Geophysical Research Abstracts
Vol. 18, EGU2016-7130-1, 2016
EGU General Assembly 2016

Plagioclase-peridotites recording the incipient stage of oceanic basin formation: new constraints from the Nain ophiolites (central Iran)

Tahmineh Pirnia Naeini (1), Shoji Arai (2), and Emilio Saccani (1)

(1) Department of Physics and Earth Sciences, Ferrara University, Ferrara 44122, Italy, (2) Department of Earth Sciences, Kanazawa University, Kanazawa 920-1192, Japan

Pargasite-bearing plagioclase peridotites of Nain have recorded a complex tectono-magmatic and -metamorphic history. Based on texture, as well as mineral major and trace element chemistry, two stages of facies exchange have been documented in the peridotites, namely, from plagioclase to spinel and vice versa. The earliest event that influenced the peridotites was a low degree of flux melting (<4%) which occurred at the pargasite stability field. Melting resulted in a small fraction of highly enriched melt as well as a depleted chemistry of the pargasites and coexisting pyroxenes. The produced melt fraction was scanty, and consequently hardly mobile. It crystallized in-situ in the peridotites in form of plagioclase. After the melting stage, cooling caused the peridotites to recrystallize in spinel facies. Recrystallization obliterated all textural features associated with formation of magmatic plagioclase in the peridotites. However, lines of evidence are documented by the chemistry of the spinel-facies mineral assemblage, which strongly suggest the pre-existence of plagioclases. This evidence includes a positive Eu anomaly in pargasites and pyroxenes, as well as a Zr negative anomaly in orthopyroxenes.

The spinel-facies assemblage subsequently recrystallized in the plagioclase stability field. Recrystallization occurred in various degrees. Strong recrystallization resulted in the formation of modally typical, but atypically enriched, harzburgite from the lherzolite. Remarkable textural characteristics of peridotites that indicate subsolidus origin for plagioclases include: (1) plagioclase heterogeneous distribution, (2) plagioclase exclusive concurrence with spinel and, (3) plagioclase modal positive correlation with olivine but negative correlation with pyroxenes and pargasite. The transition from spinel to plagioclase-facies was associated with the following compositional variations in the peridotite minerals: (1) Al, Mg, Ni decrease and Cr, Ti, Fe increase in spinel; (2) Al, Ca decrease and Cr, Ti increase in pyroxenes and pargasite; (3) slight overall increase in the concentration of rare earth elements and most trace elements in pyroxenes and pargasite, except for Eu and Sr for which a slight decrease is observed. The pointed variations all support the subsolidus origin of the plagioclases, since they took place at constant Mg#s of pyroxenes and coexisting olivines.

The magmatic and metamorphic events that affected the Nain peridotites correspond well to the expected geodynamics of a short-lived oceanic basin. Melting was a result of peridotites upwelling (up to the plagioclase-facies) in the early stages of the ocean spreading. Cooling and the subsequent recrystallization in the spinel-facies correspond to the early ceasing of spreading and magmatism in the ocean. Reconditioning of the peridotites in the plagioclase-facies is likely related to the ocean closure and Nain ophiolite emplacement. Based on the short-lived and subduction-related character deduced from the ubiquitous occurrence of amphiboles in the peridotites, we strongly suggest a back-arc setting for the Nain Mesozoic Ocean.