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STILBITE FROM STRZEGOM (LOWER SILESIA)

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A b s t r a c t. Stilbite (desmine) occurring in open spaces in the druses of granitic pegmatites in Strzegom has been investigated using microscopic, X-ray, thermal and infrared spectroscopic methods. Its chemical formula is given.

The occurrence of zeolites in open spaces in the druses of granitic pegmatites in Strzegom (former German name: Striegau), Lower Silesia, was known long time ago (Traube 1888, Michell 1941), and their beautiful specimens are exposed in numerous museums. However, they were not examined in detail till now. One of the most abundant of these zeolites, stilbite, is described in this paper.

Stilbite from Strzegom forms characteristic bunches and sheaf-like aggregates of prismatic crystals (Phot. 1), up to several centimetres in size, growing upon various earlier minerals, especially smoky quartz and feldspars. The examined specimens are of brownish-yellow colour. Its specific gravity is 2.123.

When examined in thin section, stilbite is colourless showing good cleavage in one direction, most probably $\parallel (010)$. Its relief is low. It displays subtle twinning (Phot. 2). Extinction is locally not uniform. Highest interference colours are first-order white with a slight tinge of yellow. Refractive indices: $n_g = 1.501$, $n_a = 1.489$. Birefringence = 0.012. The crystals and cleavage traces are length-slow. The interference figure is biaxial negative with a small axial angle.

The chemical composition of the investigated zeolite in presented in Table 1. The formula calculated on the basis of 72 oxygen atoms is as follows:

$$(Ca_{2.8}K_{0.3}Mg_{0.5}Na_{0.9})(Al_{8.1}Si_{27.5}Ti_{0.2}Fe^{3+}_{0.3}O_{72})\cdot 35.2H_2O$$

It corresponds fairly well to the formula of this mineral given by Deer *et al.* (1963) as well as to the composition of the stilbite from Iceland, the

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Table 1

Chemical analysis of the stilbite from Strzegom

Component	Content (weight %)	Mol. equiv.	Element	Atomic ratios	Atomic ratios on the basis of 72 O
SiO_2	55.52	0.9240	Si	0.9240	27.5
Al_2O_3	13.94	0.1367	Al	0.2734	8.1
Fe_2O_3	0.71	0.0044	Fe^{3+}	0.0088	0.3
TiO_2	0.46	0.0058	Ti	0.0058	0.2
CaO	5.28	0.0942	Ca	0.0942	2.8
MgO	0.74	0.0184	Mg	0.0184	0.5
Na_2O	0.97	0.0156	Na	0.0312	0.9
K_2O	0.56	0.0059	K	0.0118	0.3
$+H_2O$	17.70	0.9724	H_2O		35.2
$-H_2O$	3.81	0.2114			

Analyst: M. Sikora

crystal structure of which has been investigated by Galli and Gottardi (1966). It differs from the stilbite from Nova Scotia used in more recent Slaughter's structural investigation (1970) in a considerably higher Ca : Na ratio.

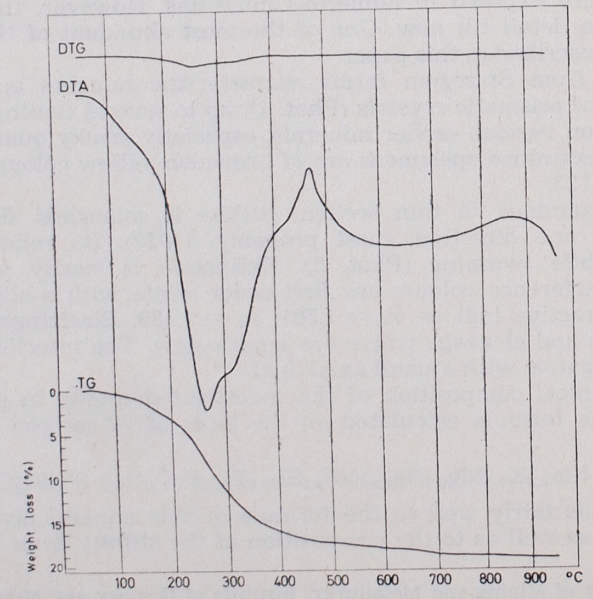

Fig. 1. Thermal curves of stilbite from Strzegom

X-ray diffraction trace of powdered specimen was obtained with a TUR M-61 diffractometer using filtered CoK_α radiation. The interplanar spacings of the zeolite from Strzegom are compared with those of some other stilbites in Table 2.

Table 2

Interplanar spacings for stilbites

Strzegom		Gerval (Mason, Greenberg 1954 — *vide* Deer *et al.* 1963)		Jordanów (Heflik 1964)		Palm Grove (XRDC — *vide* Micheiev 1957)		Karadag (Lazarenko *et al.* — *vide* Heflik 1964)	
d(Å)	*I*	*d*(Å)	*I*	*d*(Å)	*I*	*d*(Å)	*I*	*d*(Å)	*I*
9.25	10	9.1	9	9.163	10	9.05	10	9.14	7
8.52	1								
5.38	2	5.4	2	5.352	2				
5.03	1					5.03	2		
4.69	5	4.68	7	4.657	5	4.64	7	4.7	6
4.59	2								
4.49	1							4.50	3
4.30	1	4.30	3					4.31	1
4.06	10	4.08	10	4.057	10	4.03	10	4.08	10
				3.877	1	3.94	2		
3.779	3	3.74	4					3.77	2
3.504	1							3.51	1
3.418	4	3.41	5	3.325	5	3.44	5	3.40	3
3.208	3	3.20	5	3.195	3	3.20	2	3.19	5
								3.11	1
3.041	8	3.03	7	3.013	9	3.00	9	3.03	8
2.886	1								
2.792	5	2.79	3	2.758	4	2.78	5	2.78	4
								2.72	1
								2.61	1
2.617	1	2.69	2					2.56	2
2.580	3	2.59	2	2.598	1	2.60	5		
				2.480	2	2.49	2		
				2.333	2	2.37	2	2.35	1
2.361	2								
2.321	1								
		2.26	3	2.221	2	2.24	2		
2.136	1								
2.110	1								
2.069	1							2.03	1
2.035	1	2.04	2	2.057	4	2.04	5	1.900	1
1.902	1			1.888	2	1.895	2	1.828	3
1.829	4	1.83	1					1.779	1
1.733	2	1.78	1	1.776	2	1.770	2	1.663	1
		1.67	2	1.660	1	1.651	2	1.591	5
1.591	2	1.60	2	1.584	3	1.593	5	1.556	5
1.558	3	1.56	2	1.549	3	1.549	5		

Thermal curves of the stilbite from Strzegom registered with the apparatus "Derivatograph" (Hungary) are presented in Figure 1. On the DTA curve a double endothermic reaction at 270 and 310°C is recorded, followed by an exothermic reaction at 470°C. The doubling of the endothermic peak is certainly due to the presence of hydrated divalent cations Ca^{2+}, similarly as in the case of Ca-montmorillonites. Most water molecules hold in the structural channels are lost on heating till about 270° but some H_2O molecules coordinated immediately by divalent cations requires slightly higher temperature to be expelled. The double endothermic reaction of stilbite from Jordanów has also been recorded by Heflik (1964). The character of the DTA curves of both stilbites is similar to those described by Koizumi (1953) and Mason and Greenberg (1954) — *fide* Deer *et al.* (1963). The product of heating the stilbite from Strzegom to 900°C is vitrous.

Infrared spectrum was recorded in KBr discs with an UR-10 (Zeiss) spectrometer. The spectrum (Fig. 2) is almost identical with that of the

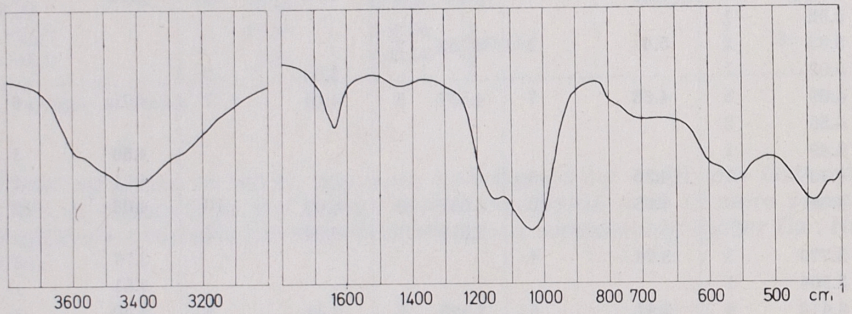

Fig. 2. Infrared absorption spectrum of stilbite from Strzegom

stilbite from Taigarhorn (Iceland) presented by Moenke (1962), the frequencies of the chief absorption bands being 440, 560, 1030, 1145, 1645, 3250 and ca. 3400 cm^{-1}.

The structural investigation of stilbite carried out by Galli and Gottardi (1966) and refined by Slaughter (1970) revealed the presence of two sets of channels in its silica-alumina framework. The smallest diameter of the channels in the direction *a* is approx. 4.4. Å. On this basis Galli and Gottardi postulated stilbite to be promising for industrial applications as molecular sieve. Therefore, further examination of this zeolite seems to be necessary.

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STILBIT ZE STRZEGOMIA

Streszczenie

Stilbit (desmin) występujący w druzach wśród pegmatytów granitowych w Strzegomiu poddano badaniom mikroskopowym, rentgenowskim, termicznym i spektroskopowym w podczerwieni. Na podstawie analizy chemicznej wyliczono jego wzór strukturalny.

OBJAŚNIENIA FIGUR

Fig. 1. Krzywe termiczne stilbitu ze Strzegomia
Fig. 2. Widmo absorpcyjne w podczerwieni stilbitu ze Strzegomia

OBJAŚNIENIA FOTOGRAFII

Fot. 1. Snopowe agregaty kryształów stilbitu ze Strzegomia. Pow. × 2
Fot. 2. Mikrofotografia stilbitu ze Strzegomia, na której widoczne są jego zbliźniaczenia. Nikole X. Pow. × 40

Витольд ЖАБИНЬСКИ

СТИЛЬБИТ ИЗ СТШЕГОМА

Резюме

Стильбит (десмин), образующий друзы в гранитных пегматитах Стшегомского массива анализировался микроскопическим, рентгеновским, термическим и ИК-спектроскопическим методами. По данным химического анализа была вычислена структурная формула минерала.

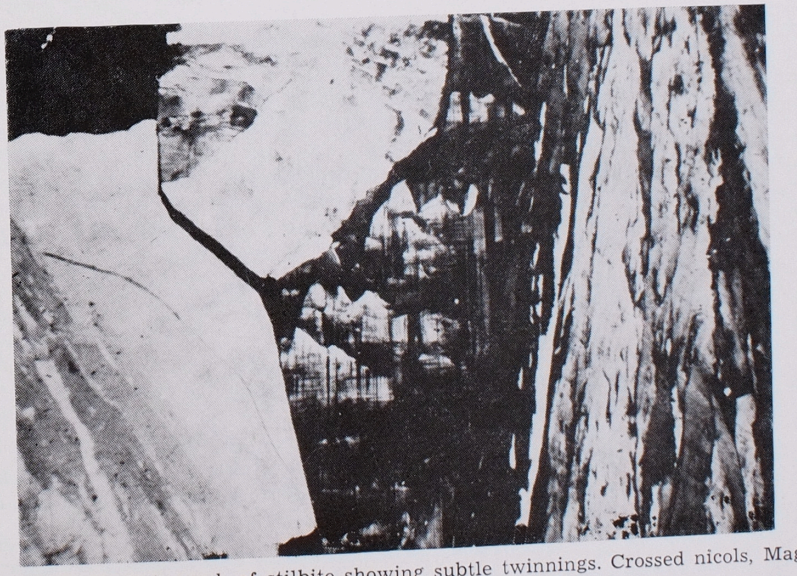
ОБЪЯСНЕНИЯ К ФИГУРАМ

Фиг. 1. Термические кривые стильбита из Стшегома
Фиг. 2. ИК-спектры поглощения стильбита из Стшегома

ОБЪЯСНЕНИЯ К ФОТОСНИМКАМ

Фото 1. Сноповидные агрегаты кристаллов стильбита из Стшегома. Увел. × 2
Фото 2. Микрофотоснимок стильбита из Стшегома, на котором наблюдается двойникование этого минерала. Николи X. Увел. × 40

Phot. 1. Sheaf-like aggregates of the stilbite crystals from Strzegom. Magn. × 2



Phot. 2. Microphotograph of stilbite showing subtle twinnings. Crossed nicols, Magn. × 40

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