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MINERALOGY.—*Minasragrite, a hydrous sulphate of vanadium.* WALDEMAR T. SCHALLER, Geological Survey.

The blue efflorescence occurring on patronite at Minasragra, Peru, was found to be a sulphate of vanadium and was named after the locality. It occurs abundantly at Minasragra, according to Mr. D. F. Hewett,[1] and also is forming at the present time on many of the patronite specimens in museums. A large specimen of patronite in the United States National Museum had a considerable amount of the blue efflorescence on it and furnished the material for the present investigation.

In addition to the matrix minerals, such as patronite, quisqueite, and the nickelic pyrite, bravoite, the specimen shows as an efflorescence blue minasragrite, white tufts of prismatic crystals of morenosite, glassy green equidimensional crystals of melanterite, and clear bladed crystals of gypsum. All of the efflorescent minerals have clearly been derived from the oxidation and hydration of those forming the matrix.

No measurable crystals of minasragrite were observed, the mineral forming small mamillary masses and granular aggregates with drusy surfaces, generally distinct from the other sulphates but in places penetrated by masses of morenosite needles. Examined under the microscope, the minasragrite shows irregu-

[1] Personal communication. Abundant material, much purer than the original sample, has now been obtained and an analysis of this better material will be undertaken.

lar granular masses, indistinct short prisms, and rarely sharply defined units of a rhombic shape (angle about 78°). Some pieces break up into similar rhombs by cleavage, so that it may be that all the observed rhombs are cleavage pieces and not distinct crystals. From the general inclined extinction of all straight edges it is concluded that the mineral is monoclinic or triclinic.

TABLE 1

ANALYSIS OF MINASRAGRITE MIXED WITH IMPURITIES

	ANALYSIS	DISTRIBUTION				
		Minasragrite	Melanterite	Morenosite	Gypsum	Insoluble
V_2O_4	5.29	5.29				
FeO	0.97		0.97			
NiO	1.92			1.92		
CaO	0.46				0.46	
SO_3	10.92	7.12	1.08	2.06	0.66	
Insoluble	66.16					66.16
H_2O (by diff.)	14.28	9.06	1.68	3.24	0.30	
	100.00	21.47	3.73	7.22	1.42	66.16

TABLE 2

RECALCULATED ANALYSIS AND RATIOS OF MINASRAGRITE

	ANALYSIS	RATIOS	CALCULATED
V_2O_4	24.64	1.02 or 1×1.02	23.92
SO_3	33.17	2.86 or 3×0.95	34.58
H_2O	42.19	16.17 or 16×1.01	41.50
	100.00		100.00

The color of minasragrite is blue, the luster vitreous. The refractive indices are approximately as follows: $\alpha = 1.515$, $\beta = 1.525$, $\gamma = 1.545$. The pleochroism is strong: X = deep blue, Y = blue, Z = colorless. The mineral is optically negative.

Heated in a closed tube, minasragrite readily fuses and gives off water. It is very soluble in cold water. The sample scraped off for analysis necessarily contained all the minerals of the efflorescence, which were separated from the patronite by cold water. The water of the sample had to be expressed by difference, and the insoluble matter (mostly patronite) was air dried and not heated before weighing. The results of the analysis are given in table 1.

The analysis, with the insoluble matter and associated melanterite, morenosite, and gypsum deducted and recalculated to 100 per cent, is shown with the ratios in table 2.

The ratios yield the formula $V_2O_4 \cdot 3SO_3 \cdot 16H_2O$, which is interpreted as $(V_2O_2)H_2(SO_4)_3 \cdot 15H_2O$, minasragrite being a highly hydrated acid vanadyl sulphate. Quantitative determinations (by permanganate titrations) show that all of the vanadium in the mineral is in the tetravalent condition.

Several hydrates of acid vanadyl sulphate are known. The pentahydrate $(V_2O_2)H_2(SO_4)_3 \cdot 5H_2O$ is formed when the acid solution is evaporated on a water bath at about 90°, and it can be recrystallized from sulphuric acid at 100°. Lower hydrates are formed at higher temperatures.[2] It is therefore to be expected that at ordinary temperature a higher hydrate than the pentahydrate would form, and in minasragrite, formed at ordinary temperature, 15 molecules of water represent the extent of the hydration.

It is interesting to note that Gerland[3] reported a hydrate with 14 molecules of water, but later investigators have failed to find it. Possibly Gerland's 14-hydrate was identical with minasragrite.

[2] KOPPEL, J., and BEHRENDT, E. C. *Verbindungen des vierwertigen Vanadins.* Zeitschr. anorg. Chem., **35**: 154. 1903. Earlier references are cited by these authors. See also GAIN, GUSTAVE. *Sur quelques sulfates de vanadium tetravalent.* Comp. rend., **143**: 1154–1156. 1906.

[3] GERLAND, B. W. *Ueber einige Verbindungen des Vanadins.* Ber. d. Chem. Gesellsch., **9**: 869. 1876.