Sapphirine- and corundum-bearing mafic rock from the Ronda peridotite massif, as a result of crustal material recycling

Tomoaki Morishita[1], Shoji Arai[2], Fernando Gervilla[3]

[1] Earth Science, Kanazawa Univ., [2] Dept. Earch Sci., Kanazawa Univ., [3] Tierra, Granada Univ

We have sampled sapphirine- and/or corundum-bearing aluminous mafic rocks alternating with peridotite from the Ronda massif. Microtexural relationships in the aluminous mafic rock suggest its exhumation history from eclogite facies. We will present trace element compositions of the sapphirine- and corundum- bearing aluminous mafic rock from the Ronda massif and discuss its evolution history.

The Ronda massif has been divided into several domains, and its tectonic history has been still contraversal (Obata, 1980; Van der War & Vissers, 1993; 1997; Tubia, 1994 Zeck, 1997). The mafic rocks including pyroxenites in the Ronda massif have been also divided into several types (Dickey, 1970; Obata, 1980; Suen & Frey, 1987; Garrido & Bodinier, 1999). We have sampled sapphirine- and/or corundum-bearing aluminous mafic rocks alternating with peridotite from the Ronda massif. A SHRIMP zircon age (131+/-5 Ma) in a corundum-bearing garnet pyroxenite from the Ronda massif was thought to be its protolith age (Sanchez-Rodrigues & Gebaure, 2000). The aluminous mafic rocks were taken from the garnet-spinel mylonite zone of Van der War & Vissers (1996). One of the aluminous mafic rock samples is more than 8 cm in thickness and can be divided into six sublayers corresponding to the modal mineral variations. The six sublayers have different bulk chemical compositions. The aluminous mafic rocks of this study from the Ronda massif are roughly equivalent to the Type II layer from the Beni Bousera massif, northern Morocco (Kornprobst et al., 1990). The rock shows a granoblastic metamorphic texture consisting mainly of partially to completely kelyphitized garnet and colorless clinopyroxene with minor amounts of plagioclase, green-spinel, corundum, sapphirine and opaque minerals. Spherical symplectitic aggregates consisting of secondary clinopyroxene and plagioclase occur in the primary clinopyroxene. Al2O3 and Na2O contents of primary clinopyroxene cores show wide ranges from 6 to 16 wt. and from 1.5 to 3.3 wt. , respectively. Corundum is always associated with spinel and plagioclase. Sapphirine occurs in two mineral associations. One is present as elongated lamella-like shape within clinopyroxene. The other is present as aggregates of very fine plates in plagioclase-rich domain. In both cases, a part of sapphirine is replaced by symplectitic spinel aggregate. The sapphirine + plagioclase aggregate strongly suggests a presence of kyanite as one of earlier phases in the studied aluminous mafic rock. Clinopyroxene rich in Ca-tscermak component roughly requires high temperatures above 1000 C at pressures in which garnet can coexist (above 1.5 GPa) (Gasparik, 1987), although the garnet-cpx thermometer can not be applied here due to breakdown of primary phases. The experimental results by Raheim & Green (1974) demonstrated that that kyanite + quartz appears first in the anorthotic gabbro composition on the final breakdown of plagioclase at high pressures (c. 20 kbar at 1100 C).

Kornprobst et al. (1990) considered that a protolith of the corundum-bearing garnet pyroxenites (the Type II layer of their discrimination) from the Beni Bousera massif was a plagioclase-rich, lower-pressure cumulative product because of their significant positive Eu anomaly. They concluded that the mineral assemblage of clinopyroxene + garnet + corundum was accomplished deep in the mantle after subduction and/or dragging down of the plagioclase-rich protolith of crustal origin during convection of the mantle. R705A of Suen & Frey (1987) has high Sr/Nd ratios, low REE concentration and positive Eu anomaly. R705A has the same petrographical characteristics as the studied aluminous mafic rock except for the absence of corundum and sapphirine (Suen & Frey, 1987). We confirmed, however, symplectitic spinel within kelyphite and plagioclase-rich domain in the R705A. These textural similarities suggest that R705A was also experienced higher P-T condition (eclogite facies metamorphism) after it was formed from melt. In our presentation we will present trace element compositions of the sapphirine- and corundum- bearing aluminous mafic rock from the Ronda massif and discuss its evolution history.