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SHORTER COMMUNICATIONS

JAGOWERITE: A NEW BARIUM PHOSPHATE MINERAL FROM THE YUKON TERRITORY

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Introduction

The discovery of jagowerite resulted from a mineral exploration program in the western central part of the Yukon Territory during the summer of 1968. The mineral is named in honour of the late Professor J.A. Gower who taught mineralogy at the University of British Columbia from 1967 to 1972. The mineral has been approved by the Commission on New Minerals and Mineral Names, I.M.A. Type specimens of jagowerite are in the mineral collection of the Department of Geological Sciences, The University of British Columbia.

Jagowerite is found in crystalline masses up to one inch across in quartz veins which occur in tension fractures in a carbonaceous argillite of Paleozoic age. Other minerals associated with jagowerite are pyrite and hinsdalite. The mineral locality is approximately 16 miles north of the Hess River, N.T.S. area 105-N-7 at approximately 132°48′30″ W and 63″35′ N in the Yukon Territory.

Physical and optical properties

Jagowerite is light green in color with a vitreous luster and fluoresces greenish-white under a long-wave ultraviolet radiation. The mineral has a hardness of 4.5, a specific gravity of 4.01 gm/cc (meas.) and 4.05 gm/cc (calc.) and is insoluble in hydrochloric acid. Jagowerite possesses the following pinacoidal cleavages: {100} good, {011} good, and {0$\bar{1}$1} fair. The optical properties are: $n_\alpha = 1.672$, $n_\beta = 1.693$, $n_\gamma = 1.710$, all determined with Na-light with an estimated error of ±0.003. The estimated $2V$ is 80 ±5° and the mineral is optically positive.

X-ray studies

Single crystal precession photographs reveal the mineral to be triclinic. The *x*-ray powder data given in Table 1 were obtained from a Philips diffractometer using Ni-filtered CuK_α radiation, a scan speed of ½° 2θ/minute and a silicon standard. The following unit cell parameters were determined from the powder diffractometer data using the U.S.G.S. least squares refinement program (Evans, Appleman & Handwerker 1963): $a = 6.049(2)$ [1], $b = 6.964(3)$, $c = 4.971(2)$ Å, $\alpha = 116.51(4)°$, $\beta = 86.06(4)°$, $\gamma = 112.59(3)°$.

A crystal structure analysis has recently been carried out utilizing single crystal counter data. The structure was successfully refined in space

TABLE 1. JAGOWERITE: *X*-RAY POWDER DATA

Io	d_{obs}	d_{calc}	*hkl*	*Io*	d_{obs}	d_{calc}	*hkl*
20	5.73	5.722	010	5	2.37	2.371	$\bar{2}11$
40	5.55	5.542	100	20	2.32	2.321	111
25	5.13	5.121	$\bar{1}10$	20	2.28	2.285	$1\bar{1}2$
10	3.97	3.968	$1\bar{1}1$	10	2.23	2.226	201
10	3.69	3.683	$\bar{1}01$	35	2.21	2.205	$\bar{2}11$
60	3.26	3.261	101	20	2.18	2.178	$\bar{2}10$
100	3.00	3.004	$\bar{2}10$	20	2.14	2.142	$0\bar{3}1$
55	2.94	2.944	$\bar{1}10$	10	2.07	2.074	$\bar{1}30$
30	2.91	2.912	011	20	2.02	2.018	021
10	2.85	2.861	$02\bar{0}$	20	1.98	1.979	$\bar{2}30$
8	2.61	2.614	$2\bar{1}1$	35	1.90	1.907	$03\bar{0}$
5	2.56	2.561	$\bar{2}20$	25	1.84	1.842	$\bar{2}02$
30	2.47	2.472	$01\bar{2}$				

*Diffractometer scan with internal standard, Cu/Ni radiation, CuKα = 1.54178Å, $I_{\bar{5}}$=visually estimated peak intensities. Indexed with a=6.049, b=6.964, c=4.971Å, α=116.51°, β=86.06°, γ=112.59°.

* Now at Phelps Dodge Europa Limited, London, England.

1. Number in parentheses refers to one standard deviation.

group $P\bar{1}$ and will be reported in a subsequent paper.

Chemical composition

A gravimetric analysis for Ba, Ca, Al, P, S and Fe was carried out by H. Sharples of General Testing Laboratories of Vancouver, B.C., and included a determination for SiO_2 because of the fine scale intimate mixture of jagowerite and quartz. The SiO_2 value was subsequently subtracted and the composition recalculated. The original gravimetric analysis contained 2.05 weight % CaO which did not compare with 200-300 ppm indicated by emission spectroscopic and solid source mass spectrographic methods. Therefore, a second gravimetric analysis for calcium was undertaken which revealed the first analysis to be in error as a result of some of the barium remaining in solution and being determined as calcium. No calcium was detected in the second analysis.

The chemical composition determined was: BaO 38.41, P_2O_5 31.41, Al_2O_3 25.87, Fe_2O_3 0.26, S 0.15, H_2O+ 4.09, total 100.19%. The trace element determination by emission spectroscopic and solid source spectrographic methods revealed the following elements in concentrations less than 1000 ppm: Ca, Cr, Ti, V, Ta, Mn, Cu, Be, Sr and Si.

The gravimetric analysis indicates two possible idealized formulas: $BaAl_2P_2O_9(H_2O)$ or $BaAl_2P_2O_8(OH)_2$. In order to determine the nature of the water in jagowerite two infrared spectroscopic analyses were carried out. The first analysis utilized the standard KBr pellet technique and the second sample was prepared in a nujol mull. The results indicate no molecular water is present in the specimen. A subsequent crystal structure investigation has confirmed the formula $BaAl_2P_2O_8(OH)_2$ ($Z = 1$) to be the correct one. The determined formula based on ten oxygens is: $Ba_{1.07}Al_{2.15}Fe_{.01}P_{1.89}S_{.02}O_8(OH)_2$.

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Reference

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