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SVANBERGITE FROM THE RADJOU IRON ORE DEPOSIT (SYRIA)

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Abstract. X-ray, IR spectroscopic and microscopic analyses were made on svanbergite from the Radjou deposit. This mineral has been found in haematite ore in which it forms oval concentrations of snow-white colour (1—3 mm in diameter) or discontinuous veinlets. Svanbergite presumably owes its origin to hydrothermal processes. Basaltic magma, which forms extensive covers over vast areas of northern Syria, is assumed to be the source of strontium and, maybe, of phosphorus as well.

INTRODUCTION

During the mineralogical and petrographical investigations of iron ores from the Radjou deposit in NW Syria it has been found that some samples contain small concentrations of a snow-white mineral which appeared to be svanbergite $SrAl_3(PO_4)(SO_4)(OH_6)$. Svanbergite is a rare mineral, which determined the authors to investigate it thoroughly.

The Radjou iron ore deposit is in north-western Syria, about 100 km north of Aleppo. It is made up of variegated clays with nests of haematite-limonite ores, resting on the karstified Jurassic limestones and overlain by Albian and Cenomanian limestones and dolomites (Protasevitch). The main components of ore are limonite, haematite, chlorites and kaolinite, appearing in variable amounts. The ore has a conglomeratic texture and consists of irregular limonite-haematite and chlorite balls embedded in the clay-ferruginous groundmass. A small amount of hydrargillite has also been noted in the ore. The presence of that mineral, as well as the mode of occurrence of the ore and its texture, suggests that Radjou is a deposit of redeposited laterite ores.

Svanbergite has been found in the most compact parts of haematite ore. It forms small oval concentrations 1—3 mm in size and irregular, discontinuous veinlets (Phot. 1). It is snow-white in colour and macroscopi-

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cally non-transparent. In the point samples highest in svanbergite its content estimated with the naked eye amounts to about 10%, which gives the rock a spotted appearance.

Viewed in thin sections, the svanbergite concentrations appear to be cryptocrystalline (Phot. 2). At the concentration boundaries, larger ragged grains up to 0.02—0.04 mm in size are visible in places. The interference colours are low in the cryptocrystalline concentrations and medium in the coarse-crystalline ones.

In veinlets svanbergite is accompanied by calcite with which it forms intergrowths (Phot. 3). The veinlets have, as a rule, a sectional structure.

Svanbergite was identified by X-ray powder method, using film technique (Table 1). The X-ray powder data are very similar to those obtained by Michieiev (1957) and Gladkovskij and Chramcov (1968).

Table 1

X-ray powder data for svanbergites

Radjou (CuK_{α})		After Michieiev (1957)		After Gladkowskij, Chramcov (1968)	
I	d_{hkl}(Å)	I	d_{hkl}(Å)	I	d_{hkl}(Å)
5	5.76	8	5.73	8	5.73
1	5.02	3	4.96		
1	4.24 Q			1	3.82
7	3.54	8	3.51	6	3.50
4	3.34 Q			1	3.18
10	2.98	10	2.97	10	2.935
1	2.80	4	2.77	1	2.753
5	2.66 H				
4	2.47	4	2.47		
10	2.22	10	2.22	10	2.191
3	2.04	4	2.02	1	1.990
8	1.91	8	1.91	10	1.887
2	1.88 H				
1	1.807 Q				
5	1.763	8	1.75	8	1.744
3	1.724	3	1.71	1	1.709
2	1.685 H				
4	1.640	4	1,64		
2	1.612	3	1.60		
2	1.509				
4	1.485	4	1.49	4	1.484
6	1.463	4	1.46	8	1.450
3	1.417	4	1.41		
4	1.385 Q				
1	1.369	4	1.37	4	1.372
1	1.332	3	1.32		
6	1.293	6	1.29	8	1.284

H — haematite, Q — quartz

The small size of concentrations makes it impossible to separate pure svanbergite and, consequently, to make its chemical analysis. A qualitative analysis has revealed the presence of strontium. The earlier analyses of svanbergite (Gladkovskij, Chramcov 1968) showed that its composition is variable. Up till now, the role of water in this mineral has not been explained. Some authors show the presence of water of crystallization, but the thermal curves cited fail to confirm that statement. To elucidate this problem, IR spectrum has been recorded in the UR-10 (Zeiss, Jena) spectrophotometer in the range of 400—1800 cm^{-1} and 2800—3800 cm^{-1}, using KBr disks (1 mg of substance and 300 mg KBr).

The basic absorption bands of svanbergite (Fig. 1) are due to vibrations of the $(PO_4)^{3-}$ and $(SO_4)^{2-}$ anions. The absorption maxima due to the ν_3

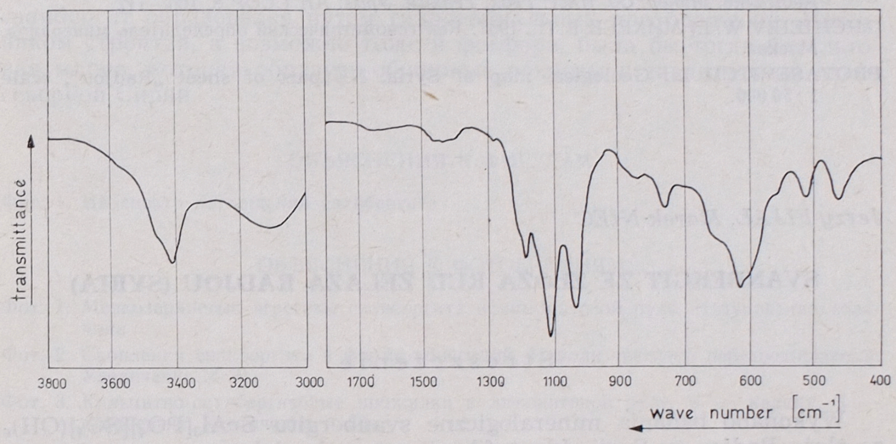

Fig. 1. Infrared absorption spectrum of svanbergite

vibrations of those ions have been recorded in the range 1000—1250 cm^{-1} (1035, 1112, 1190 cm^{-1}). In the range of lower wave numbers (550—700 cm^{-1}), the absorption bands due to the ν_4 vibrations of the complex anions PO_4 and SO_4 appear at 565, 615 and 660 cm^{-1}. In the range of 400—550 cm^{-1} less intensive bands can be observed, for which vibrations of the ν_2 type are responsible. The maxima recorded in the range higher than 2900 cm^{-1} have a different nature. The broad pronounced band with a maximum at 3100 cm^{-1} is most likely due to the valence vibrations of H_2O molecules while the maximum 3415 cm^{-1} is produced by vibrations of the structural OH groups of svanbergite.

Svanbergite and similar minerals have been reported from several bauxite deposits (Beneslavskij 1974). Strontium is not a component characteristic of bauxite, therefore Gladkovskij and Chramcov (1968) are of the opinion that svanbergite occurring in the deposits of the Kursk magnetic anomaly owes its origin to hydrothermal processes which accompanied the intrusions of diabase dykes.

The lack of sufficient geological data does not permit to advance a consistent theory of svanbergite genesis in the Radjou deposit. It seems probable, however, that svanbergite owes its origin to hydrothermal processes in this case as well. The source of strontium, and presumably also of phosphorus, may have been basaltic magma, which formed in the Quaternary an extensive cover over a vast area south of the Radjou deposit (Protasevitch).

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SVANBERGIT ZE ZŁOŻA RUD ŻELAZA RADJOU (SYRIA)

Streszczenie

Wykonano badania mineralogiczne svanbergitu $SrAl_3[PO_4][SO_4](OH)_6$ ze złoża Radjou w Syrii. Identyfikacji minerału dokonano na podstawie badań rentgenowskich, spektroskopowych w podczerwieni i mikroskopowych. Minerał występuje w rudzie hematytowej, w formie owalnych skupień o średnicy 1—3 mm oraz w postaci nieciągłych żyłek. Przypuszcza się, że svanbergit powstał na drodze hydrotermalnej. Źródłem strontu, a być może i fosforu byłaby magma bazaltowa tworząca rozległe pokrywy na znacznym obszarze północnej Syrii.

OBJAŚNIENIE FIGURY

Fig. 1. Widmo absorpcyjne w podczerwieni svanbergitu

OBJAŚNIENIE FOTOGRAFII

Fot. 1. Drobnoziarniste agregaty svanbergitu w rudzie limonitowej. Wielkość naturalna

Fot. 2. Konkrecyjne skupienia svanbergitu. Nikole częściowo skrzyżowane. Pow. × 30

Fot. 3. Żyłki kalcytowo-svanbergitowe w rudzie limonitowej. K — kalcit, S — svanbergit. Pow. × 30

Ежи ФИЯЛ, Марек НЕЦЬ

СВАНБЕРГИТ ИЗ МЕСТОРОЖДЕНИЯ ЖЕЛЕЗНОЙ РУДЫ РАДЖУ (СИРИЯ)

Резюме

Были произведены минералогические исследования сванбергита $SrAl_3[PO_4][SO_4](OH)_6$ из месторождения железной руды Раджу в Сирии. Отождествление минерала основано на рентгеновских, инфракрасных спектроскопических и микроскопических исследованиях. Минерал был обнаружен в гематитовой руде в форме овальных включений диаметром 1—3 мм, которые образают прерывистые прожилки. Предполагается, что сванбергит образовался путём гидротермальных преображений. Источником стронтия, а возможно тоже и фосфора, была бы тогда базальтовая магма, которая образует обширные покровы в значительной части северной Сирии.

ОБЪЯСНЕНИЯ К ФИГУРАМ

Фиг. 1. ИК-спектр поглощения сванбергита

ОБЪЯСНЕНИЯ К ФОТОГРАФИЯМ

Фот. 1. Мелкозернистые агрегаты сванбергита в лимонитовой руде. Натуральная величина

Фот. 2. Скопления сванбергита в форме конкреций. Николи частично перекрещиваются. Увеличение × 30

Фот. 3. Кальцитно-сванбергитовые прожилки в лимонитовой руде. К — кальцит, S — сванбергит. Увеличение × 30

Phot. 1. Fine-grained svanbergite aggregate in limonitic ore. Natural size

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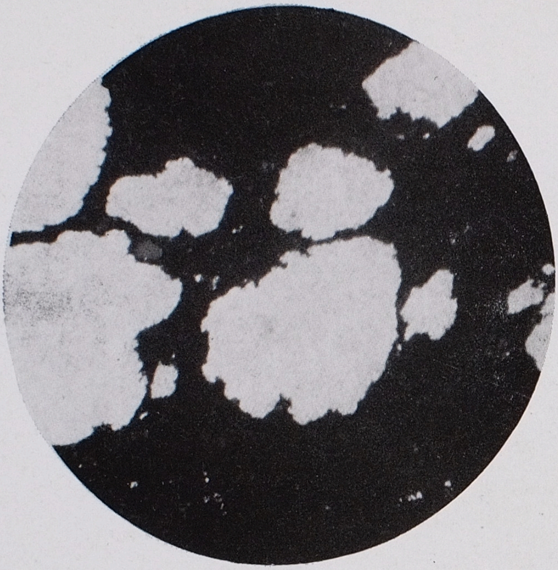

Phot. 2. Concretional svanbergite aggregate. Partialy crossed nicols. Magn. × 30

Phot. 3. Calcite-svanbergite stringer lodes in limonite ore. K — calcite, S — svanbergite. Magn. × 30