

Ophiolite in the Western Ethiopia: A fossil mantle wedge of the East African Orogenic Belt

*Abdulkadir Sofiya Ayano¹, Akira Ishiwatari², Naoto Hirano¹, Tatsuki Tsujimori¹

1.Department of Earth Science, Graduate School of Science, Tohoku University, Japan and Center for Northeast Asian Studies, Tohoku University , 2.Nuclear Regulation Authority

East African Orogenic Belt (EAO) along eastern Africa and western Arabia is the world's largest Neoproterozoic to Cambrian orogenic belt (Fritz et al. 2013). This amalgamated belt with a ~6000 km length reflects collision of arcs or microcontinents against the Archean craton margins. Although ophiolites and their subducted equivalents are minor components, those rocks provide a clue to understand the petrotectonic evolution, particularly geodynamic process of Neoproterozoic arc-trench systems. In this contribution, we will present petrological features of the Arabian-Nubian Shield ophiolite of the western Ethiopia, and will introduce significance of metasomatism to form "listvenite" (Cr-muscovite-bearing silica-carbonate rock) by CO₂-rich hydrothermal fluids.

We have studied metamorphosed mafic-ultramafic bodies in Tulu Dimtu area (western Ethiopia) of the Arabian-Nubian Shield. The ophiolitic bodies exposed within a NNE-SSW trending metavolcanics and quartzite complex; they consist mainly of serpentinite (antigorite schist), serpentinitized harzburgite with minor metagabbro/metadolerite. The ultramafic bodies bear abundant Cr-muscovite-bearing silica-carbonate rocks, so called "listvenite". The serpentinitized harzburgite contains high-magnesian metamorphic olivine (forsterite [fo]93-96) with magnetite and rare relict primary mantle olivine (fo90-91). Both serpentinite schists and serpentinitized harzburgite contain zoned chromite; the cores with the ferritchromite rims preserve a pristine Cr/(Cr+Al) atomic ratio (Cr# = 0.79-0.87), suggesting a highly-depleted residual peridotite likely formed a supra-subduction zone wedge mantle. Metagabbros have a MORB/OIB-like affinity; they contain epidote-amphibolite facies mineral assemblages but rich in carbonate minerals. Listvenites in Tulu Dimtu contain relict chromites that overlap with Cr# of those in serpentinite and serpentinitized harzburgite, excepting one sample (Cr#=0.57). Noteworthy chromites in listvenite has a significantly higher Mg/(Mg+Fe) ratio. This indicates that a complete metasomatic replacement of serpentinitized peridotite to form listvenite took place prior to re-equilibration between chromite and surrounding mafic minerals; in other words, listvenite-forming metasomatism have occurred before the serpentinitization of harzburgite. The CO₂-rich hydrothermal fluids infiltration into wedge mantle might have occurred prior to regional metamorphism/deformation of the EAO.

Keywords: listvenite, metasomatism, serpentinitization, East African orogeny, Ethiopia