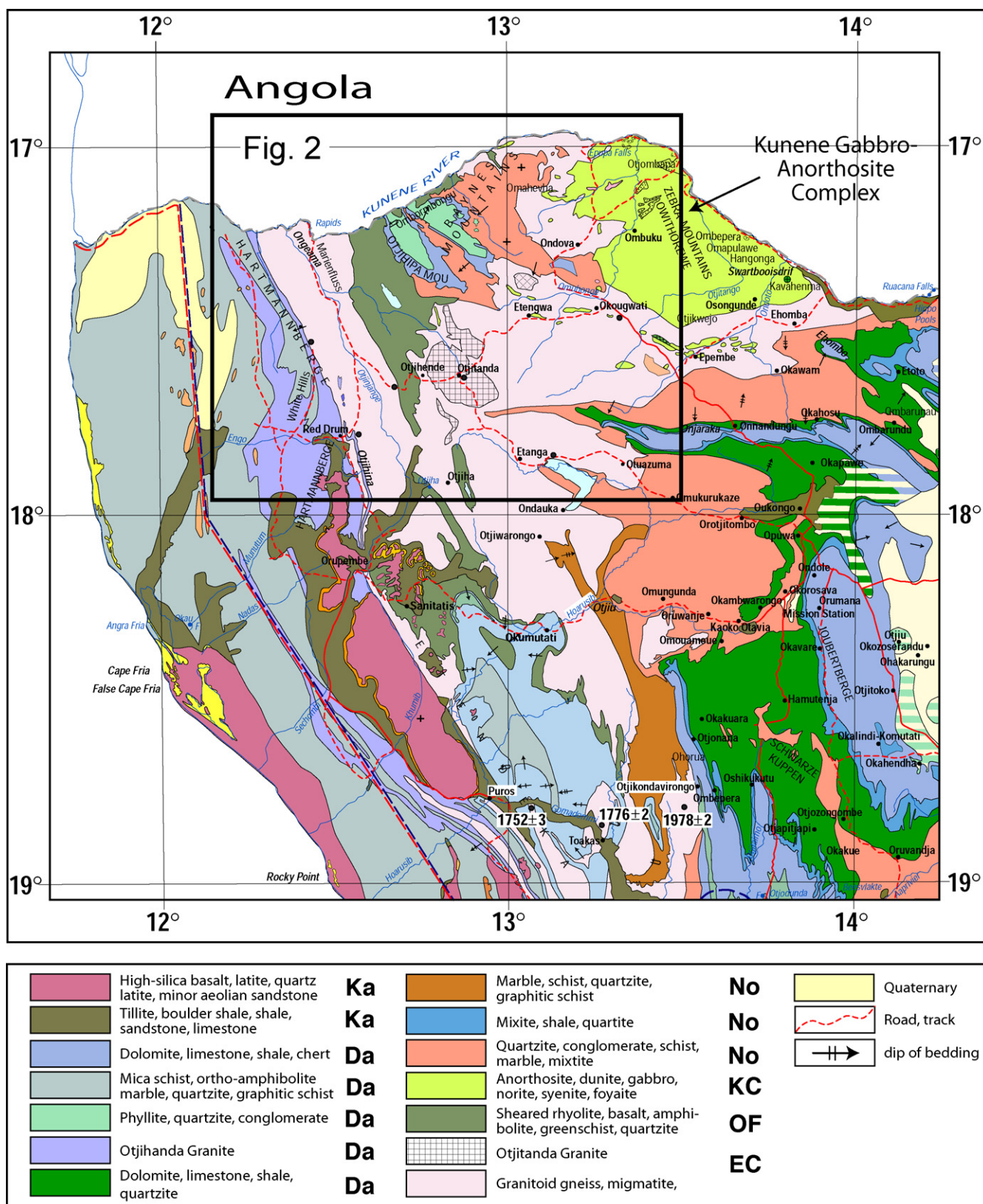


Fig. 1. Overview map of the Epupa Complex and environs in NW Namibia (after Geol. Map of Namibia 1:1,000,000, 1980). Abbreviations in legend: Ka = Karoo; Da = Damara sequence; No = Nosib sequence; KC = Kunene Gabbro-Anorthosite Complex; OF = Okapuka Formation; EC = Epupa Complex.

accessibility. On the provisional Geological Map of Namibia, 1:250,000 (Sheet 1712-Swartbooisdrif, Schreiber, 2002) it is shown as consisting of a variety of gneisses or just “mixed gneiss”.

In the northeast the Epupa gneisses are intruded by the ca. 1385 Ma Kunene gabbro-anorthosite complex (KGAC, Drüppel et al., 2007) and are in tectonic contact with the high-grade Epembe Unit dated between 1640 and 1500 Ma and with granulite-facies

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