SHORT COMMUNICATIONS

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Polydymite and chrome-rich fuchsite in virginite from Baie Verte, Newfoundland

THE Baie Verte peninsula in north central Newfoundland is crossed by the major NNE-trending Baie Verte fault which is associated with a series of ultramafic lenses of ophiolitic origin (Williams, 1977). A number of the smaller of these lenses occur as an attractive mottled green rock, known as virginite, which is widely used for ornamental display. It also occurs as distinctive fragments in the Siluro-Devonian Cape St John Group volcanic rocks and sediments (Neale *et al.*, 1975). The virginite has not been precisely described, usually being referred to as fuchsite rock (e.g. Neale *et al.*, 1975; Williams, 1977). Therefore, samples of the rock, collected from pods in a crush zone on the west side of the Baie Verte road, west of Flat Water Pond and south of Middle Arm Brook (about 47° 50′ N.; 56° 18′ W.), have been studied to determine its mineralogy.

The rock consists of 90% or more of pale green breunnerite, minor quartz and less than 1% of fuchsite with traces of pyrite and polydymite. The fuchsite varies from green to deep green in hand specimen.

Two representative samples have been studied in detail with the electron microprobe (Microscan Mark V with energy dispersive analysis). Sample 8-1 contains 90% breunnerite, 9% quartz and less than 1% fuchsite, pyrite and polydymite. The breunnerite has FeO 4.98, MnO 0.00, MgO 44.35, CO_2 (by stoichiometry) 51.56%, total 100.89%; the polydymite averages Fe 4.11, Ni 52.03, Co 2.10, S 42.05, total 100.29%; the pyrite which is usually associated with the polydymite, averages Fe 43.19, Ni 2.50, Co 1.20, S 52.96, total 99.85%. Sample 8-2 consists of 96% breunnerite, 3% quartz and traces of fuchsite, polydymite (Fe 2.17, Ni 54.67, Co 2.13, S 42.28, total 101.25%) and pyrite (Fe 44.46, Ni 1.62, Co 1.04, S 52.95, total 100.07%). The breunnerite is FeO 4.58, MgO 42.81, CO_2 (by stoichiometry) 49.63%, total 97.02%. In both samples the nickel sulphide closely approaches $(Ni, Fe, CO)_3S_4$ with Ni forming 89 to 93% of the total Ni + Fe + Co. The limited substitution of Fe into polydymite is well documented by Vokes (1967) and has been explained by Vaughan *et al.* (1971). The phase relationships of the Ni, Fe, Co sulphides are quite complex and the intimate association of pyrite and polydymite suggests that exsolution has probably taken place. The pyrite has a much higher Co/Ni ratio (0.5–0.6) than the polydymite (0.04). The pale green colour of the breunnerite is clearly due to Fe substituting for Mg; all analyses contain more Fe than the minimum of 5 mol. percent $FeCO_3$ which distinguishes breunnerite from magnesite (Deer *et al.*, 1962), but not so much Fe that the colour becomes brown.

The composition of the fuchsite in the above two

TABLE I. Fuchsites from virginite, Newfoundland

	8-1	8-1	8-2	8-2	8-2
SiO_2	47.06	47.95	48.50	46.26	46.31
TiO_2	0.27	0.21	0.0	0.0	0.29
Al_2O_3	27.79	30.33	26.73	26.50	24.47
Cr_2O_3	6.44	4.39	6.21	7.90	7.72
FeO	0.56	0.41	0.54	0.69	0.39
NiO	0.25	0.0	0.60	0.78	1.11
MnO	0.0	0.0	0.0	0.0	0.0
MgO	1.76	1.72	2.14	1.84	2.44
CaO	0.0	0.0	0.0	0.0	0.0
Na_2O	0.0	0.44	0.0	0.0	0.0
K_2O	11.11	10.83	11.64	10.59	11.27
TOTAL	95.24	96.28	96.36	94.56	94.00
Ions to 22(O)					
Si_{IV}	6.40	6.38	6.54	6.38	6.47
Al_{IV}	1.60	1.62	1.46	1.62	1.52
Al	2.86	3.14	2.79	2.69	2.50
Ti	0.03	0.02	0.00	0.00	0.03
Cr	0.69	0.46	0.66	0.86	0.85
Fe^{2+}	0.06	0.05	0.06	0.08	0.05
Ni	0.03	0.00	0.07	0.09	0.12
Mn	0.00	0.00	0.00	0.00	0.00
Mg	0.36	0.34	0.43	0.38	0.51
Ca	0.00	0.00	0.00	0.00	0.00
Na	0.00	0.11	0.00	0.00	0.00
K	1.93	1.84	2.00	1.86	2.01
T	8.00	8.00	8.00	8.00	8.00
C	4.03	4.01	4.00	4.10	4.06
B	1.93	1.95	2.00	1.86	2.01
Si/Al	1.43	1.34	1.54	1.48	1.60

samples is given in Table I, from which it is apparent that the composition is variable within each specimen, the Cr_2O_3 content lying between 4 and 8%. The latter is high for a muscovite, as most analyses in the literature do not exceed 5% Cr_2O_3 unless the mica is phengitic. Thus Rumyantseva *et al.* (1984) report 17.93% Cr_2O_3 but with only 4.00% Al_2O_3 and 51.70% SiO_2 (i.e. Si : Al 22 : 1) in a chromium phengite. Deer *et al.* (1962) report the highest Cr_2O_3 on record up to that date as 6.08% (Whitmore *et al.*, 1964). The association of the present fuchsite matches best with the ankerite-quartz-sulphide-gold grouping of Whitmore *et al.* (1946) although the carbonate is not ankerite. The high content of K in the fushsite means that even if the modal proportions of the mineral were only 0.5%, the K content of the rock, assuming no other mineral contains K, would be 0.055% K_2O, which is too high to be derived isochemically from most ultramafic igneous rocks (Wedepohl, 1969). The implication is that some K was introduced in the fluids that carbonated the original igneous rock. The relatively high Ni content of the fuchsite, reaching a maximum of over 1% NiO is also unusual and is linked with a small phengitic substitution giving the highest ratio of Si : Al of 1.60 : 1 which is still a long way from the 3 : 1 lowest ratio of phengite (Deer *et al.*, 1962). Ni is a relatively unusual component of muscovites but was presumably derived from the original ultramafic rock.

The variegated green colour of the virginite therefore largely derives from the composition of the breunnerite with a small contribution from the unusually high, but varied, Cr content of the fuchsite. It seems likely that a more extensive search in the Baie Verte fracture zone would identify fuchsite with even more Cr and Ni.

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High potassium-chlorine-bearing hastingsites in skarns from Primorye, Far East USSR

CHLORINE-BEARING potassium amphiboles are typical of metasomatites from ore deposits, particularly iron-ores, but sometimes occur in granites, potassic syenites, and gneisses (Krutov, 1936; Hallimond, 1947; Ontoev, 1958: Geijer, 1960; Serdyuchenko, 1960; Kalinin, 1983; Lobanova, 1963; Pavlov, 1964; Deer *et al.*, 1965; Vakhrushev, 1965; Knyazev, 1966; Kostyuk, 1970; Leake, 1978; Dick and Robinson, 1979; Minerals, 1981; Sharma, 1981; Kamineri and Bonardi, 1982). A high chlorine content is the most typical feature of amphiboles from metasomatites of iron-ore deposits (Minerals, 1981). The initial discovery was a Cl-K amphibole with chlorine content of 7.24 wt. % in the Dash-