Petrochemistry of the non-volcanic continental margin peridotite from the Iberia Abyssal Plain (ODP Leg 173)

Natsue Abe[1]

[1] GEMOC, Macquarie Univ.

http://www.es.mq.edu.au/GEMOC/

Highly serpentinized peridotites from beneath the non-volcanic continental margin were sampled from southern Iberia Abyssal Plain (ODP Leg 173), and the primary mantle minerals were analysed for major- and trace-element chemistry.

The trend of mineral compositions is distinctive from that for both simple melt extraction and common mantle metasomatic trends. Their geochemical character is intermediate between those of abyssal peridotite and peridotite xenoliths from continental regions. Those geochemical features are similar to those in clinopyroxene of peridotite xenoliths from arcs. This compositional trend is probably due to the "open-system melting", that occurs contemporaneously with enrichment in trace elements by an influxing agent.

The Iberia Abyssal Plain located the West Iberia Margin in the northeast Atlantic Ocean is one of the ocean-continent transition (OCT) zones of non-volcanic rifted margins. Highly serpentinised peridotite, well-lineated metagabbro (amphibolite), tonalite, and clastic breccias of these rock types were sampled during ODP Leg 173 (Whitmarsh et al. 1998). All investigations related to the cruise contributed to studies of lithospheric extensional structures in the crust and mantle, the emplacement and seabed exposure of mantle rocks, synrift magmatism, the onset of seafloor spreading and the characterization of the OCT.

46 serpentinised ultramafic samples from Holes 1068A and 1070A were studied. Those samples have relict primary minerals; Clinopyroxene, spinel, +-Opx, +-olivine, +-amphiboles. Most of serpentinised peridotites have pseudomorphs after plagioclase around chromian spinel. All peridotite samples are mostly serpentinised and some contain mantle spinel relics.

Cr# of spinel widely varies from 0.22 to 0.61, almost covering the whole range for abyssal peridotites (Dick 1989), but most of them are lower than 0.4. Na_2O content in Clinopyroxene is constant; 0.5-0.8 wt%. Three samples of Hole 1070A have Opx (Al_2O_3 = 4.3 - 5.0 wt%) with Clinopyroxene. Amphibole in Hole 1068A is tremolite with high Mg# (0.956), while those in 1070A are (pargasitic) hornblende.

In situ trace-element analyses of clinopyroxenes were conducted on a Cameca IMS-3f SIMS at Tokyo Institute of Technology. Their chondrite-normarised REE patterns are LREE-depleted convex-upward pattern, except for one which has a slightly LREE-depleted flat pattern. Ce, Yb and Sr contents widely vary 1.2-7.7, 5.6-17.6 and 0.8-3.5 times of chondrite value (Anders & Grevesse 1989), respectively. These concentrations are intermediate between other abyssal and young continental clinopyroxene values. However, they show less correlated with the degree of melt extraction of the samples as measured by Cr# of coexisting spinel.

Iberia Abyssal peridotite is easily distinguished from other abyssal peridotites from Mid-Ocean ridge regions (e.g. Johnson et al. 1990) (which appear to comprise a simple residual suite), and peridotite xenoliths from young continental lithosphere which show by metasomatic enrichment, by different geochemical trends. The clinopyroxenes in the Iberia Abyssal Plain peridotites are enriched in incompatible elements such as Sr, Zr and Ce relative to other abyssal peridotites and, remarkably, the Ti/Zr ratio of all clinopyroxenes is close to 100. These Clinopyroxene geochemical characteristics indicate that the Iberia Abyssal Plain Clinopyroxene can be neither a series of simple restites nor a series of simple metasomatites. It is most probable that those peridotites are the residue of a partial melting assisted by or associated with addition of fluid/melt with a constant and low Ti/Zr ratio.

On the other hand, the trace-element composition is similar to that of supra-subduction zone mantle, which has a geochemical character intermediate between abyssal peridotite and peridotite xenoliths from young continental lithosphere. (Abe 1997). Silva et al. (2000) suggest that an ancient arc, the Precambrian Ibero-Armorican Arc, exists adjacent to the Iberia, north-western France and the Canadian Grand Banks margins on the basis of magnetic data from this area.

There are two possibilities for the origins of Iberia Abyssal Plain mantle.

(1) It was made by the open-system melting with flux from the plume causing the rifting.

(2) They represent mantle materials that have experienced processes in an active margin before rifting.

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