Duite-Wehrlite-Olivine Clinopyroxenite Series Rocks from the North Fiji Basin : Precious Deep-Seated Rocks from the Backarc Basin

Dunite-Wehrlite-Olivine Clinopyroxenite Series Rocks from the North Fiji Basin: Precious Deep-Seated Rocks from the Backarc Basin

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Dunite, wehrlite, and olivine clinopyroxenite were recovered from the North Fiji Basin, one of the active backarc basins in the southwest Pacific. Wehrlite and olivine clinopyroxenite are commonly observed in ophiolite suite, but are very rare, as compared with residual peridotite, from oceanic floor (e.g. Girardeau and Francheteau, 1993). Moreover, reports of ultramafic rocks from backarc basin are generally limited (e.g. Ohara et al., 2002). Thus wehrlite series rocks from the North Fiji Basin are precious samples because the backarc basin and the mid-ocean ridge are candidates for tectonic setting. of the genesis of ophiolite.

The North Fiji Basin that lies in the boundary between the Pacific Plate and the Indo-Australia Plate is an active backarc basin at the present day (Fig. 1). Spreading of the North Fiji Basin started at 10 Ma, and the basin experienced a complicated tectonic history (Auzende et al., 1988). The Fiji Transform Fault, which is a 1500 km long structural element in the North Fiji Basin, is a left lateral transform fault from the active spreading center to the Lau Basin. Wehrlite series rocks were dredged from the Central Hill, which is a topographic high lying in the nearby north of Fiji Transform Fault, by one of SOPAC cruises.

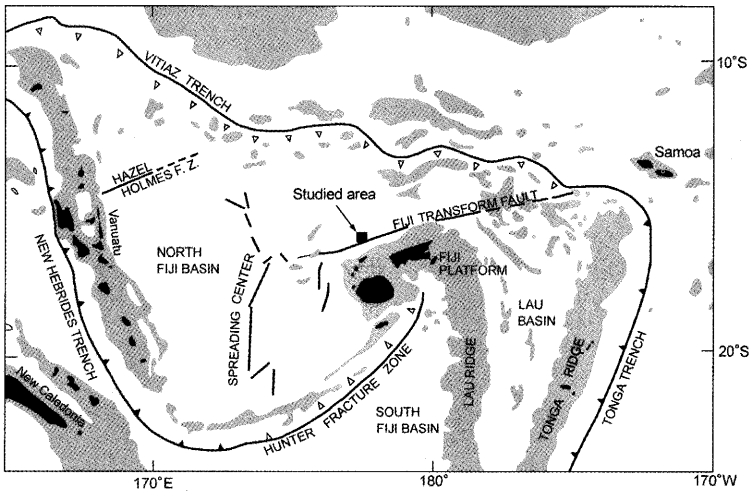

Fig. 1. Tectonic setting of the North Fiji Basin, modified from Auzende et al. (1995).

Wehrlite series rocks are composed of olivine, clinopyroxenite, and chromian spinel in primary minerals. Secondary minerals are serpentine, chlorite, altered orthopyroxene, altered plagioclase, amphibole (tremolite-hornblende), and magnetite. Although the degree of serpentinization is severe in dunite, primary silicate minerals are preserved in wehrlite and olivine clinopyroxenite. Primary modal compositions could be estimated from pseudomorghs. Dunite seems to gradually change to olivine clinopyroxenite through wehrlite.

Fo value of olivine in wehrlite and olivine clinopyroxenite is variable from 88.2 to 78.9 (Fig. 2), showing their plotting off the olivine spinel mantle array (Arai, 1994), which is a residual spinel peridotites field. Chromian spinel is highly variable in chemistry. Cr# [=Cr/(Cr+Al)] and Mg#

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[=Mg/(Mg+Fe^{2+})] are variable from 0.41 to 0.85 (Fig. 2) and 0.15 to 0.50 respectively in chromian spinel. TiO_2 content and Fe^{3+}/(Cr+Al+Fe^{3+}) atomic ratio is also variable, from 0.06 to 1.67 wt% and from 0.03 to 0.37, respectively (Fig. 3).

Wehrlites and olivine clinopyroxenites from the North Fiji Basin are possibly of cumulate origin. The high Cr# character of chromian spinel indicates that the rocks were equilibrated with a certain melt produced by a high-degree partial melting. Fe^{3+}/(Cr + Al + Fe^{3+}) atomic ratios of chromian spinel are distinctly higher than those of MORB (ca. <0.10) (Fig. 3). This character is similar to arc-related basalt. Jarvis et al. (1994) argued that the Bligh Ridge, which exists to the east of the Central Hill, was separated from the Fiji Platform by the motion of Fiji Transform Fault. The Fiji Platform is interpreted as a remnant old arc that might be active before formation of the North Fiji Basin. This is consistent with the arc origin of the wehrlite series rocks deduced from mineral chemistry. The genesis of the wehrlite series rocks obtained from the Central Hill is possibly related to a magmatic activity of the old Fiji Platform.

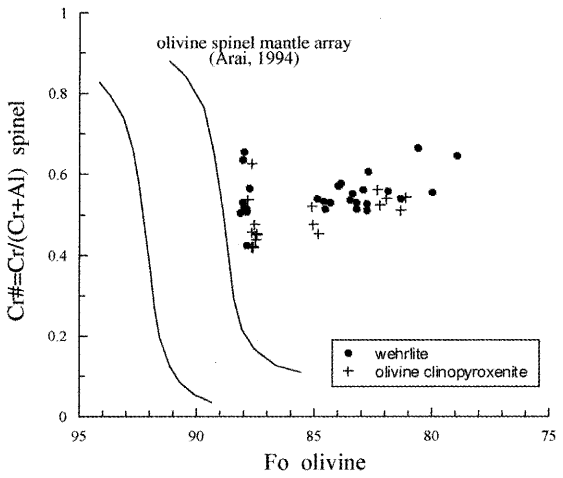

Fig .2. Relationships between Fo of olivine and Cr/(Cr+Al) atomic ratio of chromian spinel

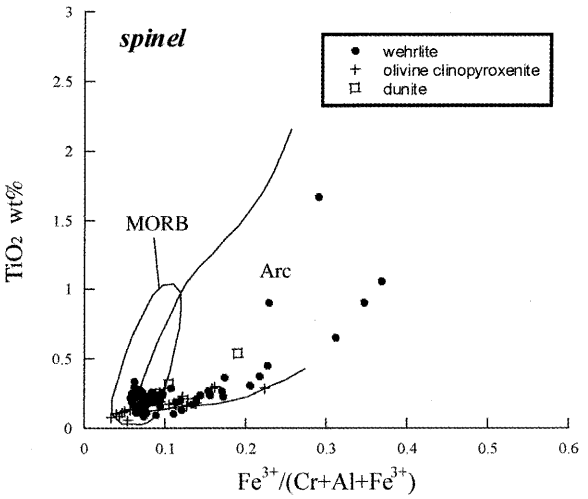

Fig. 3. Relationships between Fe^{3+}/(Cr+Al+Fe^{3+}) atomic ratio and TiO_2 content of chromian spinel. MORB and arc are discriminated by Arai (1992).

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