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STRONTIODRESSERITE, A NEW Sr-Al CARBONATE FROM MONTREAL ISLAND, QUEBEC

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Abstract

Strontiodresserite occurs as vitreous to silky white coatings, some of which are atoll-shaped, in a silicocarbonatite sill at St-Michel, Montreal Island, Quebec. The mineral is lath-like, with maximum dimensions $0.1\times0.01\times0.001$ mm and is biaxial negative, $2V$ 42½ (1)°, $n\alpha$ 1.510(4), $n\beta$ 1.583(2), $n\gamma$ 1.595 (calc.), Y parallel to elongation, X normal to it and in the plane of the plates. Microprobe analyses gave CaO 2.83, 2.90, 2.60; SrO 24.07, 24.25, 24.75; Al_2O_3 29.16, 29.12, 29.12 wt. %, Ba and Pb not detected, average (Sr,Ca):Al=0.995:2.000. The mineral effecvesces in dilute HCl and the similarity of its powder pattern with those of dundasite and dresserite suggests that strontiodresserite is $(Sr,Ca)Al_2(CO_3)_2(OH)_4\cdot H_2O$. Strongest lines of the powder pattern are 7.93(10), 4.39(8), 3.002(7), 5.99(6), 2.638(6), 3.55(4). Orthorhombic dimensions calculated from the pattern are a 9.14, b 15.91, c 5.59 Å, D(calc.) 2.76 g/cm³ for the theoretical formula with Sr:Ca=4:1 and Z=4, D(meas.) 2.71 g/cm³. Dundasite, dresserite, and strontiodresserite have the same general chemical formula, but they are not isostructural.

Sommaire

La strontiodressérite se présente en enduits blancs d'éclat vitreux à soyeux, parfois en forme d'atoll, dans un filon-couche de silicorcarbonatite à Ville St-Michel, dans l'île de Montréal, Québec. Les cristaux sont en forme d'aiguilles aplaties dont les dimensions maximales sont: $0.1\times0.01\times0.001$ mm. Ils sont biaxes négatifs avec $2V$ 42½(1)°, $n\alpha$ 1.510(4), $n\beta$ 1.583(2), $n\gamma$ 1.595(calc.), Y parallèle à l'allongement, X normal à celui-ci dans le plan de la plaquette. Les analyses à la microsonde indiquent: CaO 2.83, 2.90, 2.60; SrO 24.07, 24.25, 24.75; Al_2O_3 29.16, 29.12, 29.12% en poids, Ba et Pb n'ont pas été décelés, la moyenne du rapport (Sr,Ca):Al=0.995:2.000. Le minéral entre en effervescence dans HCl dilué, et son diagramme de poudre ressemble beaucoup à celui de la dundasite et à celui de la dressérite, ce qui fait penser que la strontiodressérite possède la formule chimique $(Sr,Ca)Al_2(CO_3)_2(OH)_4\cdot H_2O$. Les raies les plus intenses du diagramme de poudre sont: 7.93 (10), 4.39 (8), 3.002 (7), 5.99(6), 2.638 (6), 3.55 (4). Les dimensions orthorhombiques calculées à partir du diagramme sont a 9.14, b 15.91, c 5.59Å; D(calc.) 2.76 pour la formule théorique avec Sr:Ca=4:1 et Z=4, D(mes.) 2.71. Bien que la dundasite, la dressérite et la strontiodressérite soient chimiquement analogues, elles ne sont pas isostructurales.

Introduction

A silicocarbonatite sill at St-Michel, Montreal Island, Quebec, contains a variety of rare minerals (Sabina 1976). Among the four barium and strontium carbonates unique to this locality is the new mineral strontiodresserite. The name and mineral have been approved by the Commission on New Minerals and Mineral Names, IMA.

Properties

Strontiodresserite has been identified as sparse coatings on three hand specimens of the sill. One of the specimens has been deposited with the Royal Ontario Museum, Toronto (ROM M-34626), and another with the National Mineral Collection, Ottawa (13704). On all specimens the mineral is associated principally with abundant quartz and minor fine-grained dawsonite. Most strontiodresserite coats, and is partly interstitial to, aggregates of frosty quartz crystals, but some also occurs as atoll-shaped rings up to 3 mm in diameter. The cores of the atolls average about 2 mm in diameter and consist of quartz crystals; strontiodresserite is almost wholly confined to the margins of the cores.

All strontiodresserite appears as vitreous to silky aggregates of white, extremely fine-grained lath-like grains of maximum dimensions $0.1\times0.01\times0.001$ mm. These are arranged radially around the cores of atolls. The laths are biaxial negative, $2V$ 42½(1)°, $n\alpha$ 1.510(4), $n\beta$ 1.583(2), and calculated $n\gamma$ 1.595(4). Y is parallel to the lath elongation, and X is normal to it and in the thinnest, platy plane.

The optical properties indicate that strontiodresserite has orthogonal symmetry. Powder X-ray patterns of the mineral are slightly diffuse

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TABLE 1. POWDER X-RAY DATA FOR STRONTIODRESSERITE*

I_{est}	d_{meas}	d_{calc}	hkl	I_{est}	d_{meas}	d_{calc}	hkl
10	7.93	7.93	110	4	2.046	several	
6	5.99	6.00	120	1	1.993	1.995	332
2	4.80	4.77	101			1.989	080
1	4.57	several		½	1.945	1.943	180
8	4.39	4.39	210	½	1.919	1.924	062
<½	4.09	4.09	121			1.921	332
1	3.96	3.96	220			1.883	361
4	3.55	3.55	131	<½	1.882	1.883	162
½	3.46	3.46	230		1.866	1.868	441
		3.45	211	1	1.821	several	
3	3.236	3.242	041	½B	1.771		
		3.234	221		1.765		
7	3.002	3.005	150	5	1.732		
		3.000	240	<½	1.681		
<½	2.940	2.944	231	½	1.660		
1	2.799	2.797	002	½	1.590		
3	2.670	2.676	301	½	1.527		
6	2.638	several		<½	1.505		
1	2.538	2.536	321	½	1.477		
		2.535	122	<½	1.450		
2	2.388	several		<½	1.425		
1	2.360	2.359	212	½	1.400		
½	2.284	several		<½	1.378		
1	2.204	2.206	170	<½	1.362		
		2.201	350	<½	1.325		
<½	2.126	2.122	261	<½	1.291		
½	2.097	2.099	430	2	1.271		
		2.097	411				

* Camera diameter 114.6 mm; indexed for $CuK\alpha_1$ with a 9.14, b 15.91, c 5.594Å.

and are broadly similar to those of $PbAl_2(CO_3)_2(OH)_4 \cdot H_2O$ (dundasite), and $BaAl_2(CO_3)_2(OH)_4 \cdot H_2O$ (dresserite). Indexing of the strontiodresserite pattern was readily accomplished by comparison with the data for dundasite. The cell dimension of the new mineral are a 9.14(1), b 15.91(1), c 5.594(5)Å. These were derived by least-squares refinement of 14 diffraction lines between d 4.80 and 1.866Å. The indexed powder X-ray pattern is given in Table 1.

Composition

A complete chemical analysis could not be obtained from the small amounts of strontiodresserite available. Cation percentages were determined from grains mounted in a polished section and analyzed with a microprobe operated at 20kV, 0.028 microamperes, and a defocused beam. The standards used were synthetic Al_2O_3, and natural calcite and strontianite. The last, obtained from Dr. A. G. Plant of the Geological Survey of Canada, contains 2.42 wt. % Ca. The three areas analyzed gave CaO 2.83, 2.90, 2.60; SrO 24.07, 24.25, 24.75; Al_2O_3 29.16, 29.12, 29.12 wt. %. Ba and Pb were not detected, and S is less than 0.15 wt. %. The respective atomic ratios are (Sr,Ca):Al = 0.986:2.000, 1.001:2.000, and 0.998:2.000.

Strontiodresserite effervesces in dilute HCl; the presence of carbonate was confirmed in the infrared study of Farrell (1977), whose work also established that water and hydroxyl are present in the mineral. Thus, based on the similarities to dresserite and dundasite, the theoretical formula of strontiodresserite is probably $SrAl_2(CO_3)_2(OH)_4 \cdot H_2O$.

The calculated density is 2.76 g/cm³ for the stoichiometric formula with Sr:Ca=4:1 and Z=4. A measured specific gravity of 2.71 was obtained by suspension in heavy liquids. The measured value, although low, is of an appropriate magnitude, especially when compared with the discrepancies in the measured and calculated densities of dundasite and dresserite as discussed by Jambor *et al.* (1969) and Cocco *et al.* (1972).

Heating Experiments

Small amounts of strontiodresserite were heated in open tubes in horizontal furnaces, and were held at temperature for a minimum of 5 hours. The heated products were as follows: 100°C, strontiodresserite; 150°C and 200°C, strontiodresserite + phase X; 275°C, phase X; 550°C, amorphous. Crystalline products were obtained at higher temperatures (750 to 1080°C), but none could be identified. The powder X-ray patterns of phase X indicate that the compound is probably the strontium analogue of barium-bearing phase X which formed in the thermal breakdown of dresserite and hydrodresserite (Jambor *et al.* 1977).

Comparisons with Dresserite and Dundasite

The crystal-structure study of dundasite by Cocco *et al.* (1972) showed that its formula is $PbAl_2(CO_3)_2(OH)_4 \cdot H_2O$, and its space group is *Pbnm*. Re-examination of dresserite by one of us (A.C.R.) has confirmed that weak $h0l$ diffraction spots with $h \neq 2n$ are present on precession films. Thus, dresserite lacks the n-glide present in dundasite, and the minerals are not isostructural.

No single-crystal data are available for strontiodresserite, and its powder pattern is not amenable to the selection of a specific space group. However, strontiodresserite is elongate parallel to its optical Y axis, whereas dundasite and dresserite are elongate parallel to Z. It seems likely, therefore, that none of the minerals is isostructural even though all have the same general chemical formula.

Chemical analyses of dundasite and dresserite indicate that these minerals absorb excess water beyond the formula requirement of $1H_2O$. In the case of strontiodresserite, the slight diffuseness of its powder X-ray pattern may be a possible indication of structural disruption aris-

ing from non-stoichiometric proportions of CO_2 and H_2O. Nevertheless, some important properties of dundasite, dresserite, and strontiodresserite follow the same trends evident in anhydrous carbonates, namely, refractive indices and calculated densities progressively decrease in the sequence Pb→Ba→Sr, and cell volumes decrease in the sequence Ba→Pb→Sr.

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