Supplemental material for
Boniface, N., and Tsujimori, T., 2021, New tectonic model and division of the Ubendian–Usagaran Belt, Tanzania: A review and in-situ dating of eclogites, *in* Wakabayashi, J., and Dilek, Y., eds., Plate Tectonics, Ophiolites, and Societal Significance of Geology: A Celebration of the Career of Eldridge Moores: Geological Society of America Special Paper 552, https://doi.org/10.1130/2021.2552(08).

S1

Dating of Proterozoic orogenic events around the Tanzania Craton: New insights from *in-situ* zircon and monazite geochronology

Nelson Boniface[a]; Tatsuki Tsujimori[b]
[a] University of Dar es Salaam, Geology Dept Box 35052, Tanzania
[b] Institute for Study of the Earth's Interior, Okayama University—Misasa

The western and southern margins of the Tanzania Craton border the Ubendian-Usagaran Orogenic Belts (UUOB) thought to have acquired their current configuration by collision, subduction, and magmatism in Paleoproterozoic times. The accumulation of *in-situ* zircon and monazite geochronology, including our own data, reveals a poly-orogenic nature of the Ubendian-Usagaran Belt. EPMA Th-U-Pb chemical dating of monazite and SIMS and LA-ICPMS U-Pb dating of zircon shows clear three Proterozoic metamorphic events. The Paleoproterozoic tectono-thermal magmatic events reveal a prolonged nature and are dated between 2.0 Ga and 1.86 Ga. During the Paleoproterozoic times the UUOB had orogenic processes that were coupled with subduction of oceanic lithosphere manifested by relics of eclogites. Eclogite-granulite transitional-facies metabasalts with a MORB-affinity yield U-Pb zircon ages of 1.89–1.87 Ga as a subduction event that was followed by a possible collisional event at 1.83–1.82 (Boniface *et al.*, 2012). Preliminary U-Pb dating of zoned metamorphic zircon from a Ubendian eclogite with granulite-facies overprinting yields an upper-intercept age of 1.92 Ga for possibly eclogite-facies stage core and a 605 Ma for granulite-facies rim. The Mesoproterozoic tectonic events occurred between 1.4 Ga and 1.0 Ga; these events overprinted the earlier events and do not show any evidence of subduction-related high-pressure metamorphism. In contrast, the Neoproterozoic times saw the subduction of an oceanic lithosphere in the Ubendian Belt between 590 Ma and 540 Ma (Boniface & Schenk, 2012). U-Pb zircon geochronology for relict eclogites of mafic granulite blocks within migmatitic gneiss shows a Pan-African metamorphic event. The Neoptroterozoic orogenic event is associated with the closing of small ocean basins between the Archean cratons of Tanzania and Bangweulu.

Reconstruction of multiple tectono-metamorphic history based on reconnaissance of *in-situ* dating has just began. Particularly, further understanding of a series of long-living orogenic processes surrounding the Tanzania Craton requires a more comprehensive petrochemical studies and systematic *in-situ* geochronology. In this contribution, new insights, including our on-going project, into the metamorphic evolution of the UUOB are presented.

References

Boniface, N., Schenk, V., & Appel, P., 2012. Paleoproterozoic eclogites of MORB-type chemistry and three Proterozoic orogenic cycles in the Ubendian Belt (Tanzania): Evidence from monazite and zircon geochronology, and geochemistry. Precambrian Research, v. 192-195, 16–33.

Boniface, N. & Schenk, V., 2012. Neoproterozoic eclogites in the Paleoproterozoic Ubendian Belt of Tanzania: evidence for a Pan-African suture between the Bangweulu Block and the Tanzania Craton. Precambrian Research, v. 208-211, p. 72–89.

S2

1.96 Ga kyanite-epidote eclogites with 605 Ma granulite-facies overgrowth in the Ubendian Belt, Tanzania

NELSON BONIFACE[1], TATSUKI TSUJIMORI[2]

[1] Departmen of Geology, University of Dar es Salaam, P.O. Box 35032, Tanzania

[2] Centre for Northeast Asian Studies, Tohoku University, 41 Kawauchi, Aoba-ku, Sendai, Miyagi 980-8576, Japan

Eclogites and eclogite-facies rocks from the Ubendian–Usagaran Orogenic Belts (UUOBs) provide a clue to understand petrotectonic and geochemical proceses of a Paleoproterozoic subduction zone along the Archean cratons. Previous studies have demonstrated that the both Paleoproterozoic (1.89-1.86 Ga in Ubendian/Western UUOBs and ~2.0 Ga in Usagaran/Eastern UUOBs) and Neoproterozoic (590-520 Ma) eclogites in Western UUOBs have a MORB-like geochemical affinity. Some Neoproterozoic eclogites have an arc basalt affinity, manifesting the last amalgamation of Gondwana along the suture that separated the Archean cratons of Tanzania and Bangweulu. Altough the Western UUOBs has thrusted onto the Tanzania Craton around 550 Ma, no Pan-African age suture zone has so far been recognized in the Eastern UUOBs.

Recent *in-situ* zircon and monazite geochronological data reveals a poly-orogenic nature of the Western UUOBs. The Ufipa Terrane in Eastrn UUOBs hosts epidote-bearing kyanite eclogites that were overprinted by a Pan-African granulite-facies reginal metamorphism. Despite the high-temperature overprinting event, eclogite-facies stage kyanite and garnet preserve inclusions of prograde clinozoisite and omphacite. Zoned metamorphic zircons contain fluid inclusion-bearing cores of 1.96 Ga for a prograde eclogite-facies stage and rims of 605 Ma granulite-facies overgrowths. In contrast, kyanite-free eclogite were formed during Neoproterozoic time between 590 and 520 M in a Pan-African suture that separated the Tanzania Craton from the Bangweulu Craton. The Neoproterozoic eclogites have also MORB-type geochemistry and contains Cl-rich amphiboles. Development of omphacite-rich veins suggest fluid infiltration and consequent mineral precipitations during eclogite-facies metamorphism.

In this contribution, we will present new insights into the Proterozoic subduction-zone metamorphism and metamorphic evolution of the UUOBs.