Japan Geoscience Union Meeting 2012
(May 20-25 2012 at Makuhari, Chiba, Japan)

SCG06-P03 Room:Convention Hall Time:May 25 15:30-16:30

Mid to late Archean TTG magmatism in the eastern Madagascar; a view from whole rock geochemistry and U-Pb geochronology

ICHIKI, Takashi[1*], Yasuhito Osanai[2], Masahiro Ishikawa[1], Nobuhiko Nakano[2], Tatsuro Adachi[2]

[1]Graduate School of Environment and Information Sciences, Yokohama Nat. Univ., [2]Earth Sci., Kyushu Univ.

Madagascar occupies a key position in the East African Orogen for understanding the continental growth and the tectonics of collision between East Gondwanaland and West Gondwanaland. Especially in the eastern Madagascar is composed of mid Archean domain (Masora) in the east and late Archean domain (Antananarivo) in the west.

The magma genesis and timing of magmatism were studied by whole-rock chemical analysis and LA-ICP-MS U-Pb zircon age dating of granitoids in these domains.

Masora domain is divided into two parts, north and south region, defined by metamorphic grade. The rocks from the north region are only weakly deformed. The north region mainly consists of trondhjemites with subordinate amounts of metapelities including meta-BIFs, and late granitoids with mafic-ultramafic rocks. Trondhjemites in the northern Masora domain are characterized by high SiO2 (67.80-70.98 wt.%), high Al2O3 (15.86-18.44 wt.%), and high Na2O (5.35-5.98 wt.%), low TiO2 (0.27-0.40 wt.%), Mg# (31-35), CaO (1.90-2.24 wt.%), K2O (1.64-2.65 wt.%). Antananarivo domain is divided into two parts, north and south region, defined by lithology. The south region mainly consists of Hbl-Bt gneisses with subordinate amounts of Grt-Opx granuilites, amphibolites, quartzites and metapsammites including meta-BIFs. Whole rock chemical analyses for the major and trace elements demonstrate that Hbl-Bt gneisses in the southern Antananarivo domain are of igneous origin and chemically comparable with CIPW normative tonalities. Hbl-Bt gneisses are characterized by high SiO2 (71.00-73.16 wt.%), high Al2O3 (15.89-16.33 wt.%), and high Na2O (4.41-4.67 wt.%), low TiO2 (0.18-0.23 wt.%), Mg# (38-43), CaO (3.40-3.82 wt.%), low K2O (1.04-1.71 wt.%). All of these granitoids (trondhjemites and Hbl-Bt gneiesses) show pronounced negative Nb, Ti, P anomalies on the primitive mantle-normalized spidergram. These characteristics are comparable to Archean TTG (tonalite-trondhjemite-granodiorite) (e.g. Martin et al., 2005).

A xenocrystic zircon in a trondhjemite sample collected from the northern part of the Masora domain gives a single grain concordat age of mid Archean (ca. 3.2 Ga). Hbl-Bt gneiss sample in the southern part of the Antananarivo domain shows slightly scattered and discordant late Archean age (ca. 2.7 Ga). This new age is slightly older than reported oldest ages of Antananarivo domain (ca. 2.5 Ga; Kroner et al., 2000).

These results show that the area between mid Archean (Masora) and late Archean (Antananarivo) domains is underlain by ca. 2.7Ga tonalitic rocks. Similar magmatic age is reported from the southern India. Late Archean magmatic age of the charnockite and meta-granite (ca. 2.65-2.53) were reported from the Salem Block in the southern India (Clark et al., 2009; Sato et al., 2011), where located between the mid to late Archean Dharwar Craton (e.g. Peucat et al., 1993) to the north and late Archean Madurai Block (Plavsa et al., 2012) to the south. Hence we speculate that Madagascar and India records progressive outward continental growth by accretion of mid-to-late Archean (ca. 2.7-2.6 Ga) crust and the late Archean (ca. 2.5 Ga) crust to ca. 3.2Ga Dharwar nuclei crust. Although Tucker et al. (2011) suggested the 'Greater Dharwar Craton' model to explain the juxtaposition of Madagascar with India from the late Archean (ca. 2.5 Ga), we suggest more stepwise crustal growth in the Archean era.

Keywords: Madagascar, Achean TTG, geochronology, geochemistry