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

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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 CO_2-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), serpentinized harzburgite with minor metagabbro/metadolerite. The ultramafic bodies bear abundant Cr-muscovite-bearing silica-carbonate rocks, so called "listvenite". The serpentinized harzburgite contains high-magnesian metamorphic olivine (forsterite [fo]93-96) with magnetite and rare relict primary mantle olivine (fo90-91). Both serpentinite schists and serpentinized 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 serpentinized 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 serpentinized 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 serpentinization of harzburgite. The CO_2-rich hydrothermal fluids infiltration into wedge mantle might have occurred prior to regional metamorphism/deformation of the EAO.

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

