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CANADA

DEPARTMENT OF MINES AND TECHNICAL SURVEYS

OTTAWA

MINES BRANCH INVESTIGATION REPORT IR 66-9

NICKELIFEROUS MAGNESITE-QUARTZ ROCK FROM BAIE VERTE, NEWFOUNDLAND

by

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MINERAL PROCESSING DIVISION

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COPY NO. 4

FEBRUARY 10, 1966

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James A. Soles*

SUMMARY OF RESULTS

Examination of a bright green carbonate-quartz rock from Baie Verte, Newfoundland revealed the presence of the uncommon nickel sulphide violarite, $(Ni_2Fe)S_4$, and a chromian muscovite. The petrogenic significance of these minerals is discussed, and the economic implications noted.

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INTRODUCTION

A large hand specimen of bright green rock from the Baie Verte area, Newfoundland, was examined to assess its probable durability as a building or ornamental stone. The rather unusual colour of the rock suggested it would be appealing in this capacity. It was found to contain an uncommon nickel mineral and chromian mica.

PROCEDURES

The specimen was cut and semi-polished for megascopic examination, and a polished thin section was prepared for mineralogical analysis. A sample of the rock was finely crushed, the heavy fraction was concentrated in methylene iodide, and the magnetic minerals were separated in a Model L-1 Franz Isodynamic separator. An X-ray diffractogram was made of a random sample, and Debye-Scherrer diffraction photographs were taken of the light green material colouring the rock and of minerals selected from the heavy concentrates.

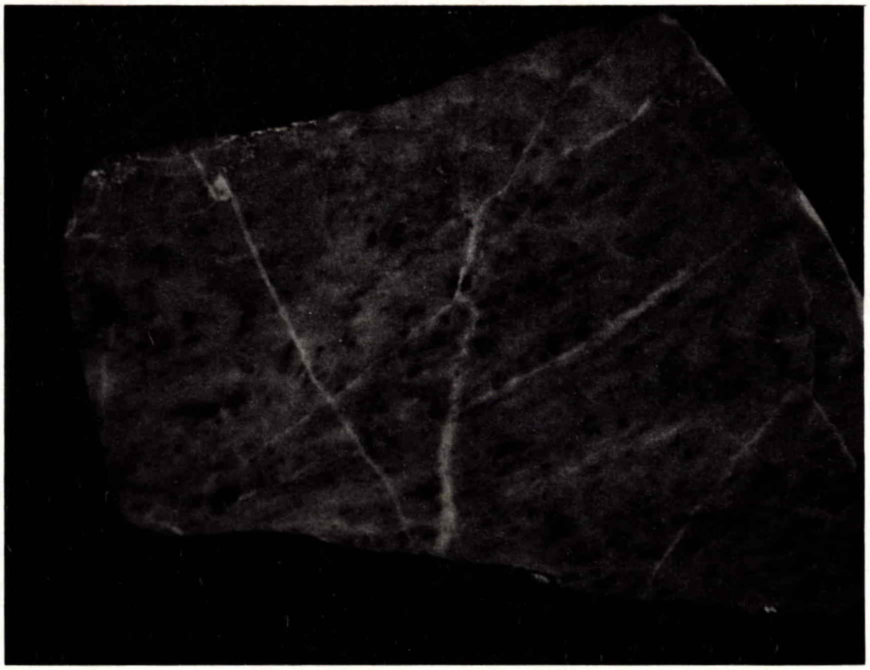

Figure 1. Green magnesite-quartz rock from Baie Verte, Newfoundland. X 0.8

PETROGRAPHY

The approximate mineralogical composition of the rock, established by point count analysis of a polished thin section, is given in Table 1.

TABLE 1

Mineralogy of Quartz-Magnesite Rock

Mineral	Amount (%)	Grain Sizes (μ)
Magnesite	65	10-500 (60% > 80μ)
Quartz	25	10-300 (60% < 80μ)
Chromian muscovite	5	1-100
Magnetite	4	1-1500
Chlorite	1	1-100
Violarite	< 0.3	5-500
Millerite? Chalcopyrite?	tr.	with violarite

The rock is principally magnesite and quartz. Its colour is emerald green, between 5 G 6/6 and 10 G 6/2 on the Rock Color Chart (1), caused by a chromian muscovite, probably fuchsite (Heinrich (2, 3)). The mica is dispersed throughout the rock along grain boundaries and concentrated in minute fractures and veinlets (Figure 2). Minor chlorite is similarly dispersed. The quartz is distributed randomly, and is also laced through the rock in a network of white veinlets (Figure 1). Magnetite occurs in scattered black specks and blotches, within which it is present as large masses or dispersed minute crystals.

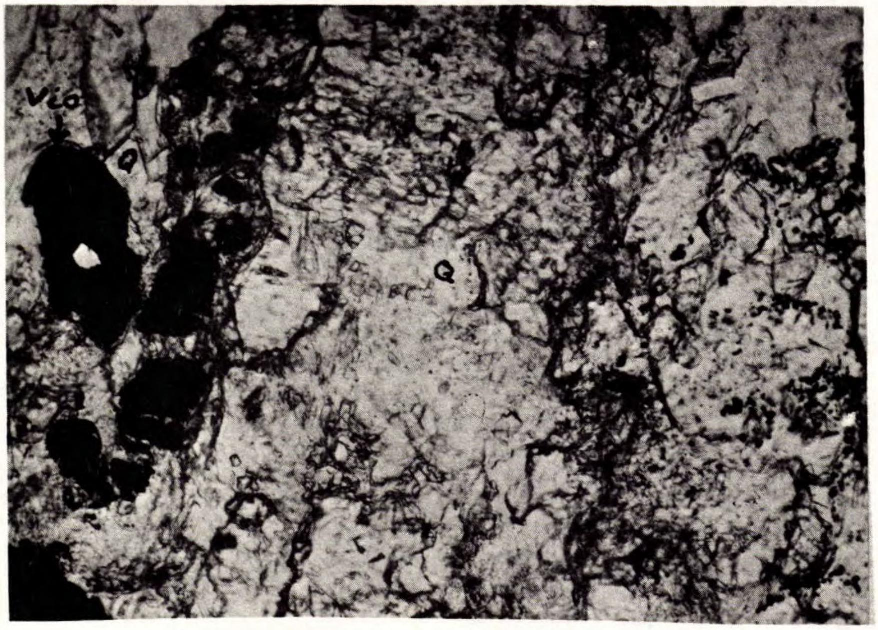

Figure 2. Photomicrograph of polished thin section of Baie Verte magnesite-quartz rock, showing intergranular seams (dark) of chromian muscovite among magnesite and less common, low relief quartz (Q) grains. Scattered magnetite dust is to the right and masses of magnetite to the left (black) with a large grain of violarite (Vio). Transmitted light; X 160.

The sulphides occur as minute specks scattered through the rock; no preferred association with other minerals is apparent. The main mineral is a member of the linnaeite series, and according to the X-ray diffraction pattern and polished section it is most likely violarite $(Ni_2Fe)S_4$. The colour in polished section is pale silvery violet. Cobalt was not detected by a microchemical test but iron was. Associated sulphides are rare, and appear as intergrowths or discrete specks in grains of violarite; millerite (?) and chalcopyrite (?) were observed in polished section (Figure 3), but their identity could not be confirmed by X-ray analysis.

Figure 3. Grain of violarite (grey) containing intergrown millerite? (white) and chalcopyrite? (Cp). Reflected light; X 550

DISCUSSION

Use of Rock as a Building Stone

Considering the mineralogy alone, the Baie Verte magnesite rock should be durable under normal weathering conditions, and therefore it might be used as a construction material provided its physical strength permits such use. Some problems could be encountered in the polishing and slow differential weathering of the magnesite and mica vs the harder and less reactive veinlet quartz.

The carbonate ultimately weathers to a pale buff in a moist atmosphere, which could limit its external use if colour retention is important. The sulphides may be relatively unstable, but in the specimen examined their proportions are low and their deterioration should not cause an unsightly discolouration. The striking green colour should encourage its use as a polished ornamental stone or as an exposed aggregate.

Petrogenic Considerations

The occurrence of violarite in this rock is of particular interest, as a nickel mineral has not been reported previously from the Baie Verte area. The exact source of the sample is not known, but from the most recent geologic information available on the area, given by Neale (4), it is probably from the vicinity of Flatwater Pond. Briefly, the local geology is shown as a northwest-trending belt of andesitic to basaltic volcanic rocks with minor sedimentary interbeds, bounded on the east by younger granodiorites and on the west by older gneisses. Bodies of altered ultrabasic rock occur in the volcanic sequence near the gneiss contact. Neale states, in his descriptive notes on a map, "Rusty weathered carbonate and talc-carbonate rock containing numerous quartz stringers was derived largely or wholly from alteration of the ultrabasic rocks. The carbonate near Flatwater Pond is chiefly pale green magnesite; ....". The latter description fits this sample.

The magnesite-quartz rock could be a product of the alteration of part of an ultramafic pluton, assuming CO_2 was present as one mobile phase during alteration. Chromite and asbestos are concentrated locally in the pluton, and sulphide minerals are in both the pluton and in volcanic rocks nearby. It appears that nickel was released (from silicates?) during metamorphism of the pluton, and combined with sulphur where it was available and the conditions were favourable. Some interesting studies on the distribution and sulphurization of nickel in the vicinity of intrusives and orebodies have been made by Chamberlain (5, 6) and Naldrett and Kullerud (7); these authors favour the hypothesis that the nickel was introduced with the intrusive rocks, and the mineral species formed was determined by the vapor pressure of sulphur, which was a mobile component at the time.

The Baie Verte occurrence may provide further information on the geochemistry of nickel in the vicinity of serpentinized ultramafic bodies. It may also cast some light on the relations between ultramafic bodies and nearby, apparently related carbonate masses. The origin of the CO_2 is of interest in this regard. The rock is mineralogically and chemically unlike carbonatites (8), so it more likely was formed by postmagmatic alteration of a high-magnesium silicate rock (e.g. dunite or serpentinite), with release of quartz, than by silicification of a carbonatite. Phase equilibrium studies in parts of the system CaO-MgO-SiO_2-CO_2-H_2O have only recently begun (Greenwood (9); Wyllie (10)).

Curiously, at this magnesite locality chromium appears to have been unstable as the oxide, although magnetite is present; presumably chromite broke down and the chromium entered the muscovite structure. The phenomenon has been observed by

Geijer (11), Leo et al. (12) and others in regionally metamorphosed siliceous rocks (schists and quartzites). It would seem that oxygen pressure is important in effecting the change.

Some consideration should be given to the possibility of economic nickel deposits being found in the vicinity of Baie Verte. The probable association of nickel with the ultramafic pluton west of Flatwater Pond suggests that the area is potentially favourable.

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