Petrographic contrast between ilmenite- and magnetite-series gabbroic rocks in the Ryoke and San-in belts, southwestern Japan

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To determine the petrographic contrasts between ilmenite- and magnetite-series magmas, I assessed rock descriptions, modal compositions, and bulk chemical compositions for the ilmenite- and magnetite-series gabbroic masses in the Ryoke and San-in belts of the Chugoku and Shikoku districts, focusing on primitive phases of the two plutonic belts. We obtained the following results:

(1) The San-in gabbroic rocks contain variable modal amounts of magnetite, up to 5.8%, whereas no magnetite was detected in the Ryoke gabbroic rocks. The outcrop measurements of magnetic susceptibility showed good positive correlation with the magnetite contents of the outcrop samples.

(2) Compared with the San-in gabbroic rocks, the Ryoke gabbroic rocks are generally less abundant in alteration minerals, such as chlorite and fibrous actinolite, and more abundant in olivine- and orthopyroxene-bearing phases.

(3) The modal and whole-rock chemical compositions indicate that the Ryoke gabbroic rocks have more cumulative characters than the San-in gabbroic rocks. The compositional differences between them can be explained mainly by the differences in their degree of crystal accumulation.

(4) Any significant differences in the N-MORB normalized patterns of trace-element and REE between the Ryoke and San-in gabbroic rocks were detected.

Features (2) and (3) may be responsible for the differences in emplacement depths between the Ryoke and San-in gabbroic masses, although these features are independent of redox states. Feature (4) suggests that the two gabbroic rocks have a common petrogenetic background.

Based on these results, it is concluded that the contamination of Ryoke gabbroic magma by sediments is insignificant, having little or no effect on redox states. It is more likely that the divergent redox states of the two gabbroic magmas are due primarily to differences in the volatile components involved in the fO_2 buffer reactions.