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Pan African Granulites from Makubike, Tanzania: a PTt study of metamorphic reaction textures

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Granulite facies rocks occur throughout eastern Africa. Six distinctive domains and/or terranes can be distinguished based on the age of magmatic precursor rocks, age of metamorphism and PT evolutionary history: (1) the Archaean Tanzania Craton; (2) the Usagaran Belt which consists of eclogites, granulites, greenschist facies metapelites as well as abundant granitoids; (3) the "Western Granulites", part of the Neoproterozoic Mozambique Belt (MB) including reworked parts of the craton and Usagaran Belt comprising granulite facies metapsammities, migmatic orthogneisses, and mafic granulites; (4) the "Eastern Granulites" consisting of a basal unit of migmatic enderbitic gneisses, mafic granulites and meta-anorthosites and a cover sequence consisting of marbles, calcsilicates, and metapelites, (5) the Galana terrane (SE-Kenya) consisting of migmatic metasedimentary and metaigneous rocks with intercalations of marbles and calcsilicates, and (6) the Unango, Marupa, and Xixano Complexes in S-Tanzania/N-Mozambique (Bingen et al., 2009) consisting of mainly migmatic metaigneous rocks with subordinate pyroxene bearing granulitic rocks.

Along the contact of Eastern and Western Granulites a unit exhibiting special textural features can be traced over a large area extending from Magubike (between Morogora and Dodoma) to south of Handeni (Mkate Mountains, Kanga Hills, Central Tanzania). Felsic as well as mafic granulites show typical poikilitic garnet corona textures around clinopyroxene and biotite or clinopyroxene, orthopyroxene, and plagioclase.

Johnson et al. (2003) already described these rocks and interpreted the observed textures by isobaric cooling occurring most likely during Archean times.

In this study, the metamorphic event which is responsible for the observed textures was dated by Sm/Nd Grt – Pl – Cpx – WR isochrones and Rb/Sr Bt – WR isochrones. We separated garnets, clinopyroxenes, and biotites from the reaction textures as well as plagioclase from the matrix. One felsic and two mafic granulite samples from different localities were investigated. Garnet, clinopyroxene, and whole rock Sm/Nd isochrones gave well constrained ages for the three samples of 538.3±4.7 Ma, 535.9±7.3 Ma, and 581.1±9.5 Ma. The Rb/Sr biotite-whole rock tie line from the same samples yields ages of 433.7±4.2 Ma, 479.0±4.7 Ma, and 484.1±4.7 Ma. PT conditions of 800-900°C and pressures of 1.1-1.4 Gpa are indicated by mineral compositions and mineral assemblage stability fields from pseudosection calculations.

The Sm/Nd and Rb/Sr data clearly indicate the the granulite facies metamorphism occurred during the Neoproterozoic/Paleozoic and is related to the East African Orogeny.

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