Mineral Chemistry and Petrogenesis of the Mazua Ultramafic Massif, Northern Mozambique: Constraints on the Associated Fe-Ti Oxides Deposit

*David Augusto Bene Unganai[1], Akira Imai[2], Ryohei Takahashi[1], Daud Liace Jamal[3], Takashi Hoshide[1]

1. Akita University, 2. Kyushu University, 3. Eduardo Mondlane University

Economic magmatic Fe-Ti-V deposits are commonly hosted by mafic-ultramafic intrusions and massif-type anorthosites. The Mazua Ultramafic Massif (MUM), located in northeast Mozambique, is one of the most promising intrusions that host Fe-Ti oxides ore deposit in the country. The orebody is a 10-km long ilmenite-rich hornblende pyroxenite, which is in sharp contact with a banded biotite gneiss. The ore commonly occurs as layers/lenses, massive and dissemination in host rocks. The average grade of the ore is 27 wt.% TiO_2, 35 wt.% Fe_2O_{3tot} and ~2 ppm V (Norconsult Consortium, 2007). However, detailed studies regarding the petrogenesis of the intrusion and its related Fe-Ti oxides ores are still scarce. Thus, we carried out microprobe and petrographic analyses to elucidate these issues.

The hornblende pyroxenite consists of ilmenite, diopside, and magnesiohornblende as main phases. Petrography reveals that the Fe-Ti oxides and pyroxenes are syngenetic. The composition of diopside ($Wo_{43.5–48.5}En_{36.0–41.4}Fs_{11.1–20.5}$) and occurrence of magnesiohornblende suggest tholeiitic, non-alkaline and hydrous (>3.0 wt.% H_2O) parental ultrabasic melt. In addition, the absence of olivine and orthopyroxene supported by wide range of #Mg in diopside (63.8–78.7) and magnesiohornblende (68.9–85.4) confirms the idea that the magma which formed MUM was differentiated.

Texture and variable mineral composition suggest that Fe-Ti oxides underwent extensive subsolidus re-equilibration during cooling, supported by the following evidences: (1) The Fe-Ti oxides show different types of micro-intergrowths such as (a) lamellae of ilmenite with clothing textures hosted in magnetite, (b) fine pattern exsolution lamellae (trellis) and blebs of aluminous spinel in magnetite, (c) reaction rims of aluminous spinel distributed along the boundary between magnetite and ilmenite and (d) re-equilibration textures involving Fe-Ti oxides and silicate phases. (2) The very low MgO content of primary ilmenite (<2 wt.%) is interpreted as a result of postcumulus oxide-silicate re-equilibration involving clinopyroxene and amphibole. (3) Determination of equilibrium conditions using geothermobarometer by Spencer & Lindsley (1981) indicates that Mazua Fe-Ti oxides last equilibrated at subsolidus temperatures (<600 ˚C) and high oxygen fugacity ($\log fO_2 > -20.0$ bars). The reconstruction of the primary composition of Fe-Ti oxides, by reintegration of exsolved with the host phases, leads to primary titanomagnetite with an ulvospinel component of ~20 mol%.

