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ĽUDMILA ROJKOVIČOVÁ*

OCCURRENCE OF ALABANDITE AT VÍGĽAŠSKÁ HUTA — KALINKA (NEOVOLCANITES OF THE CENTRAL SLOVAKIA)

(Figs. 8, Tabs. 2)

Abstract: Alabandite — MnS has been found in the central part of stratovolcanic complex Javorie. It occurs in close paragenesis with pyrite in quartz-diorite porphyry. It has been identified microscopically, by X-ray diffraction analysis and X-ray microanalyser. The ascertained Mn contents 62.15, Fe contents 0.08 and S contents 35.91 per cent correspond to the stechiometric formula $Mn_{1.000}S$. Most likely alabandite originated by low-temperature postvolcanic hydrothermal activity with H_2S supply and by its compounding with Fe and Mn comprised in the rock-forming minerals, especially in pyroxenes.

Резюме: Алабандин — MnS был обнаружен в центральной части стратовулканического комплекса Яворье. Он выступает в тесном парагенезисе с пиритом в кварцово-диоритовом порфире. Он был идентифицирован микроскопически, рентгеновским диффракционным анализом и рентгеновским микроанализатором. Установленное содержание Mn 62,15; Fe 0,08 и S 35,91 процентов соответствует стехиометрической формуле $Mn_{1,000}$ S. Алабандин возник вероятнее всего низкотемпературной послевулканической гидротермальной деятельностью при поставке H_2S и его соединением с Fe и Mn содержащихся в породообразующихся минералах, особенно в пироксенах.

Alabandite — MnS has been found in the central part of Javorie Mts., at Vígľašská Huta — Kalinka (Fig. 1). Neogene volcanic complex of Javorie Mts. represents remnants of large complex stratovolcano with peripheral, transient and central volcanic zone (V. Konečný — A. Mihaliková, 1977). Transient volcanic zone is formed mostly by redeposited volcanoclastic material (epiclastic breccias, conglomerates, epiclastic volcanic sandstones). Transient volcanic zone is represented by alternation of lava flows and volcanoclastic rocks. Central volcanic region is formed by the northern slopes of Javorie Mts., i. e. the wider area of Kalinka — Slatinské Lazy. It is built up of hydrothermally altered rocks and intrusive complex. Hydrothermally altered rocks are represented by pyroxenic and pyroxenic-amphibolic andesites (propylitized, argillitized and silicified) and secondary quartzites. Intrusive complex is not of homogeneous character and there can be distinguished facies of quartz diorite to monsodiorite (V. Konečný — A. Mihaliková, 1977).

Region of Vígľašská Huta — Kalinka has been known as early as in the last century for occurrence of pure sulphur (T. Szontagh, 1855) and W. Haidinger (1846) found hauerite — MnS_2 in this region, which was later described by M. Kuthan (1956) too. M. Kuthan (1956) also described low-temperature hydrothermal mineralization connected with postvolcanic exhalation activity represented mainly by pure sulphur and pyrite. He explains origin of pyrite by effection of H_2S on magnetite. Occurrence of hauerite in intensively spread

* RNDr. Ľ. Rojkovičová, Dionýz Štúr Geological Institute, Mlynská dolina 1, 817 04 Bratislava.

andesite tuffs 50 m below surface makes the author presuppose that Mn in hauerite follows mainly from diopside of hedenbergite and it has originated by similar way as pyrite.

The first occurrence of alabandite in our country has been described by E. Fellenberg, 1862 (in V. Zepharovich, 1873) near Gelnica and Žakarovce where it occurs with rhodonite. Green alabandite associated with pyrite, galena and rhodochrosite has been found near Čučma by F. Vivenot, 1869 (in V. Zepharovich, 1873). L. Žák – J. Novotný (1954) describe alabandite from hydrothermal vein at Litošice (Železné hory Mts.). It occurs in association

Fig. 1. Localization of structural borehole KON-1 at Vígľašská Huta – Kalinka.

with graphite, pyrite, pyrrhotine, chalcopyrite, rhodonite and quartz. According to L. Žák (1956) Mn originates most likely from the rock-forming minerals which make up sides of veins. Its transfer occurred by low-temperature hydrothermal solutions. J. Kantor – J. Krištín (1973) give occurrence of alabandite with relatively high Fe contents (9.67 %) in metamorphosed pyrrhotine-pyrite ores in Helpa (the Low Tatras) on the basis of microscopic study and X-ray microanalyser. Alabandite occurs here in association with pyrrhotine, pyrite, chalcopyrite, sphalerite, arsenopyrite, marcasite and graphite. Rhodonite and other Mn silicates are present too. It originated in the course of metamorphic mobilization (J. Kantor — J. Krištín, l. c.).

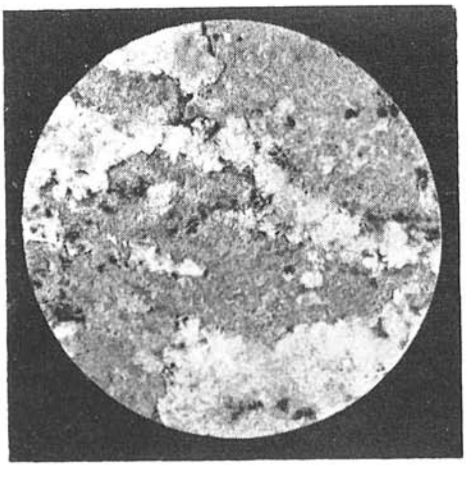

Fig. 2. Alabandite (black) on fissure of quartz-diorite porphyry together with calcite and quartz (white). Vígľašská Huta – Kalinka. Reduction 2 : 1.

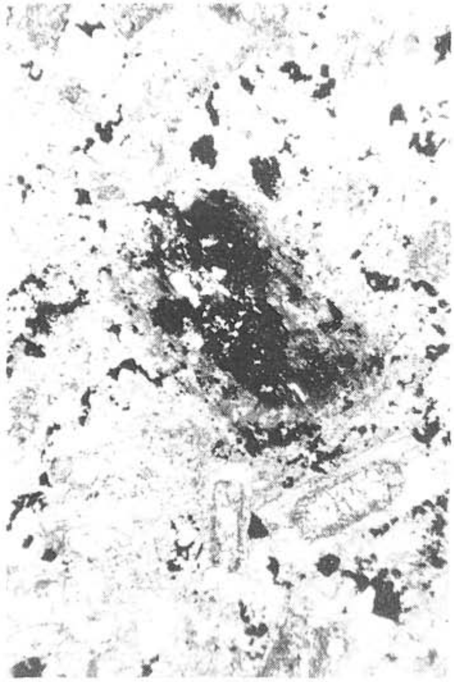

Fig. 3. Alabandite with pyrite (black) push back in the middle actinolitized and sericitized phenocrysts of pyroxenes in quartz diorite with abundant plagioclases. Vígľašská Huta – Kalinka. Transmitted light, magn. × 25, 1 nicol.

Fig. 4. Ditto as in Fig. 3, in crossed nicols.

Minerals of magmatic, hydrothermal and hypergene origin can be in general distinguished in Javorie Mts. Hydrothermal mineralization is represented by magnetite, hematite, pyrite, marcasite, pyrrhotine, chalcopyrite, enargite, sphalerite, galenite, molybdenite, arsenopyrite, antimonite, antimony and cinnabar (Ľ. Rojkovičová, in press).

Alabandite has been identified at Vígľašská Huta – Kalinka in structural borehole KON-1 in 389.2 m depth. It is more expressively concentrated in form of finegrained, dark-brown to black coatings (eyes) of 2.5 × 3 mm size on fissure of quartz-diorite porphyry along with calcite and quartz (Fig. 2). It also occurs in form of pseudomorphs on phenocrysts of pyroxenes and also in form of irregular grains scattered in the rock.

Alabandite is opaque in transmitted light (Fig. 3), on fissures and at edge of grains it is translucent to brown. It is grey in reflected light, with higher reflecting ability than sphalerite has and lower than that of hematite. It is isotropic. It shows brown-green interior reflexes being more distinct in immersion oil. Allotriomorphic, rarely idiomorphic grains up to 0.5 mm size (Fig. 5) are scattered in the rock or they form clusters. It occurs in close paragenesis with pyrite through which it intergrows. Along with pyrite it pushes back phenocrysts of

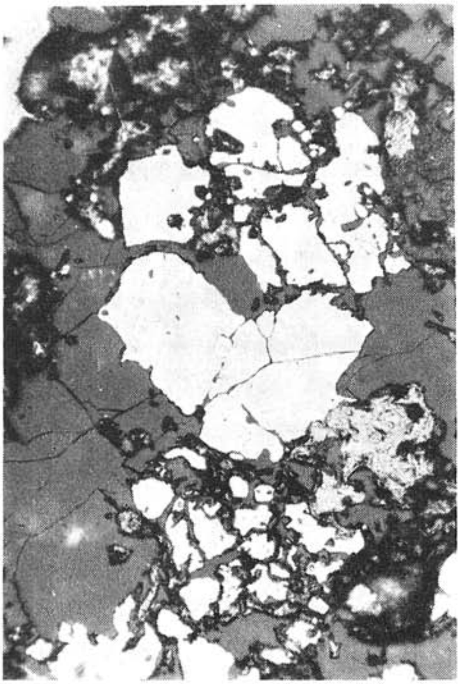

Fig. 5. Alabandite (grey) encloses pyrite (white). Vígľašská Huta — Kalinka. Reflected light, magn. × 160, 1 nicol.

Fig. 6. Alabandite and pyrite (black) form pseudomorphs on pyroxene phenocrysts. Pyrite is abundantly scattered also in quartz diorite. Vígľašská Huta — Kalinka. Transmitted light, magn. × 63, 1 nicol.

pyroxenes (Figs. 3, 4), whereby it often forms together with pyrite pseudomorphs after their repulsion (Fig. 6).

Values of microhardness measured at 40 g weight vary within 1285—1676 MPa (131—171 kp/mm^2), with mean value 1578 MPa (161 kp/mm^2), which is in accordance with data given by W. Uytenbogaardt — E. Burke (1973) (129—254 kp/mm^2).

In spite of similar optical properties of alabandite and hauerite in reflected light it is possible to refer to diversity of interior reflexes (with hauerite they are brown-red) and microhardness values being considerably higher with hauerite (485—508 kp/mm^2). Unambiguity of alabandite presence in the studied rock is proved by X-ray diffraction analysis (Tab. 1, Fig. 7).

Planar distribution of elements carried out by RNDr. D. Jančula on X-ray microanalyser JEOL JXA-5A proved the presence of Mn and S (Fig. 8 a, b, c, d) in the studied mineral and quantitative chemical analysis (analyzed by RNDr. J. Krištín, CSc.) measured by means of apparatus JEOL Super Probe-733 determined contents of individual elements in weight per cent as follows: Mn 62.15, Fe 0.08 and S 35.91 which is in good accord with stechiometric formula MnS, considering the fact that the analyzed mineral corresponds to $Mn_{1.000}S$ after conversion.

Table 1
X-ray diffraction analysis of alabandite

L. G. Berry (1974) 6-0518		V. I. Micheev (1957) — 75		Vígľašská Huta — Kalinka		Haucourt in M. Kuthan (1956)	
alabandite						hauerite	
I.	d nm	I.	d nm	I.	d nm	I.	d nm
						3	0.3035
						1	0.2715
100	0.2612	10	0.2603	10	0.2614		
						1	0.249
						1	0.215
50	0.1847	10	0.1843	6	0.1848		
						1	0.1832
6	0.1575	1	0.1634	1	0.1638		
20	0.1509	5	0.1504	2	0.1504		
8	0.1306	4	0.1302	1	0.1306		

In comparison with alabandite from Heľpa (J. Kantor — J. Krištín, l. c.) (Tab. 2) Fe contents in the studied alabandite can be considered trace. Alabandite with Fe contents 1.76 per cent is described by M. A. Zakrzewski (1980) in volcanosedimentary ores in Sweden. It originated in the course of regional metamorphosis by sulphidization of silicates and it occurs in associa-

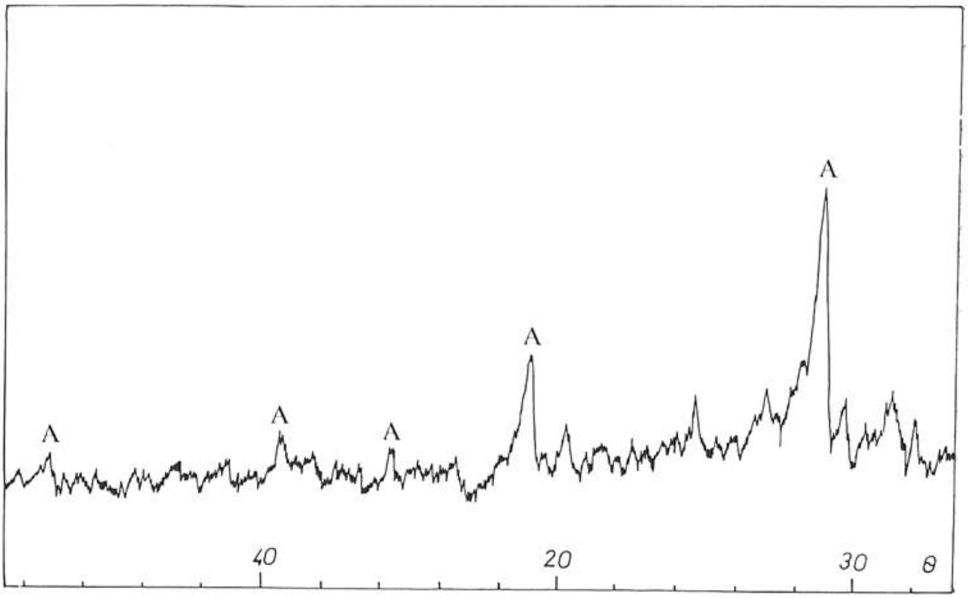

Fig. 7. X-ray diffraction record of alabandite (A). Vígľašská Huta — Kalinka.

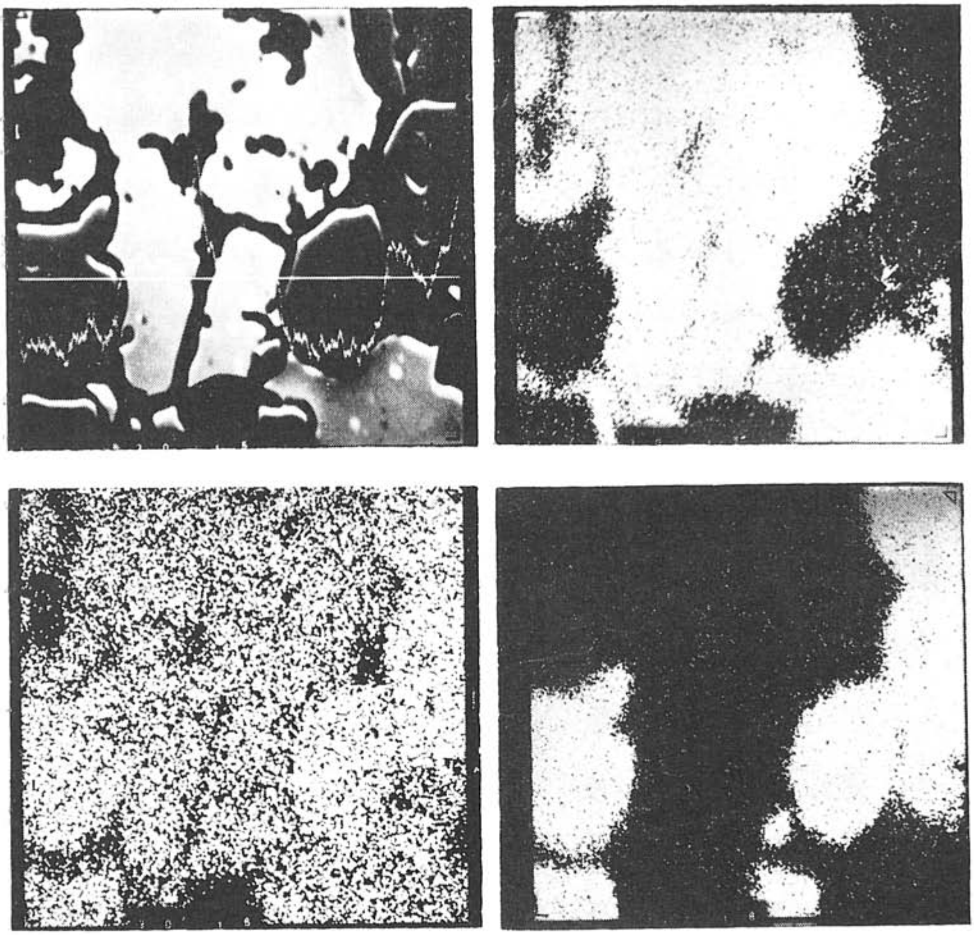

Fig. 8. Composition (a) and planar distribution of Mn (b), S (c) and Fe (d) alabandite in X-ray microanalyser. Vígľašská Huta — Kalinka. Magn. × 300.

tions with sphalerite, pyrite, pyrrhotine, galenite, chalcopyrite and sulpho-salts (M. A. Zakrzewski, l. c.).

Contents of Fe constituent in alabandite reflect temperature conditions of its origin, already P. Ramdohr (1962) referred to this fact on the basis of extensive mixing of MnS and FeS at high temperature. Direct dependence of Fe contents in alabandite at temperatures over 400 °C was experimentally proved also by B. Skinner — F. Luce (1971). Proceeding from this assumption it can be stated that low iron contents in the studied alabandite and its occurrence in close paragenesis with pyrite proves its low-temperature origin.

Quantitative chemical analyses of manganese in surrounding quartz diorite reach on the average 0.14 per cent, whereby in the surrounding of alabandite occurrence expressive change in contents of this element is not observed. Consi-

Table 2
Chemical composition of alabandite (in weight per cent)

	Mn	Fe	S	sum
MnS*	63.14	—	36.86	100.00
Vígľašská Huta — Kalinka	62.15	0.08	35.91	98.15
Heľpa**	57.26	9.67	34.69	101.35

* theoretical alabandite
** J. Kantor — J. Krištín (1973)

derably decreased manganese contents (0.004 per cent) are in the zone of intensive hydrothermal alterations (J. Štohl, 1981). It is possible that manganese leaching in this zone caused its errichment in hydrothermal solution from which its segregation in form of MnS later occurred. But repulsion of pyroxene phenocrysts by alabandite with pyrite indicates sulphidization of similar character as it is described by M. Kuthan (l. c.) during origin of pyrite and hauerite from near surrounding. Therefore H_2S supply by low-temperature postvolcanic hydrothermal activity and its compounding with Fe and Mn comprised in rock-forming minerals, especially in pyroxenes, can be presumed. Independence of manganese contents on presence of alabandite in the rock indicates rather this way of origin.

More reduction environment (389 m below surface) was more suitable for origin of alabandite in the studied region in comparison with more oxidic conditions during origin of Mn mineral – hauerite richter in sulphur (50 m below surface).

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