

In thin section the rosenhahnite occurs as fresh, euhedral, lath-like crystals (0.5–1 mm long), which are biaxial negative with an optic axial angle of 62° (cf. Pistorius, 1963–64°). Other optical properties agree with those given by Pabst *et al.* (1967) and Dunn (1975).

The X-ray powder pattern is comparable with that given by Pistorius (1963) and Pabst *et al.* Microprobe analysis gave SiO_2 47.6, Al_2O_3 0.01, BaO 0.01, total Fe as FeO 0.01, MnO 0.04, CaO 48.7, Na_2O 0.03, K_2O 0.01, total 96.41. Addition of the theoretical water content of 4.92 % to this analysis gives a hydrated formula of $\text{Ca}_{3.1}\text{Si}_{2.9}\text{O}_8(\text{OH})_2$, which approximates the ideal formula $\text{Ca}_3\text{Si}_3\text{O}_8(\text{OH})_2$ given by Jeffrey and Lindley (1973).

It would appear that the mineral associations and geological environments of the Californian and Wairere rosenhanites are closely comparable. The brecciated and cataclastic nature of the setting at Wairere suggests that formation of the mineral has occurred under highly strained conditions. However, the North Carolina association and setting points to other, as yet unknown factors being involved in the formation of rosenhahnite other than simple pressure and the use of this mineral as an indicator of high pressure may be in doubt—a comparable position to that of aragonite.

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Chromite in pyroxenite from the Massif du Sud, southern New Caledonia

CHROME-SPINELS have been described from the alpine-type peridotite complex of New Caledonia by Guillon (1970), Rodgers (1973a), and Bevan and Rodgers (1977). The most common types prove to be magnesium-rich varieties (e.g. picrochromites and ceylonites) occurring in the major peridotite rock types (harzburgites, dunites, and chromitites). Electron microprobe examination of spinels associated with pyroxenites, which occur in minor amounts in the Massif du Sud, show a number of these to have $\text{Fe}^{2+}/\text{Mg} > 1$ and to be chromites, var. beresofite.

Typical of these pyroxenite occurrences is that at Col du Mouirange where a horse of ultramafics is included in a diorite–granodiorite complex intruded across a dunite–harzburgite

TABLE I. *Electron-probe analyses and structural formulae of pyroxene and spinels (Auckland University, Geology Dept., sample no. 20032)*

	1	2	3		1	2	3
SiO ₂	52.45	—	—	Si	1.961	—	—
Al ₂ O ₃	1.97	18.36	18.66	Al ^{iv}	0.039	5.633	5.755
Cr ₂ O ₃	1.21	48.11	48.70	Al ^{vi}	0.048	—	—
FeO*	2.23	18.57	17.50	Cr	0.036	9.902	10.073
MgO	16.09	11.99	11.36	Fe ³⁺	—	0.618	0.023
CaO	23.04	—	—	Fe ²⁺	0.070*	3.425	3.600
Na ₂ O	0.10	—	—	Mg	0.899	4.652	4.429
Total	97.09†	97.03†	96.23†	Ca	0.923	—	—
				Na	0.007	—	—

1. Chromian diopside
2. Chromite lamella in 1
3. Interstitial chromite grain

- * Total iron as FeO
 † See Bevan and Rodgers (1977) regarding low totals

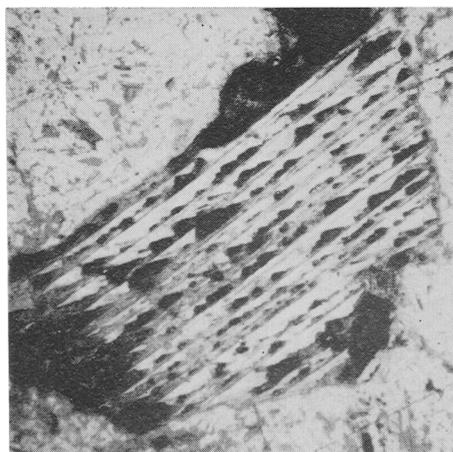


FIG. 1. Typical chrome-spinel lamellae (white) in host diopside (black). Polished grain in bakelite mount; reflected light; $\times 100$.

contact (Rodgers, 1973b, 1976). Layers of clinopyroxene, 1–2 cm thick, alternate with orthopyroxene-poor and harzburgitic layers (Guillon and Routhier, 1971, p. 33, plate 1, photo. 3). The clinopyroxenites are coarse-grained rocks with a close-packed texture and contain 20–5 % serpentine pseudomorphs after olivine and 1–2 % rounded and irregular, interstitial grains of chromite.

The clinopyroxenes are chromian diopsides (Table I), their higher levels of chromium and aluminium setting them apart from other diopsides, which occur in the ultramafic massifs chiefly as vein-forming minerals. Optical properties show $\alpha = 1.666$, $\beta = 1.680$, $\gamma = 1.696$, $2V_{\gamma} = 60^{\circ}$. Many diopside grains show fine lamellae of chrome-spinel arranged parallel to {100} of diopside. These inclusions show a range of sizes and shapes. In some grains they

consist of fine, parallel laminae (0.002 mm thick). In others they are thicker with one flat and one serrated face (fig. 1). In yet others they are thick, tabular chunks separated by fine (0.005–0.01 mm) lamellae of pyroxene. The crystallographic orientation of the spinel lamellae with respect to the clinopyroxene host has not been established. A few of the associated, individual chromite grains show minute inclusions rimmed by magnetite.

Spinel–pyroxene intergrowths have been recorded from a number of ultramafic environments (e.g. Basu and MacGregor, 1975). Often the host silicate is orthopyroxene. Where clinopyroxene is involved, the characteristic texture is usually a wormy, symplectic variety or, where the intergrowth is more ordered, the opaque mineral has been shown to be something other than chrome-spinel (e.g. ilmenite). In the present instance, much of the spinel gives the appearance of fine to coarse regularly ordered exsolution lamellae and such an interpretation suggests the recrystallization of some high-pressure/temperature, chromium-rich phase, e.g. $\text{Ca}(\text{Mg,Fe})\text{Si}_2\text{O}_6$, $\text{CaCr}(\text{Al,Si})\text{O}_6$. Both the size and ordering of the lamellae imply a protracted period of equilibration. However, it must be noted that the spinel lamellae and the spinel grains occurring interstitially between clinopyroxene and the olivine pseudomorphs differ little in composition (Table I), which points to similar conditions of crystallization for both spinel habits.

These Col du Mouirange spinels occur at the harzburgite–dunite transition zone in southern New Caledonia. They differ quite markedly in composition from the spinels in the overlying and underlying ultramafic rocks. Rodgers (1976) has interpreted this transition zone as representing the establishment of equilibrium when crystallization commenced and partial melting of pyroxene ceased, consequent upon movement of the bulk system to higher levels in the crust. The entire diopside–olivine–spinel (lamellae + discrete grains) assemblage could thus perhaps be regarded as marking the initiation of this event, with chrome-rich solid silicate phases exsolving their spinel component and the interstitial liquid crystallizing to olivine + spinel (cf. Dickey, Yoder, and Schairer, 1971).

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