ARKIV FÖR MINERALOGI OCH GEOLOGI Band 2 nr 18

Read 5 June 1957

Jagoite, a new lead-silicate mineral from Långban in Sweden

By RAGNAR BLIX, OLOF GABRIELSON and FRANS E. WICKMAN

Introduction

The Långban mines are famous for the large number of lead-silicate minerals found there. So far, hyalotekite, ganomalite, nasonite, kentrolite, melanotekite, barysilite, margarosanite, molybdophyllite, and roeblingite have been described. In this paper a tenth lead silicate is described, which, as far as we know, is new to science. We have called it *jagoite* in honour of the well-known mineral collector Mr. John B. Jago, San Francisco, California, who has shown an enthusiastic interest in the Långban minerals, and through generous donations of funds has made possible an intensive study of the Långban minerals at this museum.

Occurrence

Jagoite is a rare mineral which was discovered around 1943 in hematite ore in the stope "Canberra" together with melanotekite, quartz, and a mixture consisting of a not yet identified mineral and quartz. Jagoite occurs as fine-grained micaceous aggregates of plates and is commonly surrounded by a zone of black melanotekite.

X-ray crystallography

We have not been able to find any crystals with well-developed faces and we have therefore used X-ray methods exclusively. A Laue photograph taken perpendicular to a plate showed that the Laue-symmetry group is $\bar{3}$, i.e. the mineral is trigonal.

Oscillation, rotation, and equi-inclination photographs were taken with unfiltered copper radiation, using the *c*- and *a*-axes as rotation axes. The quality of the photographs was rather poor on account of the easiness with which the plates of jagoite are deformed.

The hexagonal unit cell has the dimensions: $a = 8.65 \pm 0.03$ Å and $c = 33.5 \pm 0.1$ Å. No systematic extinctions could be observed. This means that the possible space groups should be $P3$ (No. 143) and $P\bar{3}$ (No. 147).

The powder pattern of jagoite is shown in Table 1. It was obtained using a Debye–Scherrer camera (diameter 57.3 mm) and Ni-filtered copper radiation. No effort was made to prevent the development of a preferred orientation of the platy powder on the glass fiber. We have not thought it worth while to index

Table 1. Powder pattern of jagoite. Ni-filtered Cu radiation.

d	*I*	*d*	*I*
5.6	2	1.93	1
4.16	5	1.85	2
3.40	10	1.700	2
3.10	2	1.654	2
2.99	5	1.620	2
2.80	8	1.604	2
2.60	3	1.553	3
2.50	4	1.479	1
2.47	3	1.431	1
2.34	2	1.398	1
2.11	2	1.380	1
2.06	3	1.331	1

the lines observed because the *c*-axis of jagoite is so large that it is always possible to find at least one reflection with a suitable *d*-value.

Physical and optical properties

Jagoite has perfect basal cleavage, { 0001 }, and has a hardness of 3. The specific gravity is 5.43 as determined with a pycnometer. The luster is vitreous and shining on cleavage surfaces. The colour is yellow-green and the streak yellow. The mineral is not fluorescent under ultraviolet light.

In transmitted light under the microscope jagoite is light green. It is uniaxial with optical negative (−) character. The refringence is very high (around 2.0 according to a measurement by Nikitin's method); this is in agreement with what has been found in other lead silicates. The birefringence is intermediate (0.025). The mineral is nonpleochroic.

Chemical composition

The chemical analysis made by one of us (R. B.) is shown in Table 2. The unit cell volume is 2170 Å^3 and the specific gravity is 5.43. The molecular weight of the unit cell is consequently 7102. This value has been used in calculating the figures in column 2 of Table 2.

It might be remarked that the oxidation state of iron was tested, and that no trace of ferrous iron could be detected. The mineral was tested for "superoxide" oxygen in a special apparatus but with negative result.

The formula of jagoite derived from the chemical analysis is

$$(Pb,Ca,Mn,Na,K)_{24}(Fe^{3+},Al,Mg)_8(Si,Al,Be)_{27}O_{84}(OH,Cl)_8.$$

This tentative formula will indicate that electroneutrality is obtained by substitution of univalent cations for some of the large bivalent ones, bivalent cations for some of the trivalent ones, and beryllium and probably also aluminium for some of the silicon atoms.

Table 2. The chemical composition of jagoite.

1. The chemical analysis of jagoite (R. Blix).
2. The number of atoms in the hexagonal unit cell.
3. Suggested distribution of atoms of different sizes.
4. Ideal cell content.

	1		2	3	4
SiO_2	22.35	Si	26.40	26.74	27
BeO	0.12	Be	0.34		
Al_2O_3	0.50	Al	0.70		
Fe_2O_3	7.00	Fe^{3+}	6.22		
TiO_2	0.10	Ti	0.09	8.06	8
MgO	0.60	Mg	1.05		
FeO	nil	Fe^{2+}	0.00		
MnO	0.88	Mn	0.88		
CaO	0.65	Ca	0.82		
PbO	64.26	Pb	20.45	24.11	24
Na_2O	0.61	Na	1.40		
K_2O	0.37	K	0.56		
Cl	3.25	Cl	6.50		
H_2O (> + 105°C)	0.17	OH	1.34	7.84	8
H_2O (< + 105°C)	0.19				
F	nil	F	0.00		
O	nil	O	83.87		84
	101.05				
Less O for Cl	0.73				
	100.32				

It seems plausible to regard jagoite as a phyllosilicate. Owing to the fact that we have only one find of jagoite, we have no idea about the possible variations in its chemical composition, and can only hope that new occurrences will be discovered.

SUMMARY

Jagoite, $(Pb,Ca,Mn,Na,K)_{24}(Fe^{3+},Al,Mg)_8(Si,Al,Be)_{27}O_{84}(OH,Cl)_8$, is a hexagonal mineral with unit cell lengths $a = 8.65 \pm 0.03$ Å, $c = 33.5 \pm 0.1$ Å. The probable space groups are $P3$ and $P\bar{3}$. Physical and optical properties are given in the special section and the powder pattern given in Table 1.

Tryckt den 15 oktober 1957

Uppsala 1957. Almqvist & Wiksells Boktryckeri AB