Paleoproterozoic Eclogites of MORB-Type Chemistry and Three Proterozoic Orogenic Cycles in the Ubendian Belt (Tanzania): Evidence from Monazite and Zircon Geochronology, and Geochemistry.

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Abstract

Eclogites and metapelites from the Ubende Terrane of the Proterozoic Ubendian Belt were studied for the purpose of establishing their metamorphic history. Geochemical, petrological and geochronological data of these rocks indicate that oceanic lithosphere was subducted in the Paleoproterozoic and experienced repeated regional metamorphic cycles following their emplacement into continental lithosphere in the Proterozoic.

Eclogite facies metamorphic conditions are recorded by well-preserved porphyroclasts of omphacite (Jd_{17}), matrix plagioclase (Ab_{72}) and garnet core, which give a minimum peak pressure of 15 kbar at 700 °C reflecting a geothermal gradient lower than 13 °C/km. These eclogites have chondrite normalized REE patterns that resemble those of N-MORB and E-MORB. U–Pb SHRIMP dating of zircon in the eclogites reveal metamorphic dates of 1886 ± 16 and 1866 ± 14 Ma. These data indicate that eclogites of the Ubende Terrane in the Ubendian Belt may represent former oceanic crust that was metamorphosed during Paleoproterozoic subduction. The subduction was followed by a regional metamorphic event dated at 1831 ± 11 Ma (monazite in metapelite) and 1817 ± 26 Ma (zircon in metapelite).

Mylonitic textures are common in all lithologic units of the Ubende Terrane and reflect regional Mesoproterozoic and Neoproterozoic metamorphic overprints. The Mesoproterozoic event is dated at 1091 ± 9 Ma (U–Pb SHRIMP date on zircon rims in a metapelite), while Neoproterozoic dates of 596 ± 41 Ma (U–Pb SHRIMP zircon age of an eclogite) and 601 ± 7 Ma (U–Th total Pb age of a monazite rim from a metapelite) reflect later metamorphic events. The Neoproterozoic mylonitization of eclogites occurred under high-pressure amphibolite-facies conditions at 680–750 °C/10–11 kbar.► The Ubendian Belt, southwest margin of the Tanzania Craton, has two suture zones marked by eclogites of the Paleoproterozoic and Neoproterozoic Eras. This paper focuses on the Paleoproterozoic suture zone located in the Terrane of Ubende within the Ubendian Belt. ► The Ubende Terrane eclogites have MORB-type geochemistry and experienced subduction-related metamorphism between 1890 Ma and 1870 Ma. We have inferred a geothermal gradient of less than 13 °C/km and a minimum pressure of 15 kbar. ► After the subduction-related metamorphism another metamorphic event of cryptic nature was recorded in metapelite to have occurred between 1830 Ma and 1820 Ma. This event is probably related to an accretion or a crustal thickening metamorphism that followed after the subduction of an oceanic lithosphere. ► During Mesoproterozoic (1180–1090 Ma) and Neoproterozoic (600–570 Ma) rocks of the Ubendian Belt experienced regional metamorphic events attributed to Kibaran and Pan-African orogenic cycles respectively.

Keywords

Eclogite;
Zircon;
Monazite;
Tanzania;
Ubendian Belt