

A hydrogarnet from Tasmania

At the Lord Brassey Mine in the Heazlewood district of Tasmania there is a hydrated garnet, details of which are presented here. The mineral, which is light green in colour, occurs in shear planes in serpentinite as dense masses of fine-grained isotropic granular crystals whose average diameter is a few micrometres. The following analysis of the material has been determined by the Australian Mineral Development Laboratories.

Because of the nature of the mineral a clean separation from serpentinite could not be obtained, hence the analysis has been recalculated by subtracting all the magnesia, plus water and silica equivalent to serpentinite.

	SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	FeO	MgO	CaO	H ₂ O ⁺	H ₂ O ⁻	MnO	Cr ₂ O ₃	NiO	Sum
Anal.	35.50	0.94	23.40	0.29	6.70	28.00	2.00	0.30	0.40	1.85	0.03	99.85
Recalc.	34.26	1.12	27.79	0.34	—	33.25	0.96	—	0.05	2.20	0.04	100.01
	Ca	Fe ²⁺	Mn	Ni	Fe ³⁺	Cr	Al	Si	H			
Ratios to 96 oxygen	23.81	0.20	0.04	0.04	13.97	1.16	0.88	22.93	4.38			
	24.09				16.01			Si + H/4 24.02				

n 1.750 ± 0.005, λ = 5461 Å at 22 °C; a 12.059 Å, standard deviation ± 0.008 Å; D (calc) = 3.804 g cm⁻³; D (calc. with included serpentinite) = 3.610 g cm⁻³; D (obs) = 3.660 g cm⁻³. Density was determined by weighing the powdered mineral concentrate in air and toluene. The cell size was determined using a Guinier-Haag X-ray camera housed in the Chemistry Department of the University of Tasmania, with lead nitrate as an internal standard.

The analysis shows this mineral to be essentially an andradite-uvarovite hydrogarnet. The existence of hydro-andradite has been established by Peters (1965) and Kalinin (1967). The occurrence of hydro-andradites containing the uvarovite molecule can be inferred from the work of Isaacs (1965), which indicated that andradite-uvarovite garnets could only be synthesized under hydrothermal conditions. Some analyses for uvarovite-bearing garnets in the literature show appreciable H₂O⁺ (Coetzee, 1963; Tsao Yun-lun, 1964; Chakraborty, 1968). However as these are associated with impurities, particularly serpentinite minerals, it is not clear how much water may be due to these and not part of the garnet composition.

*Geology Department
University of Tasmania*

R. J. FORD

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Schulzenite, cuprian heterogenite, from Mina Pabellón, Copiapó, Chile

NATURALLY-occurring cobaltic hydroxide, heterogenite (Frenzel, 1872; Hey, 1962), may evidently accept extensive solid solution of copper (Hey, 1962). Cuprian heterogenite was first described by Martens (1895) from a poorly defined locality, probably northern Chile, and was named schulzenite. Hey (1962) presented a chemical analysis of a specimen from Chile, perhaps with the same provenance as the material studied by Martens, and concluded that the high copper content (CuO 14.5 wt %) was 'essential'. The purpose of this note is to report an occurrence of cuprian heterogenite in northern Chile, and possibly from the source of the type schulzenite.

Cobalt ores have been worked (Hornkohl, 1942; Ruiz, 1965) to a very limited extent from shallow shafts in the immediate vicinity of the settlement of Pabellón, in the valley of the Río Copiapó, Atacama Province (~ Lat. 27° 39.5' S.; Long. 70° 14.9' W.). The hypogene ores of the Mina Pabellón comprised 'smaltite-chloanthite' and 'safflorite-rammelsbergite' (Hornkohl, 1942), in association with pyrite, chalcopyrite, magnetite, hematite, tourmaline, and quartz. The veins, possibly of Lower Tertiary age (Sillitoe, Mortimer, and Clark, 1968), are exposed on a bedrock island projecting through the thick, polyphase alluvial fill of the Río Copiapó cañon. Upper Miocene and subsequent drainage incision has here removed any pre-existing massive supergene sulphide ores, but superficial oxidation has occurred at least since the exhumation of the mineralized zone from its mantle of aggradation.

A single specimen collected from the small dump of the shaft to the west of the *rió* exhibits anhedral grains of skutterudite enclosed in quartz, and cross-cut by numerous hair-line veinlets of chalcopyrite. The surface of the specimen is irregularly coated by a fine-grained, black to bluish-black powder, at first assumed to consist of 'sooty chalcocite', a friable aggregate of one or more copper sulphides formed in the latest,