Ertixiite——a New Mineral from the Altay Pegmatite Mine, Xinjiang, China

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Abstract

Ertixiite ($Na_2Si_4O_9$), a new mineral found in a miarolitic cavity of the Altay Pegmatite Mine, Xinjiang, China, is associated with topaz, apatite, quartz, cleavelandite, etc. The mineral is white, granular, and transparent. HNV = 570.08 – 850.96 kg/mm² (Moh's 5.8 – 6.5), D = 2.35, N = 1.502. Cubic system, $a = 5.975$ Å, V = 213.311 Å, Z = 1, $D_X = 2.34 g/cm^3$.

The chemical composition of ertixiite (the average of six samples) is: Na_2O 17.97, CaO 2.82, SiO_2 77.86, Al_2O_3 1.45, FeO 0.05, total 100.15.

The strongest lines in the X-ray powder pattern are 3.443(2, 111), 2.647(2. 210), 2.674(2, 210), 1.996(8,221), 1.798(10,311), and 1.492(2,400).

Introduction

In 1979, one of the authors collected a white granular mineral in a pegmatite miarolitic cavity of the Altay Pegmatite Mine, northern Xinjiang, China. X-ray powder study and electron microprobe analysis confirmed that it was a sodium silicate mineral. The mineral was named after the famous Ertixi River in the area. The mineral and its name have been approved by the Commission on New Mineral and Mineral Names, IMA. The original material has been preserved at the Geological Museum of the Chengdu Geological College.

Occurrence

The Altay Pegmatite Mine is located near Fuyun County, about 600 km northeast of Urümqi City, Xinjiang Autonomous Region. Ertixiite was discovered in a miarolitic cavity of a Ta-Nb-Be-bearing pegmatite, in association with topaz, albite (cleave-landite), quartz, muscovite, apatite and garnet. In an adjacent pegmatite to the northwest and east, ashanite[1], manganosicklerite[2], gahnite[3] and Th-rich monazite[4] were found.

In the miarolitic cavity there exist quartz vugs, and the crystals of ertixiite are present in extremely small amounts between albite and quartz.

Physical and Optical Properties

Ertixiite from the Altay Pegmatite Mine is colourless and transparent. Its grain size ranges from 0.1 to 0.5 mm. Vitreous luster, white streak, hardness=5.8—6.5 on Moh's scale, specific gravity =2.35 (specific gravity bottle method), and 2.34 (calculated from unit-cell data). There are no observable cleavages, and subconchoidal fractures are not so distinct.

Under the polarized microscope, ertixiite is colourless, translucent with a smooth and clean surface, and non-polychromatic. Under the crossed Nicols, ertixiite is isotropic with a refractive index of $N=1.502\pm0.001$ ($T=21°C$).

Chemical Composition

The chemical composition of ertixiite was determined on a JEOL-733 electron probe microanalyser. Ertixiite grains (Nos. E-1, E-2, E-3, E-4, E-5, and E-6) were analyzed (Table 1) under the following conditions: accelerating voltage, 25 Kv; beam current, 2 $\times10^{-8}$Å; probe diameter, 50 nm and computer-on-line, Bence-Albee correction; standards, synthetic Al_2O_3 (for Al), natural SiO_2 (for Si), natural jadeite (for Na), and natural wollastonite (for Ca). Natural samples were checked by microchemical and optical methods.

Table 1. Electron microprobe analyses of ertixiite

Oxide \ Sample No.	E-1	E-2	E-3	E-4	E-5	E-6	Theoretical composition
Na_2O	17.23	17.32	17.91	18.67	18.33	18.40	20.53
CaO	2.87	2.85	2.70	2.75	2.74	3.02	
SiO_2	77.87	78.09	78.29	77.74	78.05	77.14	79.47
Al_2O_3	1.45	1.50	1.47	1.47	1.43	1.39	
FeO	—	0.17	—	0.02	0.1	0.06	
Total	99.42	99.93	100.37	100.66	100.65	100.01	100.00
Atomic number of cations							
Na	0.5558	0.5585	0.5777	0.6022	0.5913	0.5935	0.6622
Ca	0.0512	0.0508	0.0482	0.0491	0.0489	0.0539	—
Si	1.2978	1.3015	1.3048	1.2956	1.3008	1.2856	1.3245
Al	0.0284	0.0294	0.0288	0.0288	0.0280	0.0272	—

Photos 1—6 show the distribution of Si and Na, the backscattered electron images and X-ray images. According to the measured specific gravity and the unit-cell volume, the atomic numbers of cations and oxygen ions in one unit cell of ertixiite were calculated (Table 2). The ratio of (Na+Ca): (Si+Al): O=2:4:9 was determined. Therefore, the chemical formula of ertixiite is $Na_2Si_4O_9$.

It should be pointed out that ertixiite is of low electroconductivity. Under electron bombardment, Na^+ will evaporate and migrate, resulting in the decrease of Na^+ (Fig. 1).

Table 2. Atomic numbers of cations and oxygen ions in one unit cell of ertixiite

Element \ Sample No.	E-1	E-2	E-3	E-4	E-5	E-6	Theoretical composition
Na	1.6781	1.6867	1.7440	1.8180	1.7851	1.7917	1.9993(≒2)
Ca	0.1542	0.1533	0.1455	0.1479	0.1477	0.1627	
Si	3.9183	3.9294	3.9392	3.9114	3.9276	3.8812	3.9989(≒4)
Al	0.0857	0.0887	0.0869	0.0869	0.0845	0.0821	
O	8.9587	8.9886	9.0262	9.0103	9.0211	8.9442	8.9978(≒9)

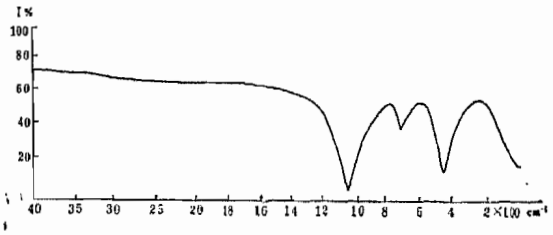

Fig. 1. The decrease of Na^+ with the time of electron bombardment.

X-ray powder Analysis

The indexed X-ray powder diffraction pattern of ertixiite from the Altay Pegmatite Mine is shown in Table 3. The photographic conditions are: Fe-radiation, no-filter, voltage 25 Kv, electron current 10 Ma, camera diameter 57.3 mm, and exposure 3h.

Table 3. X-ray powder pattern of ertixiite

I	$d_{(c.)}$	$d_{(o.)}$	hkl	I	$d_{(c.)}$	$d_{(o.)}$	hkl
2	3.446	3.443	111	8	1.99	1.996	221
2	2.987	2.988	200	10	1.801	1.798	311
2	2.672	2.674	210	1	1.725	1.722	222
2	(2.188)	2.194	221	2	1.596	1.597	321
1	2.112	2.114	220	2	1.494	1.493	400

Analyst: X-ray Laboratory of Chengdu Geological College.

According to calculations, the unit-cell parameters of ertixiite are: $a=5.975$ Å, $V=213.311$ Å, $Z=1$, $D_x=2.34$ g/cm^3. No X-ray single-crystal analysis of ertixiite was done because of the lack of crystals of suitable sizes. Therefore, only X-ray powder data are presented in Table 3.

Infrared Spectrum

The infrared absorption spectrum of ertixiite was recorded on a Perkin-Elmer 577 type using KBr disk (Fig. 2), and is characterized by the appearance of absorption bands

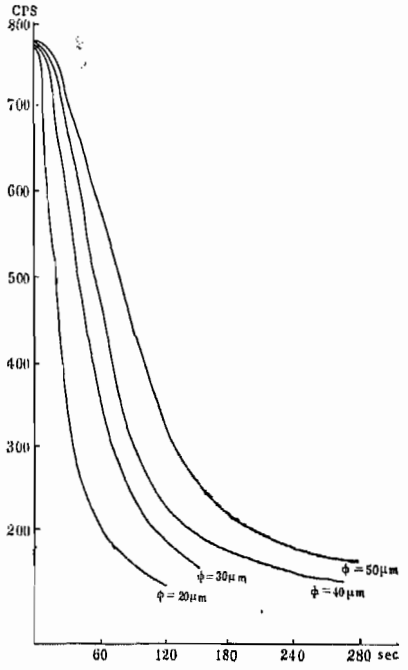

Fig. 2. IR spectrum of ertixiite.

at 1050, 775, and 475 cm^{-1}. The absorption bands at 1050 and 475 cm^{-1} correspond to the vibrations of $(SiO_4)^{-4}$, and that at 775 cm^{-1} indicates the vibration of Al-O-Al.

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