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Nové nálezy nerostů v Československu New Finds of Minerals in Czechoslovakia

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Během posledních let získalo mineralogické oddělení Národního musea řadu zajímavých a dosud nepopsaných ukázek nerostů většinou z nových nalezišť, z nichž nejvýznamnější jsou v předložené práci registrovány. Celkem je v práci charakterisováno 38 nových nálezů nerostů, a pro každý z nich udána geologická charakteristika naleziště, stanovena hlavní optická a krystalografická data, podány výsledky spektrální analýsy a pro 13 nerostů také jejich roentgenometrický výzkum. Závěr tvoří diskuse o genetických podmínkách vzniku nerostů.

Z vyvřelin jsou popsány nové nálezy axinitu a mikroklinu z oblasti žulových masivů a výskyty dvou thomsonitů a aragonitů z terciérních vyvřelin Českého Středohoří.

Poměrně hojně jsou zastoupeny nové nálezy nerostů v horninách sedimentárních, zvláště výskyty krystalovaného kalcitu z řady nalezišť v širším okolí Berouna, nálezy v karbonu i v křídovém útvaru. Pozoruhodné jsou nové nálezy nerostů v pelosideritech kamenouhelné pánve plzeňské.

Do oblasti přeměněných hornin náleží další výskyty krystalovaných kalcitů, nálezy sádrovce a granátu ve středočeském krystaliniku a zajímavá paragenese nerostů ze skarnové horniny u Hutí, sv. od Bechyně, charakterisovaná rutillem, amfibolem, apatitem a pyrrhotinem.

K nerostům českých rudních žil a ložisek náleží dva zajímavé nové nálezy krystalovaného markasitu ze starých rudních nalezišť (Kašperské hory, Stříbro), chalkopýrit z okolí Nového Knína a konečně podrobněji popsán nález haematitu (krevele a železné slídy) ze známého ložiska magnetovce u Herlíkovic v Krkonoších.

Celá řada dalších nových nálezů nerostů bude zveřejněna v české odborné literatuře, jako doplněk k české mineralogické topografii.

NEW FINDS OF MINERALS IN CZECHOSLOVAKIA

The mineralogical section of the National Museum in Prague was able in the course of the last years to secure a number of new so far unpublished finds of minerals, prevalently from completely new localities. Some of the obtained samples are of local importance only and they will be gradually published in Czech scientific papers; the rest deserving broader attention are registered in the presented paper.

I. MINERALS OF IGNEOUS ROCKS

Axinite from Hudčice near Březnice (Blatná county, Pilsen region)

A so far unknown locality of axinite from the Central Bohemian plutonic region is the granodiorite quarry on the N. slope of elevation 578, SSW. of Hudčice, SSW. of Březnice (Central Bohemia). Axinite occurred here only rarely in the aplitic facies of granodiorite (inventory No. 36,152; J. Štěpán, Praha, legit; Prof. Dr. J. Kratochvíl, Praha, donavit). The light to grey-white aplite is heavily fissured; on the fissures compact to finely-flaked grey-green chlorite is found which originated undoubtedly from a disintegration of femic particles of granodiorite. Underneath relatively rare, as much as 7 mm long needles of epidote were found. Only underneath the epidote axinite occurs, being probably the paragenetically oldest mineral. In the obtained sample it forms a 3×2 cm large, grey-violet fine-grained aggregate. Its powder preparation exhibits a high refraction and a relatively low birefringence appearing only in the very thin flakes in colours of the first order. These properties and the general macroscopic appearance themselves indicate that we are dealing with axinite. In order to confirm this identification a qualitative spectral analysis and X-ray measurement were carried out. The spectral analysis which was used for the identification was carried out by the chemical laboratory of the Central Institute of Geology in Prague. The mineral sample was tested on a Hilger spectrograph E 492 with 0.015 mm slit, electrode gap 2 mm, AC arc 7 A, on the photographic plate Foma super-ortho 10×25 cm, time of exposure 2×60 sec in the range 2460—3500 Å. The following elementary content could be derived on this basis:

- | | |
|------------------------------------|------------------------|
| I. Essential (above 1 %): | Si, Al, Ca, Mg, Fe, Na |
| II. Subordinate (above 0.1 %): | B, Mn |
| III. Insignificant (above 0.01 %): | Ti, K |
| IV. Traces (less than 0.01 %): | Be, V, Ga, Ag, Sr, Cu |

On inspection of the elements found it was possible to separate safely those forming the basis of axinite (Si, Al, Ca, Mg, Fe, B, Mn, K, Na) from isomorphic Ti and heterogeneous admixtures elements from the silicate and sulfide group which belong to the surrounding granodiorite. The roentgenometric study was carried out by the powder method of Debye-Scherrer (for the X-ray pattern see Table XVI, Fig. 1). The results obtained were compared with the X-ray pattern of axinite from Dauphiné in

southern France published in the tables of J. D. Hanawalt (11) as shown in the attached Table 1. The spectral analysis and roentgenometric examination confirmed definitely the previous optical results.

The first to describe axinite from the region of the Central Bohemian granite massif was A. Krejčí (28) who found it together with titanite and malacolite in granitic pegmatite near Písek; it was identified optically and chemically by F. Ulrich. There exist more recent rich finds of axinite from Záběhlce near Zbraslav in the vicinity of Prague, located

Table 1.

Axinite, Hudčice		Axinite, Dauphiné	
I.	d.	I.	d.
1	3.79		
4	3.68		
4	3.41	0.8	3.45
1	3.32		
2	3.12	0.8	3.13
		0.6	2.99
4	2.78	1.0	2.79
1	2.53	0.4	2.55
1	2.37	0.6	2.41
2	2.16	0.6	2.16
4	2.02	0.4	2.04
2	1.97	0.6	1.99
1	1.91		
1	1.80		
5	1.67	0.4	1.65
1	1.630	0.8	1.63
		0.4	1.578
1	1.537	0.2	1.539
1	1.507	0.2	1.524
		0.2	1.492
1	1.456	0.4	1.454
		0.4	1.422
1	1.395	0.5	1.401
2	1.352	0.2	1.354
2	1.337		
4	1.318	0.4	1.322

and described by J. Kašpar (16) and from the neighbourhood of Mandát and Davle, S. of Prague, described by K. Paděra and J. Kutina (31). P. Morávek (29) reports similar interesting finds from the broader neighbourhood of Jílové (Sázava, Štěchovice, Radlík) S. of Prague. While the axinite from Písek and Hudčice belongs undoubtedly to the granitic paragenesis, axinites from the other localities (with the exception of Radlík) belong according to the above authors probably to the pneumatolytic-hydrothermal phase of the diabase magma and are therefore significantly older geologically than the axinites from the Central Bohemian plutonic region. The occurrence at Radlík is located by the author in the oldest phase of eruptions of the Jílové zone.

Microcline from the hill Baba near Domažlice (Domažlice county, Pilsen region).

Among the numerous pegmatite veins of the crystalline of the Český Les there is also a powerful pegmatite vein, practically exploited at one time on the W. slope of the hill Baba, W. of Domažlice (elevation 461). Our sample of microcline (inventory No. 34,617; L. Janota, Domažlice, 1943, legit) was collected in the shaft opened here during the German occupation; macroscopically it is very similar to orthoclase from an analogous locality on the near St. Vavřinec Hill, SW. of Domažlice, as described by R. Rost (35).

The obtained sample is a bulk of cleavage microcline; the size of the individual is 10×7 cm, light-grey with whitish stripes. Vitreous cleavage planes are moderately undulate and contain at places imperfectly demarcated leaves of weakly greenish muscovite as much as 3 cm in diameter grown into them. The undulation of cleavage planes was caused probably by high pressure to which the pegmatite vein was exposed in a certain time. In a thin section placed parallel to (001) we can ascertain that the feldspar is in the initial stage of kaolinization, manifested by a whitish haze apparent especially in reflected light. In transmitted light the very dense "grating" is clearly visible which is characteristic of microcline. A reliable identification property is the oblique angle of extinction on (001) : $n \alpha / a = 150$, $n \leq 1.527$. The thin section shows also that at places microcline is irregularly intergrown with albite to albite-oligoclase which can be dependably identified by their low angle of extinction of albite lamellae and by its index of refraction, always higher than the index of refraction of microcline. The ration of albite to microcline can be assessed at 1:10. The largest ingrowth of albite found in the thin section was of the size of 2.7×0.6 mm. At other occasions microcline is found to be intergrown with irregularly lobar grains of quartz of the maximum size of 0.8×0.5 mm, often in association with minute and thinly dispersed granules of black hematite which is bluish in reflected light and exhibits beginning limonitization at the margins.

The optical determination was supplemented with spectral analyses carried out by the chemical laboratory of the Central Institute of Geology in Prague (the technical data are the same as for the preceding mineral), and by the laboratory of the Precious Metals Commission in Prague. The latter institution used for their work the ISP — 22 spectrograph. The technical data: slit 0.010 mm, electrode gap 3.2 mm, AC arc 4 A, generator PS-39, photographic plate Foma super-ortho antihalo, exposure 30 sec, wave range 2230—4400 Å.

These spectral analyses yielded the following results:

	CIG	PMC
I. Essential (above 1 %):	Si, Al, K, Na, Ca	Si, Al, K, Na, Ca, Mg
II. Subordinate (above 0.1 %):	Mg, Fe	Fe, Ba, Sr, Ti, Pb, Mn, Cu
III. Insignificant (above 0.01 %):	—	—
IV. Traces (less than 0.01 %):	Mn, Cu, Sr, Ba, Sn, Zn, In, Pb, Ti	Ag

The basis of microcline is given by K, Al and Si, with probably isomorphic admixtures of Na, Ca, Ba and Sr. The rest belongs to hetero-

geneous admixtures, especially to silicates, oxides and sulfides from the pegmatite. The presence of oxides and sulfides is only assumed in agreement with the paragenesis, the silicate muscovite, however, was ascertained both macroscopically and microscopically. It follows from the results of spectral analyses and of microscopic examination that we are dealing here with microcline with fractions of acid plagioclase with mechanical admixtures of silicates, particularly of muscovite, and with probable admixtures of oxides and sulfides.

The occurrence of microcline in granitic pegmatites, regularly in association with orthoclase, is quite frequent as indicated also by its finding in pegmatites from the neighbourhood of Domažlice.

Thomsonite from Folknáře near Děčín (Děčín county, Ústí region).

On the hill Sokolí (formerly Falkenberg), elevation 501, ENE of Folknáře, E. of Děčín, there occurs in cavities of leucitic tephrite abundant crystalline thomsonite (inventory No. 38,729; F. Slavík donavit). The leucitic tephrite forms an extensive sheet between the villages of Březina and Huntířov, S. and E. of Folknáře, which is denuded at many places. It has a dark-grey color while fresh, becomes yellowish on weathering and contains abundant fine grains and crystals of augite. From the mineralogical point of view the amygdaloid facies of the rock are interesting as they contain cavities as large as 5×5 cm, with smaller cavities clearly predominant. Of the few minerals described from this locality mention should be made of the large crystals of basalt amphibole which is due to F. A. Reuss (33, p. 174) who describes also the occurrence of grey-white fibrous zeolite. J. E. Hibsich (13, p. 268) described augite from the western slope of the Sokolí hill; J. Stoklasa (38, p. 26) described osteolite from the tuffs at the foot. Thomsonite forms rich coherent layers on walls of amygdaloid cavities of leucitic tephrite composed of fine grey-white to whitish, at places somewhat yellowish crystals, 1—2 mm large. Morphologically they are of columnar habit and in their vertical zone there are basically only faces of both pinacoids (100) and (010) while the frontal pinacoid sometimes weakly predominated; then the columns are somewhat flattened along this face; more often both faces are in equilibrium. It is only rarely that we find also the (110) faces, usually regularly developed. Crystals are demarcated by the (001) face, flat and smooth, but at times somewhat rounded and usually roof-shaped so that it can be taken rather for a very flat prism. Thomsonite crystals with a similar form have been described in the amygdaloid facies of feldspar porphyrite ESE. of Mettweiler at St. Wendel, NNE. of Saarbrücken in the Saar (GFR) by A. Hahn (10, p. 172). Another morphological feature of interest of the described thomsonite are fine laminar growths of smaller individuals which are parallel to (010). They can be taken for a parallel concrescence of smaller crystals touching in the face (010). Similar growths had not been detected in thomsonite before. On the other hand, no characteristic fan-shaped aggregates of thomsonite were found on the Sokolí hill although they are common in the other known localities.

Thomsonite forms rather small clusters and druses of crystals with a vitreous to dull luster, but at places also spherical aggregates with a parquetted surface of milk-white color. Beside the described crystal limitation of thomsonite it was identified also by spectral and X-ray analysis. The spectral analysis carried out in the laboratory of the Precious Metals Commission in Prague yielded the following results of elementary content:

I. Essential (above 1 %):	Na, Ca, Al, Si
II. Subordinate (above 0.1 %):	K, Fe
III. Insignificant (above 0.01 %):	Cu, Mg
IV. Traces (less than 0.01 %):	Ti, Mn, Ag

The basis of thomsonite is formed by the following elements: Na, Ca, Al, Si, while K is to be considered as an isomorphic admixture. The remaining elements belong to heterogeneous admixtures. It can be assumed that we are dealing here with thomsonite with little mechanical admixture of augite and of sulfides from the surrounding leucitic tephrite.

The roentgenometric study carried out by the method of Debye-Scherrer (cf. the X-ray pattern on Table XVI, Fig. 2) yielded values which were then compared with the X-ray pattern of thomsonite from Kilpatrick in Dumbartonshire in Scotland, shown in the tables of J. D. Hanawalt (11, p. 215). The results from both localities of thomsonite are shown in Table 2. Morphologically and genetically the Folknáře thomsonite is similar to that from cavities and fissures of melaphyric amygdaloids in quarries on the SE. slope of the Kozákov mountain, E. of Turnov. It originated in a similar way as other zeolites in the hydrothermal phase accompanied by a partial decomposition of particles of the mother rock.

Thomsonite from Ludvíkovice near Děčín (Děčín county, Ústí region).

No finds of zeolites had been known from the basalt of the Proš hill (formerly Poppenberg, elevation 527) E. of Ludvíkovice NE. of Děčín. F. X. M. Zippe (45, p. 47) described fine crystals of augite from this locality, E. Bořický (3, p. 26) mentions blue grains of haüynite visible often with plain eye. In a deserted quarry E. of Ludvíkovice, at the foot of the mentioned hill, rich aggregates of thomsonite crystals were found in basalt cavities (inventory No. 36,486; J. Štof, Děčín, 1938, legit).

The dark-grey basalt from this locality contains abundant minute columns of black augite and frequently also streaks formed by a light-grey tuff material with small fragments. In these rock streaks there occur cavities on the walls of which fine radially fibrous aggregates of thomsonite crystallized. The sample collected there shows two such cavities, the larger of which measures 20×35 mm and the smaller 12×7 mm. Thomsonite forms in the cavities white or pinkish hemispherical aggregates about 5 mm in size. The hemispheres are formed by fine radially arranged fibrous crystals converging to a yellow center. Individual crystals are usually snow-white, their terminal parts protruding into the basalt cavity are occasionally quite transparent. Their average size is 0.16×2.5 mm. They have a long rectangular shape and a columnar habit.

Table 2.

Thomsonite, Folknäre		Thomsonite, Kilpatrick, Scotland	
I.	d.	I.	d.
3	6.43	0.6	8.0
2	5.77	0.6	5.8
1	5.24	0.4	5.2
6	4.52	0.8	4.67
2	4.34	0.4	4.35
2	4.06	0.4	4.07
1	3.81	0.2	3.84
6	3.46	0.8	3.48
6	3.15	0.8	3.30
6	2.83	1.0	2.85
1	2.75		
6	2.64	0.8	2.66
1	2.55	0.2	2.59
1	2.41	0.4	2.43
1	2.24	0.4	2.26
6	2.17	0.6	2.16
1	2.11	0.2	2.11
2	2.05	0.4	2.07
		0.4	2.01
2	1.94	0.4	1.95
1	1.87	0.2	1.88
3	1.80		
1	1.73		
2	1.70	0.6	1.71
1	1.67		
6	1.61		
1	1.58	0.6	1.581
1	1.56		
1	1.53	0.4	1.534
		0.2	1.502
5	1.459	0.8	1.462
		0.4	1.441
		0.4	1.424
1	1.389	0.4	1.387
		0.2	1.338
1	1.328		
		0.4	1.318
1	1.310	0.4	1.308
1	1.299		
		0.4	1.284

In the vertical zone usually the (010) and (100) faces predominate which are quite frequently in equilibrium. Only rarely do we find also the (110) faces which then only make obtuse the edges of both pinacoids. The terminal face is (001), sometimes finely striated. The parallel extinction, varying sign of elongation and n being less than 1.519 indicate that the sample in question is thomsonite. The spectral analysis carried out under the technical conditions described above yielded the following elementary content (the Precious Metals Commission laboratory):

- | | |
|------------------------------------|--------------------|
| I. Essential (above 1 %): | Na, Ca, Sr, Al, Si |
| II. Subordinate (above 0.1 %): | Mg, Be, B |
| III. Insignificant (above 0.01 %): | Ti, Zn, Cu, Fe |
| IV. Traces (less than 0.01 %): | Mn, Pb, Ag, Ba |

While the Ca, Na, Al and Si form the basis of thomsonite the remaining elements belong to heterogeneous admixtures prevalently of silicate nature, to a lesser extent also to sulfides from the surrounding tuffaceous basalt. Augite was determined directly optically in the heterogeneous admixtures. The roentgenometric examination of a powder pattern was carried out according to Debye-Scherrer by the chemical laboratory of the Central Institute of Geology in Prague (cf. the X-ray pattern on Table XV, Fig. 1). The values obtained were compared with those for thomsonite from Kilpatrick in Dumfriesshire in Scotland as shown in the tables of J. D. Hanawalt (11, II-1619). The agreement of both sets of values is apparent from Table 3. Thomsonite appears to be also in this case a product of the hydrothermal phase in the evolution of the rock.

Aragonite from Vlastislav near Třebenice (Lovosice county, Ústí region).

To a fair number of finds of aragonite in the cavities and in fissures of basalt igneous rocks from the region of the České Středohoří aragonite from Vlastislav, NW. of Třebenice could be added (inventory No. 35,854—35,856; Č. Zahálka, 1948, legit). Through Upper Turonian limestone marls nephelinic basalt penetrates here on the ridge of which the little castle Skalka stands nowadays. From the basalt fissures violet calcite is known as described by V. Zepharovich (46, p. 87); now we are able to add the aragonite as a product of the hydrothermal phase at a higher temperature.

Aragonite forms grey-white, sometimes yellowish, sometimes pinkish, columnar to thinly columnar radial aggregates. Individual columns are as much as 9 cm long and 0.7 cm wide. Genetically they are younger than calcite, the crystals of which are sometimes enclosed in them or grow on top of them. That would indicate the origin from a warmer solution which passed through the nephelinic basalt fissures following the crystallization of calcite.

Aragonite crystals are bounded mostly by vertical zone faces, particularly by the (110) ones, which have a vitreous luster and are markedly striated at places. The terminal faces have not been found in the samples obtained.

The spectral analysis was carried out by the laboratory of the Central Institute of Geology in Prague and by the laboratory of the Precious Metals Commission in Prague, under the conditions described above. The analyses yielded the following elementary content:

	CIG	PMC
I. Essential (above 1 %):	Ca, Al	Ca
II. Subordinate (above 0.1 %):	Si, Sr, Fe, Mg	Si, Sr, Mg, Al
III. Insignificant (above 0.01 %):	Na, Mn, Ti	Mn, Ba, Pb, Cu
IV. Traces (less than 0.01 %):	Cd, Cu, In, Ba, K, V, Sn, Zr	Ag, Na

Table 3.

Thomsonite, Ludvikovice		Thomsonite, Kilpatrick, Scotland	
I.	d.	I.	d.
		4	5.2
8 dif	4.70	8	4.67
dif	4.34	4	4.35
		4	4.07
6	3.50	2	3.84
5	3.20	8	3.48
8 dif	2.88	8	3.30
5	2.67	10	2.85
4	2.58	8	2.66
3	2.45	2	2.59
4 dif	2.27	4	2.43
6 dif	2.21	4	2.26
2	2.13	6	2.16
3	2.08	2	2.11
		4 d	2.07
3	1.97	4 d	2.01
3	1.89	4 d	1.95
5	1.82	2	1.88
2	1.73		
3	1.63	6	1.71
1	1.58		
2	1.54	6 d	1.581
		4	1.534
5	1.47	2	1.502
3	1.44	8	1.462
		4	1.441
4	1.39	4	1.424
		4	1.387
4 dif	1.32	2	1.338
3	1.28	4	1.318
		4	1.308
		4	1.284
		2	1.273

Only Ca is attributable to aragonite, while Sr, Ba, Mg, Fe and Pb are isomorphic admixtures. There is a relatively high heterogeneous admixture of silicates and occasionally of oxides from the surrounding nephelinitic basalt. Of silicates there are present augite and nepheline. The presence of Cu and Ag could indicate a minute admixture of heterogeneous sulfides.

The general type of this occurrence of aragonite reminds of that from Světec, NE. of Bílina, or from the vicinity of Valeč, ENE. of Bochoř in the Doupov Mts. (western Bohemia).

II. MINERALS OF SEDIMENTARY ROCKS

New finds of calcite and chalcedony from the neighbourhood of Beroun
(Beroun county, Prague region).

In the course of a systematic geological-palaeontological survey carried out by a number of workers in recent years in the region of the brachysynclinal closing of the Barrandien basin in the southern part of Beroun county some interesting finds of crystalline calcite in silurian and devonian limestones were made.

Calcite from Srbsko near Beroun

Large crystals of calcite were found in the eastern wall of a calcite quarry belonging to the Czech Cement and Limestone Works, SE. of Srbsko, SE. of Beroun (inventory No. 37,783—37,790; R. Horný, Budňany, 1951, legit). In the quarry marked by J. V a c h t l (40) by number 119, silurian and devonian limestone is quarried. The denuded wall, partly covered with soil and sand is formed by the Koněprusy limestone the fissures of which are filled with crystalline calcite. There are rare cavities, on the walls of which calcite crystallizes in particularly large crystals. From there we have also the largest calcite druses (inventory No. 37,783) of the size 32×26 cm formed by crystals 15 cm of length, which are light-yellow, at places with a brownish hue, frequently with light-grey marbling. The crystal points are usually light-grey-yellow. Morphologically the rhombohedral type prevails, with faces of the basic rhombohedron, R ($10\bar{1}1$), which are dull, even sometimes coarse and parquetté, with abundant accessories formed mostly by fine crystal damask.

An interesting bounding can be found on crystals from the smaller druse from this locality (inventory No. 37,784) which have the same crystal type but show very rich oscillatory grooving caused by the alternation of several scalenohedra. Thus the vicinity of ($10\bar{1}1$) is produced but its faces are preserved in the center of each large face in the form of a small rhombus (cf. the figure on Table XIII). Similar forms of calcite had been described for the first time by J. F. K e m p (18, p. 62) from a deposit of white crystalline calcite in the Pease quarry near Port Henry, N. Y., USA, where calcite occurs which has a similar appearance as that from Srbsko. But no similar calcite crystals were found in the silurian and devonian limestones from the remaining neighbourhood of Srbsko. A. H o e n i g (14) and some other authors mention only stalactites and calcite sinters in silurian limestone cavities, especially in the well-known Barrande cave on the left bank of the Berounka. Morphologically similar vicinal rhombohedra have been described already by F. X. M. Z i p p e (45, p. 65) from the Braník limestone layers near Zlíchov, S. of Prague (inventory No. 13,652; 6,066; 6,067; 6,069). In some cavities of this locality coarsely crystalline calcite was found which yielded cleavage forms mostly transparent or translucent, at places cloudy-yellowish with yellow margins, as large as 7 cm (inventory No. 37,785—37,790). In places the interesting

zonal crystal structure is apparent the nucleus of which is either cloudy-yellowish, less frequently light-grey and opaque (inventory No. 37,786), the margin is rich yellow and the rest is fully transparent. Similar samples of cleavage calcite can be found in the collection of the National Museum which originate from the vicinity of Mořina, ESE. of Srbsko, from the neighbourhood of Braník limestones (inventory No. 27,341).

The spectral analysis of calcite from Srbsko carried out in the chemical laboratory of the Central Institute of Geology in Prague under the technical conditions described above produced the following results:

I. Essential (above 1 %):	Ca
II. Subordinate (above 0.1 %):	Al, Si, Mg
III. Insignificant (above 0.01 %):	K, Na, Fe, Sr, Ti, Mn
IV. Traces (less than 0.01 %):	Ba, Cu, Zr

The basis of calcite is formed by Ca with which Mg, Sr, Ba, Mn and Fe of isomorphic admixtures are associated, the Mg being prevalent. Mechanical admixtures are those of iron oxides, particularly of limonite, and of silicates, most probably flakes of biotite. The trace quantity of Cu could indicate the probability of a minute amount of chalcopyrite being present. Genetically this calcite can be considered as a product of crystallization from relatively cool solutions with a temperature less than 30°C. These solutions passed through the fissures, dissolved the limestone and in the upper parts of the fissures produced calcite crystals.

Calcite from Chlum near Beroun

A similar occurrence of calcite as the one described above was found also N. of Srbsko in a large limestone quarry on the Chlum hill (elevation 347) ESE. of Beroun which is marked by number 117 in the above-mentioned register of J. V a c h t l (40). In the section of Slivenec marbles forming the lower part of Braník limestones there occur fissures filled with coarse-grained light-yellow-grey calcite, forming neat crystals at places. The strata here belong to the Lower Devonian and thus the occurrence is younger than the previous one.

The sample of calcite obtained from this locality (inventory No. 37,792; R. Horný, Budňany, 1951, legit) is formed in the lower part by a coarse-grained, at first ochre-brown, then light-grey calcite on which layers of finergrained grey-brown calcite crystallized; on their surface there are abundant 15 mm crystals of calcite. They are also grey-yellow, at places they are darker and clustered densely. They have mostly a lentil-shaped habit and are of the rhombohedric type with dull, at places markedly finely grooved faces. Some crystal faces are parquetté and have an overlapping surface. Morphologically the predominant form is the scalenohedron with a low vertical which forms usually twins along (0001). Only rarely can we find in the lateral part of the crystals faces of the first-order prism (10 $\bar{1}$ 0) or of more complicated scalenohedra with longer sections on the vertical. A characteristic feature are the re-entrant angles in the lateral part of the twins. Similar forms of calcite had not been

described from the Czech Devonian limestones. C. M o r t o n (30), however, described the same forms from the vicinity of Bamle, SW. of Oslo, on the southern coast of Norway. For the scalenohedron predominating in these forms he derived the complicated symbol $1/7 R 5$ (3257).

The spectral analysis of the Chlum calcite carried out in the laboratory of the Precious Metals Commission in Prague yielded the following results (technical conditions as above):

- | | |
|------------------------------------|------------|
| I. Essential (above 1 %): | Ca, Fe |
| II. Subordinate (above 0.1 %): | Mn, Mg |
| III. Insignificant (above 0.01 %): | Al, Cu, Si |
| IV. Traces (less than 0.01 %): | Ag |

Apparently we are dealing here with calcite with the usual isomorphic admixtures (Mg, Fe, Mn), with heterogeneous limonite forming the pigment of calcite crystals, and with a heterogeneous admixture of aluminosilicates, or even sulfides. Fe occurs most probably in two forms, either as an isomorphic admixture of calcite or as a mechanically admixed mineral pigment.

The origin of calcite is probably the same as in the previous locality.

Calcite from Koněprusy near Beroun

The third new find of crystalline calcite comes from the main quarry on the Zlatý Kůň (elevation 466), S. of Koněprusy, S. of Beroun, opened in the Koněprusy limestones. No crystallized calcite had been described from this locality although it occurred here frequently. Only the older chemical analyses of the Koněprusy limestone and its technical description are known (B. K a t z e r, 17) and an analysis of this limestone by J. F o r m á n e k (9, p. 16). The sample obtained (inventory No. 36,178; K. Tuček 1944 legit) consists of an ochre-yellow compact calcite with fine dendrites of wad on frequent fissures. Passing through it there are frequent veinlets filled with a coarse-grained white calcite in the cavities of which crystals occur. They have a lentil-shaped habit, are of the rhombohedral type and are at most 5 mm in size. They are yellowish to whitish with dull but straight crystal faces on which not infrequently fine dendrites of wad occur. In the crystal bounding the $1/2 R$ (0112) predominates the lateral edges of which are cut off by the faces of prism ∞P (1010) always markedly coarser than the rhombohedron faces. At places also the hypoparallel groups of crystals can be observed. In calcite samples with chalcedony covers (inventory No. 36,179—36,183) some crystals are as much as 3.5 cm long, they are markedly druse-like but morphologically identical. On some of them (e. g. inventory No. 36,183) we can observe a more marked development of prismatic faces so that crystals of the "cannon type" originate. Elsewhere (inventory No. 36,180) a further type of crystals was identified, namely in the form of a double rhombohedron $2R$ (0221) of the size 8×4 cm; it is grey-yellow to brownish on the surface, the faces are druse-like and coarse, strongly corroded.

Of interest is also the zonality clearly visible in some samples (inventory No. 36,186). The dark-brown, 4 cm crystals pass sharply to completely white ones. The dark coloration is caused most probably by limonite with an admixture of finely dispersed organic substances. In many cavities it can be ascertained that the oldest growth zone is formed by light-grey calcite which is rusty in contact with the Koněprusy limestone. Then follows a zone which is colored dark-grey and finally a black-grey one. This marked zonal structure with sharp boundaries indicates a fast alternation of the mother lye with various admixtures in the course of crystal growth. Another sample (inventory No. 36,187) shows markedly variegated calcite forms in a cavity of the Koněprusy limestone. They have the form of light-yellow stalactite buds and of minute curtains. These buds are either crystal individuals or radially fibrous aggregates arranged about the stalactite axis.

The occurrence of the scalenohedric calcite with large crystals (15—17 cm) and with coarse, markedly corroded faces has been described briefly from the quarry Kobyla SE. of Koněprusy by I. Chlupáč and R. Horný (4). The found crystals exemplify the high variety of calcite forms on both localities mentioned. Their genesis is identical with that of both of the above cases.

Chalcedony from Koněprusy near Beroun

The youngest mineral of the calcite paragenesis of the main quarry in Koněprusy is chalcedony (inventory No. 36,179—36,183; K. Tuček 1944 legit). It forms fine blue-grey to snow-white films on calcite crystals in druse cavities of veins passing through the Koněprusy limestone (see Fig. on Table XIV). The microscopic examination reveals that its covers are about 0.05—0.5 mm thick, are dull grey-white with a bluish tinge in reflected light and light-yellow to dark-brown in transmitted light. The paragenetically older bluish chalcedony can be identified here with certainty; it has low interference colors with a negative sign of elongation. On it there is deposited a whitish crust formed by quartzine with a positive sign of elongation. The index of refraction of both minerals is always significantly lower than 1.538. While quartzine is formed by clearly defined fibers about 0.08 mm long chalcedony is less clearly fibrous and has shorter fibers. The youngest calcite crystals are covered with a thin layer of chalcedony only but quite often another layer of quartzine is adjacent. Both these layers have a finely botryoid surface, the quartzine fibers standing perpendicular to the chalcedony layer. Genetically both chalcedony and quartzine are expressive of a definite but rather small amount of silicic acid in the lime solution from which both minerals crystallized as the youngest products. Only rarely can an even younger generation of calcite be found; this is then formed by either a translucent or a transparent botryoid layer or less frequently by minute crystals. The latter are translucent or even transparent and belong to — 2R (0221) (e. g. inventory No. 36,182). In other cases (inventory No. 36,180) chalcedony forms fine ramiform to arboriform images which are quite characteristic of some of its localities.

Calcite from Vinařice near Beroun

New finds of crystalline calcite were reported also from Devonian limestones from the vicinity of Vinařice, S. of Beroun (SE. of Koněprusy). In a limestone hill Zadní Kobyla (elevation 452, N. of the village) there is an extensive quarry in the Lower Devonian strata of Měňany limestones. On dislocation filling fissures of these limestones white, grey-white to yellow-grey calcite crystals were found (inventory No. 35,972—35,973; F. Prantl Praha, 1948 legit). Calcite forms either 1 cm thick coarse-grained crystalline veinlets or abundant, till 15 mm long crystals densely clustered on fissures. The crystal form is usually imperfect. They are markedly rounded and affected by chemical corrosion; they crystallize either without transition directly from the coarsegrained vein filling or they grow on fissures without this crystalline base. Morphologically we are dealing here with predominant faces of scalenohedron $R\ 3\ (21\bar{3}1)$, the lateral edges of which are made obtuse by the faces of a first-order prism $\infty P\ (1010)$. On some forms rarely also the $-2R\ (02\bar{2}1)$ can be found in place of scalenohedric faces. The crystal face quality is not always the same and all the faces have usually various accessories. The scalenohedric faces are frequently finely grooved parallel with the lateral edge of the scalenohedron; the prismatic faces are smooth and dull, sometimes finely undulate.

The points of almost all crystals are dark which is caused by the finely dispersed particles of fresh pyrite enclosed in the crystals. On some crystal cross-sections it can be seen that pyrite particles are arranged zonally in layers parallel with the crystal faces. We are dealing here with a definite growth phase when on the surface of existing crystals particles of pyrite were separated from the solution after which — probably following a short pause — the crystal growth proceeded. Besides, a younger second generation of pyrite crystals developed which sit in groups on calcite crystals. These pyrite crystals apparent on both samples obtained are completely limonitized nowadays. Only at places the original cubic form can be vaguely distinguished. They are formed by rusty limonite which has a characteristic dark-brown color of the nucleus which becomes ochre toward the surface. This is a case of recurrent phase of calcite crystals development which was described even from other localities of Czech calcites, e. g. in Podolí near Prague and elsewhere.

The pseudomorphoses of limonite after pyrite are clearly visible on two other samples from this locality (inventory No. 35,970—35,971; F. Prantl, Prague 1948 legit). The yellow dislocation breccia with abundant fragments of larger white crystals is covered by a white or light-yellow layer of younger calcite 1 cm thick, which is formed by crystals bounded by $R3\ (21\bar{3}1)$ faces with terminal $R\ (10\bar{1}1)$, densely packed together. At places there protrude or grow on them larger, 10 mm long scalenohedra of grey-yellow calcite. On the calcite crust there are uniformly dispersed cubelets 3 mm in diameter of pseudomorphoses of limonite after pyrite. They are dark-brown with a crust of light-yellow ochre on the surface, sometimes clustered in small aggregates. Their form is usually imperfect

and their faces are often markedly distorted, parquetté or broken up in various fashions.

Pyrite, which is paragenetically the youngest mineral and which sits on the crystalline crust of calcite as well as on its crystals is undoubtedly of organogen origin. It came into solution due to decomposition of organic compounds contained in the limestones. In the surface parts, however, it was early metamorphosed. Its limonitization took place with the concurrent liberation of powdery limonite pigment which colors the surrounding limestone. Thus the limonite pseudomorphoses are constantly attacked and their form is not well preserved. From the genetic point of view it can be assumed that the given cases of origin of crystalline calcite with chalcedony and pyrite in limestone silurian and devonian strata exemplify an epigenesis supported to a great extent by the limestone material itself, as shown unequivocally by the presence of chalcedony (SiO_2 content) and of pyrite (organic compounds). From the solutions passing through the fissures of limestone at temperatures not exceeding 30°C calcite crystallized first (possibly in several generations), followed by chalcedony with quartzine and finally by pyrite. The limestone fissures can be taken most probably for exokinetic, originating in the course of folding.

Minerals from the carboniferous Pilsen basin

Pyrrhotite from Nýřany (Stod county, Pilsen region)

Pyrrhotite is a relatively rare mineral of the carboniferous sediments; our sample was obtained from the Krimich mine (Pankrác shaft), NE. of Nýřany, WSW of Pilsen (inventory No. 36,827; F. Slavík, Prague 1950 donavit). We have to do here with an older find from the collection of the former German Technical University at Prague. In fissures and cavities of grey upper carboniferous conglomerate from the lower grey strata characterized by strikingly minute, at most 1 cm large pebbles of grey quartz, there occur clusters of tombac-brown flaky and plate-form pyrrhotite crystals. They reach at most 2—3 mm in length and 0.05—0.06 mm in thickness. Their (0001) face is straight only in the smaller platelets, otherwise it is sharply distorted and crumpled. Flakes and platelets have often well-marked lateral demarcation formed by faces of a first-order hexagonal prism ∞P (10 $\bar{1}0$) in the form of very narrow areas. Due to the unevenness of the base the common rosette-form aggregates of crystals have not been formed here. The flakes grow on the fissures and even in the cavities of conglomerate. They are strongly attracted by magnet showing thus quite unequivocally that the mineral in question is pyrrhotite. The spectral analysis carried out by the laboratory of the Precious Metals Commission in Prague under the same technical conditions as above produced the following results:

- | | |
|------------------------------------|--------|
| I. Essential (above 1 %): | Fe |
| II. Subordinate (above 0.1 %): | Ca, Si |
| III. Insignificant (above 0.01 %): | Al, Pb |
| IV. Traces (less than 0.01 %): | Mg, Mn |

It can be deduced from these results that the sample is pyrrhotite without admixture of pentlandite, with a heterogeneous fraction of mechanically admixed aluminosilicates, most probably kaolin, with traces of carbonates and with a small amount of galena. Of carbonates probably most abundant is ankerite which was actually identified during the investigation. The finds of pyrrhotite in sedimentary rocks are relatively rare. However, from the Central Bohemian Kladno coal basin there are several mentions of it. J. Kratochvíl (27) mentions a pyrrhotite sample from the collection of A. Ječmen in Kladno and of its occurrence in the underlying basal Algonkian shales of the former Theodor mine SSE. of Pchery, N. of Kladno (l. c. p. 26). He claims that in both cases the occurrence is very infrequent. Pyrrhotite occurs here as the paragenetically youngest mineral on a layer of crystalline ankerite in groups as large as 2.5 cm, formed by tombac-colored crystals. The sample from the collection of the mineralogical section of the National Museum (inventory No. 8,079) shows perfectly bounded crystals of pyrrhotite with ankerite and calcite on an Algonkian grey shale. In a further paper J. Kratochvíl (26, p. 5) mentions another find of pyrrhotite from the Kl. Gottwald mine (formerly Ronna) near Hnidousy, N. of Kladno, in the form of dark brown-red crystals on sandstone. J. Kašpar (15, p. 12-16) mentions pyrrhotite among the minerals of carboniferous sediments as well as of pelosiderites in a number of Kladno mines, always as a rare mineral. A. Betěchtin (2, p. 241) mentions only very rare finds of pyrrhotite with siderite in sediments from the vicinity of Kerč, from a well-known deposit of iron ores. The reason for this general rareness of pyrrhotite occurrence in sediments can be found in the conditions of its origin which do not require a higher concentration of sulphur in hot solutions.

The mineral paragenesis in the Krimich mine is strikingly similar to that of minerals from fissures of carboniferous sediments and from pelosiderites of the Kladno coal basin. The rare occurrence of pyrrhotite can be explained in connection with the occurrence of pyrite and millerite with crystalline ankerite which were described in fissures of Nýřany carboniferous sandstones already by O. Feistmantel (8). Even in this connection the considerable resemblance of mineragenetic conditions of the Kladno and the Pilsen basins can be seen.

Minerals of pelosiderites from Zbuch (Stod county, Pilsen region)

A number of further mineral finds were obtained from the cavities and fissures of carboniferous pelosiderites from the Mine of Defenders of Peace (formerly the Anniversary Masaryk Mine) E. of Zbuch, SW. of Pilsen. The loaf-shaped pelosiderites occur here in the lower grey strata (the Middle Westfalien) between the lower and the upper Radnice bed in the 2 m intercalation of hard coal slate, found by L. Čepěk (7, p. 14), called "grindstone" by the miners.

Pelosiderite forms extensive as well as smaller loaf-shaped to spherical concretions which are always covered by a black or black-grey crust of

coal slate on the surface. They reach the size of a man's head and they are usually split inside the nucleus so that they represent true septariae quite analogous with those from the Kladno carboniferous. They were formed also by the same process, namely by sedimentation and clustering of colloidal ferrous carbonate in the carboniferous peats. Due to desiccation and contraction numerous cavities were formed inside, forming the septariae of nowadays. They were first described in detail by A. E. Reuss (34) who found flat yellow-brown or dark-brown lentils and thin layers. Powdery kaolin (inventory No. 36,347, F. Ulrich, Prague, 1935 legit) from the Zbuch septariae is mentioned in the report of E. Bořický, quoted by V. Zepharovich (46, p. 164).

Of the minerals of pelosiderite septariae from Zbuch two can be cited as not yet described: siderite and barite. Crystalline siderite from the Pilsen black-coal basin was known so far only from the St. Catherine mine near Břasy SW. of Radnice whence A. E. Reuss (34, p. 131) described its small crusts of bronze-yellow rhombohedra with kaolin covering the plant fossil prints in pelosiderites. In the Kladno black-coal basin crystalline siderite occurs rather frequently in minute brown crystals about 1 mm in size in the form of covers in the septariae, as described by J. Kašpar (15, p. 46). More frequent occurrence of larger isolated crystals are known from the region around Rakovnik. — In cavities and fissures of red-brown pelosiderites from Zbuch there occurs siderite (inventory No. 36,330—36,343; F. Ulrich, Prague 1935 legit) quite frequently, both grained and in lentil-shaped crystals. On the pelosiderite there grows first a layer of black-grey to black-brown columnar siderite crystals forming at places also spherulitic aggregates (sphaerosiderite). On this layer follows a grained layer of individuals of brown color which protrude into possible cavities by their well formed crystal faces. This layer often passes over into amber to orange siderite. The same coloration is frequently visible even in siderite crystals from the cavities which are then clearly zonal: inside they are orange-yellow, on the surface yellowish-brown. Only infrequently is the sequence reversed. Microscopically a considerable amount of powder hematic can be detected in the pelosiderite which indicates most likely a partial metamorphosis of its siderite component. The hematite pigment from the pelosiderite penetrates into fissures of crystalline siderite in the septaria. After a sharp boundary which designates a definite pause in crystallization there follows the youngest generation of siderite which is somewhat milky in the lower part. The cloudiness is dull white-grey in reflected light and speaks most probably for the presence of kaolinic admixtures. Some hematite pigment occurs along with it while the upper part of crystalline siderite is already transparent. Individual siderite crystals have the form of a simple lentil-shaped — $\frac{1}{2}$ R (011 $\bar{2}$) with faces always finely striated along the shorter diagonal. There occur frequent crystals with strongly rounded forms and with an overlapping surface of the average size of 5 mm. Their faces are bright but sometimes lightly strewn with kaoline (inventory No. 36,340). The crystalline siderite from the septariae originated undoubtedly from ferric solutions reacting with CO₂ escaping in the course of carbonification.

An interesting variety of siderite from the Mine of Defenders of Peace

in Zbuch is the sideritic oolite (inventory No. 36, 349—36, 350; F. Ulrich, Prague 1935 legit); it is a spherulitic siderite deposited in clay material. About its finds near Kladno mentions can be found with J. K a š p a r (15, p. 12). The sample obtained indicates an 8 cm thick layer of grey-green kaolinic rock thickly penetrated by minute particles of a grey to light-ochre siderite. Towards the margins the layer of siderite diminishes and finally only the clay mineral is visible. A microscopic investigation reveals that the majority of oolite is formed by spherulites about 0,80 mm in diameter or by individual grains about 0,5 mm in diameter. The grains are usually rounded; at places, however, they have the form of fragments and exhibit a good rhombohedric form. We are dealing here probably with a new sedimentation of disrupted siderite. The siderite grains are transparent, only at places are their contours fringed with a brown hematite powder. In the central part of the layer the clay material forms usually but a minute filling between the grains and the spherulites of siderite.

The paragenetically youngest mineral in the pelosiderite septariae is barite (inventory No. 36,344—36,346; F. Ulrich, Prague 1935 legit) the crystal aggregates of which together with grey-white crystals sit on brown lentil-shaped crystals of siderites. They are about 6 mm in diameter, they have a platelike habit and in their form the (001) and (102) faces predominate. The form in the region of a axis could not be determined as the crystals grow on the cavity wall. They are usually hypoparallely grouped (inventory No. 36,345) and they fill often completely the septaria cavity. They belong to the second type of crystals of barite which was described by J. K a š p a r (15, p. 55. Fig. 27) from the Kladno carboniferous pelosiderites.

Another mineral paragenesis of interest in the pelosiderites was discovered in the Wenceslas mine near Kamenný Újezd NW. of Nýřany, WSW. of Pilsen. The sample obtained (inventory No. 37,175; F. Slavík, Prague 1935 donavit) forms a part of a compact grey-brown pelosiderite septaria. Sphalerite was the first to crystallize on its fissures, in the form of black, at most 2.5 mm long crystals of the dodecahedral type. It is only thinly dispersed, is brown in passing light at the margins and its powder is light-amber to yellow-brown. The predominant form is $\infty 0$ (110), the faces of which are dull, sometimes weakly vitreous smooth with numerous accessories.

After the crystallization of sphalerite there was formed a coherent crust of siderite, formed by minute lentil-shaped crystals at most 3.0 mm in diameter. Their color is light-brown, at places reddish. Their principal crystal form is $-\frac{1}{2} R$ (0112) again with faces markedly finely grooved along the shorter diagonal. The grooving passes over sometimes into a marked druse quality. Less frequent than sphalerite is another sulfide, chalcopyrite, forming 1.75 mm long highly druse-like and multicolored crystals of the tetrahedral type. Even rarer is marcasite in completely minute, 0.1—0.2 mm long platelets with predominant (001), (110) and (010) faces, with a striking metallic luster and a light-yellow color. Marcasite crystals form either minute independent clusters on siderite or they sit on crystals of sphalerite or chalcopyrite. The youngest mineral paragenetically is here again the finely-powdered

snow-white or light-yellowish nacrite in the form of minute flakes about 0.02 mm in diameter which covers all the above-mentioned minerals.

It follows from the above facts that the mineral succession is the following: sphalerite—siderite—chalcopyrite—marcasite—nacrite (dickite?). The general appearance and occurrence of pelosiderites from Kamený Újezd resembles greatly the finds from Zbuch and some of those from the Kladno black-coal basin. Also their origin was of the same type.

Calcite from Hospozín near Velvary (Kralupy county, Prague region)

In the course of a survey of cretaceous strata in the more distant vicinity of Velvary a sample of crystalline calcite (inventory No. 35,859; Č. Zahálka Prague legit) was collected from their permo-carboniferous underlying stratum in the valley of the Vraný creek, S. of Hospozín, NW. of Velvary, NW. of Kralupy on Vltava. The calcite fills a fissure of a grey arkose of lower grey strata (Middle Westfalien) and is light yellow-green. On crystal faces it is dull, on cleavage planes a vitreous luster can be observed. It crystallized in the form of coarse hypoparallely grouped $-\frac{1}{2} R$ (0112). These forms fill completely the space of the fissure and they exhibit a marked zonal structure: the crystal nucleus is translucent and grey-white, the margin is yellow-green. The crystal faces have numerous accessories and are at places druse-like, passing over into an overlapping appearance. The spectral analysis carried out in the chemical laboratory of the Central Institute of Geology in Prague under the same technical conditions as above yielded the following results:

- I. Essential (above 1 %): Ca
- II. Subordinate (above 0.1 %): Al, Si, Fe, Mg, Mn
- III. Insignificant (above 0.01 %): K, Ti
- IV. Traces (less than 0.01 %): Na, Sr, Cu, Zr, V

It follows from the results that the sample in question is calcite moderately colored with an iron oxide with the usual isomorphic admixtures (Mg, Mn, Sr, Fe) and with heterogeneous aluminosilicates which were admixed to calcite in the course of its crystallization from the surrounding arkose as a mechanical component, or partly even in the course of separation of calcite from the rock. Cu indicates a trace amount of sulphide.

The origin of calcite is apparently epigenetic and took place at temperatures not exceeding 30 °C, i. e. from relatively cool solutions circulating in the overlying cretaceous layers which contain abundant limestone.

Gypsum from Neratovice (Mělník county, Prague region)

The new find of gypsum from the vicinity of Neratovice, NW. of Brandýs on Elbe belongs to the rather numerous ones of crystalline and concretion gypsum from cretaceous sediments in Bohemia, particularly from the neighbourhood of Louny and Česká Lípa. In the lower Turonian clays which form here extensive zones on the basal cenomanic sandstones

Table 4.

Gypsum, Neratovice		Gipse, p. 138	
I.	d.	I.	d.
		5	7.537
10 d	4.30	10	4.220
2 d	3.8	2	3.816
8	3.09	8	3.030
8	2.88	5	2.833
7	2.70	5	2.615
4	2.50	2	2.449
3	2.23	2	2.190
8	2.08	8	2.048
5	1.90	5	1.863
6	1.80	5	1.773
3	1.67		
4	1.62	2	1.611
1	1.58		
3	1.53	1	1.504
2	1.45	2	1.418
3	1.37	1	1.350
4	1.33	2	1.313
2	1.29		
4	1.24		
3	1.20		

relatively abundant fine crystals of light-yellow gypsum were found (inventory No. 37,923; R. Horný, Budňany 1951 legit). They reach the average size of $10 \times 5 \times 1.5$ mm, have a flatly columnar to lentil-shaped habit and are of the prismatic type. They are mostly only translucent, more rarely transparent. In their form the (110) and (111) faces predominate, subordinately are represented only small faces (111), which, however, very frequently lack altogether. The crystals are usually twins along the frontal pinacoid (100) with marked almost always clearly visible reflex edges. The crystal faces are only rarely bright being usually coarse with abundant fine accessories and remnants of clay. Their prismatic faces are sometimes vertically grooved. Crystals of similar type with both pyramids were described by S. Z a r e c z n y (43) from the Galician flysh in the vicinity of Podgórz near Kraków in Poland. From the cretaceous strata of Neratovice only the dark-brown, mostly spherical concretions of phosphorite had been known, as described by J. W o l d ř i c h (42, p. 18—19). They are found in the middle to lower part of Korycany strata developed as limy sandstones of the local cliff facies. Gypsum occurs, however, in younger strata located above those mentioned previously. The spectral analysis of gypsum from the vicinity of Neratovice was carried out by the laboratory of the Precious Metals Commission in Prague under the above-described technical conditions and the following results were obtained:

- I. Essential (above 1 %): Ca
- II. Subordinate (above 0.1 %): Sr, Mg, Al, Si, Fe
- III. Insignificant (above 0.01 %): Ba, Mn
- IV. Traces (less than 0.01 %): Na, Cu, Ag, Pb

The results obtained indicate that the sample in question is gypsum with a mechanical admixture of clay minerals from the surrounding clays and sandstones and with trace quantities of probably adsorbed sulphides (Cu, Ag, Pb). The X-ray study (see Table XV, Fig. 2) yielded data which were compared with values for gypsum given in the tables of C. Torre and J. Garrido (39, p. 138, No. 138). It follows from Table 4 that both sets of values are in good agreement.

Similarly as in other analogues localities also here in the vicinity of Neratovice gypsum originated by the action of H_2SO_4 liberated in the course of decomposition of pyrite to the surrounding lime rocks. In the flexible medium of cretaceous clay crystals had enough space for development and therefore they are more often well developed and bounded.

New finds of calcite in the Bohemian Cretaceous

The occurrence of calcite in thinly columnar honey-yellow aggregates from the vicinity of Břevnov near Prague (Ladronka and the like) and from slate fissures in the more distant vicinity of Teplice and from elsewhere can be grouped with those infrequent finds of minerals in sedimentary rocks of the Bohemian upper cretaceous. Recently they were secured from two new localities.

Calcite from Žehuň near Poděbrady (Poděbrady county, Prague region)

During the construction work on new locks for the large fish-pond near Žehuň, E. of Poděbrady, abundant samples of finely-crystalline calcite were found in the fine-grained grey sand marl from the lower section of middle Turonian (zones V—VII according to the classification of Č. Zahálka) (inventory No. 38,730; V. Zázvorka, Prague 1951 legit).

A 2 cm wide fissure of light-grey marl is coherently covered on both walls by grey-white dull and translucent calcite crystals. The latter are strikingly druse-like, are as long as 3—5 cm and have a markedly flatly rhombohedral habit. They are bounded by the predominant $-\frac{1}{2}R$ (0112) faces the edges of which are usually made obtuse by narrow prismatic faces (1010). They are always uneven, with numerous accessories and they pass over to the overlapping style. The rhombohedral faces are at places again finely grooved parallel with the shorter diagonal. All crystals are densely grouped and stand perpendicular to the base with a face lying in three lateral axes.

The spectral analysis was carried out under the above-mentioned technical conditions by the chemical laboratory of the Central Institute of Geology in Prague and it yielded the following results:

- | | |
|------------------------------------|--------------------------|
| I. Essential (above 1 %): | Ca, Mg, Si |
| II. Subordinate (above 0.1 %): | Al, Fe |
| III. Insignificant (above 0.01 %): | K |
| IV. Traces (less than 0.01 %): | Sr, Mn, Na, Ti, Zr, B, V |

It follows from the values obtained that the sample in question may be calcite with a considerable amount of isomorphic Mg and lesser fractions of Fe, Sr, and Mn. The clay minerals form heterogeneous admixtures with probable traces of ilmenite (Ti). The mechanical admixture originates from decomposed minerals contained in the surrounding sand marl.

Calcite from Blata near Jičín (Jičín county, Hradec region)

The second new find of calcite comes from a quarry in Blata, NW. of Jičín (inventory No. 38,423; F. Šalda, Jičín 1952 legit) opened in the upper Turonian kaolinic sandstone. The light-yellow to reddish, crumbling kaolinic sandstone is penetrated with a number of fissures of mostly vertical direction. On their walls there occur as much as 4 cm thick fillings formed by a light-yellow, irregularly thinly columnar calcite, the individual crystals of which stand perpendicular to the fissure wall. Into the cavity there protrude 7 mm long three faces of the rhombohedron heavily corroded and colored rusty due to powdery hematite. We are dealing here mostly with rhombohedral faces — 2R (0221) formed by fine sharp-pointed forms of tall rhombohedra on which minute whitish grains can be found with irregular form belonging apparently to newly-formed calcite. Probably a corrosion and dissolution of calcite crystals took place here followed by a new crystallization of calcite from the solution during which most of it was probably transported to other parts of the fissure. At places a certain zonality can be observed, especially where the thin columns of calcite are richer yellow toward their tips.

The base of crystalline calcite is formed by a 2 cm thick layer of sandstone heavily penetrated with a light-rusty limonite. Hence it can be assumed that the solutions brought into the fissures limonite from the decomposition of ferric components of the rock and from hematite hydration which was only followed by a temporary more powerful import of a solution containing CaCO_3 . Towards the end of crystallization of calcite the solutions brought only hematite and caused thus due to a change in their composition a corrosion of the formed calcite. Thus the youngest generation of calcite in the form of fine grains is formed. The spectral analysis of calcite from Blata carried out under the conditions mentioned above in the laboratory of the Central Institute of Geology in Prague yielded the following results:

- | | |
|------------------------------------|-----------------------|
| I. Essential (above 1 %): | Ca, Mg |
| II. Subordinate (above 0.1 %): | Al, Si |
| III. Insignificant (above 0.01 %): | Sr, K, Na, Fe, Ti, Mn |
| IV. Traces (less than 0.01 %): | Ni, Cu, Zr |

The analytical results confirm the identification as calcite with a predominant isomorphic admixture of Mg. Clay minerals with a small amount of ilmenite (Ti) and with probably trace amounts of sulphides (Cu) form mechanical admixtures. The mechanical admixtures were absorbed probably in the course of spontaneous crystallization of calcite. A part of the Fe found belongs undoubtedly to the limonitic or possibly hematitic pigment in calcite.

The genesis of both finds of calcite is of inorganic type. The minerals originated epigenetically from solutions in the range of 30—36 °C above which aragonite is formed. The Calcium-minerals pass quite easily into a bicarbonate solution which can be carried away very far from the point of its origin. In rock fissures there takes place a precipitation of calcite under ordinary or slightly elevated temperature. As far as the occurrence of calcite at Blata is concerned we must take into account the possibility of its origin from solutions associated with the eruption of basalts in the neighbourhood. Then a lower hydrothermal phase would have to be considered, particularly in its terminal part.

III. MINERALS OF METAMORPHIC ROCKS

Gypsum from Týnec on Labe near Kolín (Kolín county, Prague region)

An island of the crystalline near Týnec on Labe, E. of Kolín is denuded by a quarry on the right bank of the Elbe, E. of town. Crystalline gypsum was found in Algonkian phyllites with considerable impregnation with pyrite and with inclosures of amphibolic schists (inventory No. 36, 554; F. Souček, Prague 1949, legit). The overlying occurrence of gabbro was described there by M. Waitová-Adamová (41) who mentions also the occurrence of a quartz vein in the mentioned quarry called „Pod kolem“ which was discovered in the course of regulating the Elbe. The quartz contains ingrown rutile, bulky chalcopyrite with malachite and calcite, on the fissures then even flakes of sericite. The crystalline island is covered with pleistocene wind-blown sands, partly then with gravels of the middle and lower terraces.

The sample obtained formed a part of a vein of rusty quartz with remnants of phyllite of a grey-green color and with abundant pyrite. In the quartz fissure there crystallized first calcite forming 5—9 mm lentil-shaped crystals bounded by druse-like faces — $\frac{1}{2}R$ (0112) which are covered with a fine layer of dark-brown limonite. Calcite crystals are whitish or grey, at places they iridesce variedly and they show traces of corrosion. Gypsum crystals occur there as individuals about 22×8 mm large, also covered with rusty limonite which are transparent inside. In their form the following forms predominate: (111), (110) and (010). The (111) and (010) faces are usually in equilibrium, the prismatic faces are markedly grooved. The crystals have a markedly columnar habit, occur often in twins along (100) and have markedly distorted faces.

The spectral analysis of this gypsum was carried out under the conditions described above by the laboratory of the Central Institute of Geology in Prague and yielded the following results:

- | | |
|------------------------------------|---------------------------|
| I. Essential (above 1 %): | Ca |
| II. Subordinate (above 0.1 %): | Al |
| III. Insignificant (above 0.01 %): | Si, K, Fe, Mg, Mn, Ti, Sr |
| IV. Traces (less than 0.01 %): | Na, Zr, Cu |

It follows from the results that beside gypsum there are abundant heterogeneous admixtures present in the crystalline gypsum. Beside the identified limonite, calcite and quartz there occur also clay minerals and traces of sulphides (Cu). On some samples from this locality there predominates calcite over gypsum (inventory No. 36,555). Also 0.5 mm yellowish crystals of quartz can be found sitting on gypsum crystals and at places growing through the latter. Thus the following sequence of precipitation of minerals from the solution can be postulated: calcite—quartz—gypsum. The abundance of limonite which colors rocks and minerals a rusty color indicates a relatively intense decomposition of pyrite in phyllites, probably under the increasing influence of thermal solutions.

Garnet from Osečany near Sedlčany (Sedlčany county, Prague region)

Near a wood NE. of Osečany, N. of Sedlčany there were frequently found samples of gneiss with ingrown garnets (inventory No. 35,835—35,837; V. Kučera, Kamýk 1948 legit). Also from the neighbouring fields there were reports of freely lying worn garnets, particularly on the place called „Na pískách“. All the obtained specimens originate from a complex of metamorphic Algonkian rocks which forms an isolated island E. of Osečany, between Sestrouň, Hodětice, Strážovice and Velběhy and forms a part of an extensive area built from Algonkian and Palaeozoic rocks creating a contactly-metamorphic cover of the Central Bohemian plutonic region. The mother rock of the found garnets are hornblende gneisses of Algonkian age which are dark-grey, becoming greenish or yellowish with the onset of decomposition. They are very fine-grained with clearly visible 1—3 mm flakes of markedly crushed and corroded biotite. Microscopically this gneiss is formed by predominant oligoclase with larger grains of quartz, at places developed hypidiomorphically with abundant inserted magnetite. A significant component is the markedly corroded biotite in large leaves.

Garnet crystals are very abundant in the gneiss reaching an average size of 1.0—1.5 cm and are bounded by straight, sometimes weakly vitreous faces. In their form the (110) faces predominate as usually, the edges of which are made obtuse by (211) faces; often both forms are in equilibrium. The monstrous development of garnet forms has not been observed here. The garnet is dark to black, with red-brown inside.

In order to identify more exactly the character of the samples spectral analysis and X-ray investigation were carried out. The spectral analysis was made under the above conditions by the chemical laboratory of the Central Institute of Geology and yielded the following results:

- | | |
|------------------------------------|----------------------------------------------|
| I. Essential (above 1 %): | Si, Al, Mg, Fe, Ca, Mn |
| II. Subordinate (above 0.1 %): | Ti |
| III. Insignificant (above 0.01 %): | K, Na, V |
| IV. Traces (less than 0.01 %): | Sr, Zn, Ag, B, Zr, Co, Yb, Y, Li, Ga, Cu, Sc |

Table 5.

Garnet, Osečany		Pyrope-almandite	
I.	d.	I.	d.
1	3.14		
4	2.81	0.6	2.88
9	2.54	1.0	2.58
2	2.42	0.3	2.46
3	2.30	0.3	2.35
2	2.22	0.3	2.26
3	2.07	0.2	2.10
1	2.01	0.½	2.03
5	1.85	0.4	1.870
1	1.80	0.1	1.822
1	1.74		
1	1.68		
3	1.65	0.3	1.663
1	1.61		
7	1.58	0.6	1.598
9	1.522	1.0	1.540
1	1.453		
3	1.431	.3	1.441
		.½	1.419
5	1.281	.4	1.288
7	1.251	.6	1.258
2	1.238	.½	1.243
5	1.224	.4	1.229
2	1.210	.1	1.215
3	1.158	.3	1.164
3	1.126	.1	1.130
9	1.068	.7	1.070
9	1.049	.6	1.052
9	1.016	.2	0.9604

The roentgenometric study (see the X-ray powder pattern on Table XVI, Fig. 3) produced values which were compared with those for pyrope-almandite given in the tables of J. D. H a n a w a l t (11). Agreeing results of both measurements are apparent from Table 5. If we summarize now the results of both of these types of investigation and of macroscopic features of garnet we can judge on a garnet composed of four components with the almandite (Fe, Al) and pyrope (Mg, Al) components predominating. With these the melanite component is associated (Ca, Fe) with a fraction of Ti and some spessartite (Mn, Al). The spectral analysis results indicate the presence of a heterogeneous admixture of biotite and of other silicates from the surrounding gneiss together with trace amounts of other admixtures. — In general the Osečany garnet agrees in its properties and values quite well with the garnet forming the transition from pyrope to almandite as described by C. H. S t o c k w e l l (37, p. 339, garnet No. 4) from Ötztal in Tirol. Genetically the Osečany garnet is in the closest relation to the contact metamorphosis of the original rock, probably of a clay schist as indicated also by its occurrence together with

biotite. Both minerals originated by a contact metamorphosis of magnesium and aluminomagnesium silicates. The hornblende character of the mother rock points to a relatively intense metamorphosis in close contact of a granite massif.

Siderite from Lukavice near Skuteč (Chrudim county, Pardubice region)

A new find of fine-grained siderite originates from an old pyrite deposit near Lukavice, NW. of Skuteč (SE. of Pardubice) (inventory No. 38,651; L. Žák, Prague 1952 legit). Its light-yellow or light-green-yellow grains form relatively abundant clusters or remain scattered in the compact dark blue-grey, at places dark red-brown striped rock. 1 cm thick veinlets filled with medium-grained grey-white to yellowish quartz occur also quite rarely. The specimen obtained comes from a waste-dump of the Main Bartholomew Gallery of these old mines opened in the center of the village. The main rock of this deposit is a markedly metamorphic felsitic porphyry on the fissures of which there occurred abundant pyrophyllite. The porphyry is heavily impregnated with fine-grained pyrite. The occurrence of carbonates in this area was mentioned already several times. The first to mention it was J. Zeman (44, p. 48), the latest L. Žák (47) who described an interesting paragenesis of manganese carbonates from a near manganese deposit near Chvaletice, WNW. from here. Carbonates from this deposit are according to F. Slavík (36) of sedimentary origin.

The obtained specimen is probably a part of a hematite vein running through felsitic porphyry. At a higher magnification the fine-grained mixture of hematite with abundant red-brown stripes and scattered grains of siderite can be seen. In minute (5—10 mm) cavities apparent in some siderite clusters its imperfectly developed lentil-shaped crystals with a limonitic cover occur. Their form is given by the (0112) faces. It can be ascertained microscopically that the siderite grain clusters are a dense aggregate of allotriomorphic individuals at most 1.0 mm large. In the spaces there can be found dispersed hematite accompanied by limonite and only rarely can grains and fragments of quartz be found. In the center of siderite clusters grains of greater magnitude can be found than along the margins, from which it follows that siderite formed larger individuals wherever there was enough space.

In the cavities even siderite crystals could be formed.

The spectral analysis carried out under the same conditions as above by the laboratory of the Precious Metals Commission in Prague yielded the following results:

I. Essential (above 1 %):	Fe, Ca, Mg
II. Subordinate (above 0.1 %):	Al, Mn, Si
III. Insignificant (above 0.01 %):	B
IV. Traces (less than 0.01 %):	Zn

The results correspond with the composition of siderite where a part of the Fe belongs undoubtedly to iron oxides with which siderite is closely

associated here. Ca, Mn and Mg are the common isomorphic admixtures of siderite. The remaining elements point to a mechanical admixture of probably clay minerals.

From the genetic point of view it would be possible to assume a concurrent origin of siderite and hematite. In the mother solution there predominated very likely Fe^{III} over Fe^{II}. Hematite and siderite are precipitated in approximately the same temperature range, on the transition from the middle to the higher hydrothermal phase, i. e. about 300—400 °C. S. F. Andrian (1, p. 205) claims that in this range there appear in the felsitic porphyry traces of pyrite and hematite rather frequently. According to the observations made a conclusion can be drawn that we are dealing with a thin ore vein in felsitic porphyry the main filling of which is compact hematite passing partly into a clay variety and limonite. In the last stage of development of the vein also siderite started to precipitate along with hematite which finally filled up the formed cavities in which even now crystals of siderite occur.

Stalactitic calcite from Železný Brod (Semily county, Liberec region)

In Brodce SSE. of Železný Brod a lenticular intercalation of white crystalline limestone has been uncovered in a quarry which according to O. Kodým and J. Svoboda (23) forms a part of an incoherent system of layers of silurian limestones of the upper part of phyllitic series of the Subsudetian nappe and appears in the upper stratum of black graphitic schists. It outcrops under diabase tuffs and tuffites which form the greater part of the vicinity of Železný Brod. The limestone lentil can be followed according to R. Kettner (20) from Koberovy over Brodce all the way to Horská Kamenice, E. of Železný Brod. The limestone worked in the mentioned quarry is thinly stratiform to plate-like, of white color but containing grey or yellowish parts and at places also inclosures of graphitic schists. In the early thirties a comparatively large cavity was discovered here in which grey-white to light-yellow stalactites were found; according to local reports some of them were leg-thick. Similar cavities are not particularly rare in the local limestone because during an excursion in June 1944 I discovered a number of vertical fissures which were gradually extended by water penetrating from above. Some of the fissures were as wide as 20 cm and considerably deep so that it can be assumed that they formed only relics of larger cavities destroyed by mining. In the quarry dump I found a number of specimens of stratiform stalactitic limestone and of interesting sinters. That is where the calcite stalactite series comes from (inventory No. 36,188—36,192; J. Metelák, Železný Brod 1944. donavit).

We are dealing here with layers of limestone sinter of varying thickness (3—8 cm) with the well-known characteristically undulate and ochre-yellow surface. Two specimens (inventory No. 36,188; 36,189) show very clearly the tendency to form white or grey-white stalactites as the sinter surface becomes suddenly very uneven and passes to bud-like forms.

All such cases indicate the presence of the secondary origin of limestone on the walls or bottoms of cavities. One of the samples of stalactitic calcite (inventory No. 36,189) contains crushed material from the bottom of such a cavity composed of minute, about 4 cm in size, sharp-edged fragments of white and grey granular limestone or phyllite connected with an ochre-yellow clay cement. On this crushed material limestone precipitated from flowing solutions and formed variegated images along with stalactite buds. The latter differ very distinctly from the surrounding grey-yellow sinter by their whitish or grey-white color. The texture of limestone sinters is mostly coarsely thinly columnar with individuals standing perpendicular to the base. When the sinter base is undulate then thinly-columnar-radial texture is formed. The color of individual thin columns which may be 7 cm long in the sinters is white or grey-white; at places there are apparent coherent light-yellowish stripes, sometimes very dense (inventory No. 35,191), so that the sinter then acquires an aragonitic style. These stripes point to alternating changes in the solution composition to which at times limonitic ochre was admixed. The average size of calcite individuals in the sinters is about 4.0—0.4 cm. The spectral analysis of a stalactite from Brodce near Železný Brod carried out in the laboratory of the Central Institute of Geology in Prague and in the laboratory of the Precious Metals Commission in Prague under the above-mentioned conditions produced the following results:

	CIG	PMC
I. Essential (above 1 %):	Ca	Ca
II. Subordinate (above 0.1 %):	Al, Si, Mg	Mg
III. Insignificant (above 0.01 %):	Fe, Sr	Ba, Sr, Al, Si
IV. Traces (less than 0.01 %):	Na, Cu, Ba, K, In, Sn, Ti, Zr, Mn	Cu

In addition to calcite with isomorphic admixtures (Fe, Sr, Mg, Ba, Mn) the heterogeneous admixtures can be assumed to contain aluminosilicates or possibly oxides (Sn, Zr) from surrounding rocks which may have been included in the form of fine enclosures in calcite in the course of its crystallization, particularly those from graphitic schists or from diabases.

Albite from Černý Důl near Vrchlabí (Vrchlabí county, Hradec region)

In fissures of light grey-green orthogneiss on the W. slope of Černá hora (elevation 1299) in eastern Giant Mts. veinlets filled with granular albite can be found. The specimen obtained (inventory No. 37,379; K. Kozák, Radošovice 1949 legit) was found in the valley of the Stříbrný Potok (Silver Creek), N. of Černý Důl, E. of Vrchlabí, not far from the former Berghaus in the vicinity of abundant remnants after former iron ore works.

Albite veinlets are as thick as 2 cm and are composed of medium-grained albite of light pink color. It can be found microscopically that it is relatively fresh and that its grains contain abundant twin lamellae according to the albite law. On section along M (010) extinction was determined as: $\alpha = +15^\circ$, which speaks for albite with a very insignificant

amount of anorthite. The index of refraction is always markedly lower than that of Canada balsam.

The spectral analysis was carried out under the above-mentioned technical conditions in the laboratory of the Precious Metals Commission in Prague and yielded the following results:

- | | |
|------------------------------------|---------------------------|
| I. Essential (above 1 %): | Na, K, Ca, Sr, Ba, Al, Si |
| II. Subordinate (above 0.1 %): | Fe, Ti, Mn, Mg |
| III. Insignificant (above 0.01 %): | Pb, Cu |
| IV. Traces (less than 0.01 %): | Ag |

It can be concluded from the analytical data that the specimen is albite (Na, Al, Si) with isomorphic admixtures (K, Ca, Sr, Ba) and with a heterogeneous mixture of silicates from the surrounding gneiss, particularly of chlorite and biotite with a minute amount of sulphides (Pb, Cu, Ag).

The origin of albite veinlets in the Giant Mts. orthogneiss is undoubtedly closely connected with the eruption of the Giant Mts.—Jizera granite massif.

Minerals from the skarn rock near Hutě, NE. of Bechyně (Týn on Vltava county, České Budějovice region)

The extensive system of layers of biotitic or biotite-sillimanitic orthogneisses between Tábor and Bechyně in southern Bohemia traversed by the Lužnice river contains a number of lesser intercalations of crystalline limestones and of metamorphic basic rocks. To the latter belongs also the interesting skarn rock denuded by the Kameník quarry opened at the elevation 420, NE. of Hutě, NE. of Bechyně, on the left bank of the Lužnice. It forms a strikingly differentiated hill as it resists well weathering and denudation. Along with other metamorphic rocks of basic character it is mentioned for the first time by V. Čech (5, p. 226) who identified it as eclogite. In a later paper on minerals of this region it is described by V. Čech and R. Rost (6, p. 250, 276) as skarn containing garnets, ilmenite and pyrrhotite with only a brief characteristic. F. Kratochvíl (25, p. 519—520) in his detailed description of eclogites, serpentines and of calcium-silicate rocks from the Czech crystalline identifies this rock as a pyroxene-garnet hornstone, containing amphibole, apatite, pyrrhotite, chalcopyrite and ilmenite in the fissures. But also this publication passed the mentioned minerals without any detailed examination.

The skarn rock is dark-grey to dark-green, it is fine-grained and even macroscopically it exhibits through its coloration and texture abundant red-brown garnet. Only locally does it pass into medium-grained facies and then it contains abundant amphibole columns. It resembles strikingly some specimens of Czech eclogites, e. g. from the neighbourhood of Poličany, S. of Kutná Hora. Microscopically it is formed by a mixture of garnet with abundant amphibole and pyroxene. The most abundant component of the rock is garnet, forming pinkish to colorless grains of larger size, at places well demarcated and heavily irregularly cracked. Somewhat less abundant is the common amphibole in imperfectly

bounded slender columns and grains, frequently enclosed in garnet. It exhibits marked pleochroism: n_{α} —colorless or faint green, n_{β} —yellowish to bright yellow, n_{γ} —yellow-green to bright green. Extinction $n_{\gamma}/c=15-17^{\circ}$. The third principal component is the very light-green to transparent, low-columnar pyroxene. As far as the sequence is considered, amphibole can be taken for the paragenetically oldest component; only later garnet and pyroxene crystallized. Quantitatively all components are roughly in equilibrium. Garnet grains reach the largest size and are the best bounded ones along with those of pyroxene. Amphibole suffered probably considerably from corrosion. The petrographic identification by F. Kratochvíl seems to be correct although the fine-grained appearance of the rock does not agree well with the name of hornstone.

The skarn rock contains at places frequent fissures or cavities in which undoubtedly early before the end of solidification of the rock or shortly afterwards some minerals crystallized in larger individuals. Most abundant among these is again the common amphibole, accompanied by considerably less abundant apatite, rutile and pyrrhotite (inventory No. 34,500—34,512; 37,618—37,620). Ilmenite mentioned by the above authors could not be found in the material available. Sufficient research material could be collected during an excursion in 1943 and it forms the basis of the more detailed description and examination of individual minerals which follows below.

Common amphibole

(inventory No. 34,500—34,501) is the predominating mineral of fissure and cavity fillings of the skarn rock where it occurs usually in the form of parallelly arranged thinly columnar aggregates; it has rarely a tendency toward radial arrangement. Due to its dark-green color it does not differ from finds of amphibole from the South Bohemian crystalline region. Individual thin columns have the maximum size of 3.0×0.5 cm. The thin section displays numerous fine fissures according to the prism and numerous uneven fissures indistinct cleavage roughly perpendicular to the vertical. It exhibits only weak pleochroism: n_{α} — colorless to faint green, n_{β} — faint green with a yellowish tinge, n_{γ} — faint green, i. e. $\gamma > \beta > \alpha$. On sections parallel to (010) it extinguishes at an angle of $18-19^{\circ}$. The spectral analysis was carried out under the same conditions as above in the laboratory of the Central Institute of Geology in Prague and yielded the following results of elementary content:

I. Essential (above 1 %):	Si, Al, Mg, Fe, Ca, K, Na
II. Subordinate (above 0.1 %):	Ti
III. Insignificant (above 0.01 %):	V
IV. Traces (less than 0.01 %):	Zn, Co, Ni, Ga, Be, Li, Cu, Zr, Mn, Cr, Yb, Y

The results obtained are in agreement with the data for amphibole (Na, Ca, Mg, Fe, Al, Si) with isomorphic admixtures (K, Ti, Zn) and with a rich admixture of a clay component. The remaining elements found belong to heterogeneous admixtures, most likely to rutile (Ti, V) and sulphides (Cu, Ni, Co).

An X-ray investigation (see the X-ray powder pattern on Table XVII, Fig. 4) carried out by the powder method of Debye-Scherrer produced the values shown in Table 6.

Table 6.

Hornblende from Hutš near Bechyně			
I.	d.	I.	d.
1	3.15	2	2.00
4	3.05	2	1.87
2	2.95	2	1.63
2	2.85	1	1.57
1	2.74	1	1.510
2	2.65	1	1.493
1	2.53	4	1.431
1	2.30	4	1.356
1	2.17	1	1.330
2	2.15	2	1.308

The described amphibole resembles by its properties and general appearance other amphiboles from basic rocks of the South Bohemian crystalline region. Infrequently can we find rich-green pleochroic fringes on the circumference of some of its individuals indicating most likely a beginning chloritization. At places there occur non-pleochroic granules with a faintly greenish tinge between the thin columns of amphibole in a thin section. Due to their positive birefringence character, good prismatic cleavage and to the extinction angle subtended with the cleavage cracks on faces related to (010) $n\gamma/c = 35^\circ$ they belong most likely to diopsidic pyroxene. Even macroscopically there appear sometimes light-green, little elongated pyroxene grains in some specimens from this locality.

Apatite

(inventory No. 34,502—34,504) is another relatively abundant mineral from the fissures of the skarn rock which can be encountered on practically every sample obtained. Its light-grey-green aggregates of granular character with a yellowish tinge and greasy luster remind strongly of the well-known asparagus stone from the Greiner Mt. in Zillertal, E. of Innsbruck in Northern Tirol. It is paragenetically probably younger than amphibole and it fills the spaces between the columns of the latter. Under the microscope it can be seen that apatite forms fine granules, polyhedrically formed, of the maximum size of 0.64×1.1 mm which are only rarely hexagonal in shape and enclose fine needles and fragments of amphibole.

The spectral analysis carried out under the above conditions by the laboratory of the Precious Metals Commission in Prague yielded the following results of elementary content:

- I. Essential (above 1 %): Ca, P
- II. Subordinate (above 0.1 %): Sr, Mg, Si, Mn, Na, Fe
- III. Insignificant (above 0.01 %): Ba, Al, Pb, B
- IV. Traces (less than 0.01 %): Cu, Ag

The results obtained speak for apatite with a number of isomorphic admixtures (Na, Mg, Si, Fe, Sr). Mn, Ba and Pb can be considered also as isomorphic admixtures as R. K l e m e n t (21, p. 331) prepared synthetic apatites of these elements. Rock silicates, most likely amphibole and a fraction of sulphides (Cu, Ag, Pb) form mechanical admixtures.

The X-ray investigation (see the X-ray powder pattern on Table XV, Fig. 3) produced data which were then compared with those for chlorapatite from the Bamle mine in southern Norway, as shown in the tables of J. H a n a w a l t (11. II — 1786). The agreement of both sets of values appears from Table 7.

Table 7.

Apatite, Hutě near Bechyně		Chlorapatite, Bamle Mine, Krageroe	
I.	d.	I.	d.
d	3.85	1/2	3.92
4 d	3.32	2	3.42
3 d	3.01	1	3.08
8	2.75	9	2.85
5	2.66	10	2.76
4	2.57	2	2.64
1	2.49	1	2.55
3	2.23	3	2.31
2	2.12	1/2	2.16
1	2.04	1/2	2.04
1	1.99		
4	1.92	5	1.952
3	1.88	2	1.905
3 d	1.83	5	1.840
2 d	1.80	2	1.808
2 d	1.75	1	1.766
2 d	1.72	2	1.691
2	1.63	1	1.610
1	1.58		
1	1.52		
1	1.48		
2	1.45		

Pyrrhotite

(inventory No. 34,505—34,506) is almost inseparably associated with apatite. It occurs, however, in smaller amounts, and is located in the center of the fissures and in the spaces between amphibole thin columns. It forms bright tombac-brown fine-grained aggregates and is clearly distinguishable from the other minerals by its high metallic luster. Only rarely does it form stripe-like parts in the skarn rock proper. It is usually accompanied by minute grains of chalcopyrite which differs from it even macroscopically by its characteristic color. Its spectral analysis carried out under the above conditions by the chemical laboratory of the Central Institute of Geology in Prague yielded the following results of elementary content:

- I. Essential (above 1 %): Fe, Mg, Na, Si
 II. Subordinate (above 0.1 %): Al, Ca
 III. Insignificant (above 0.01 %): K
 IV. Traces (less than 0.01 %): Mn, Co, Sr, Ag, Ni, Cu, Ti, B, V

On the basis of the analytical results it can be assumed that the sample is pyrrhotite with a minute admixture of pentlandite (Ni, Co), rutile (Ti, V), sulphides (Cu, Ag) and with a major fraction of silicates, most probably amphibole.

The X-ray investigation (see the X-ray powder pattern on Table XVI, Fig. 5) produced data which were compared with those of pyrrhotite from Morro Velho in Minas Geraës in Brazil as found in the tables of J. D. Hanawalt (11, 69, II — 2864), and with pyrrhotite from Norande near Quebec in Canada, the values of which are to be found in the tables of G. A. Harcourt (12, p. 94). The good agreement of all the sets of values is apparent from Table 8.

Table 8.

Pyrrhotite, Hutě near Bechyně		Pyrrhotite, Morro Velho, Minas Geraës, Brazil		Pyrrhotite, Norande, Quebec	
I.	d.	I.	d.	I.	d.
2	3.23				
5	2.91	0.6	2.98	1.0	2.97
6	2.59	0.8	2.64	4.0	2.63
		0.1	2.45	0.2	2.45
2	2.16	0.1	2.26	0.2	2.26
8	2.04	1.0	2.06	8.0	2.062
		0.1	1.88	0.2	1.88
6	1.70	0.7	1.72	3.0	1.718
4	1.58	0.4	1.61	0.5	1.612
		0.2	1.451		
5	1.42	0.4	1.430	0.7	1.428
6	1.31	0.6	1.320	1.0	1.315
2	1.233	0.2	1.288		
		0.2	1.214		
3	1.168	0.3	1.172	0.5	1.170
		0.8	1.106		
8	1.093	0.8	1.094	3.0	1.10
		0.1	1.067	0.5	1.067
3	1.064	0.7	1.053		
		0.8	1.045	2.0	1.045
8	1.044	0.5	0.990	1.0	0.990
5	0.991				

Rutile

(inventory No. 34,507—34,510) is a much more abundant mineral in the fissures of the skarn rock than is either pyrrhotite or chalcopyrite. It forms relatively frequent 4 cm granular aggregates with a striking, almost adamantine luster. At places granules were found which had a perfect prismatic cleavage and smooth cleavage planes. Similarly as the other minerals from this locality rutile encloses crystals of amphibole and fills

the spaces between them forming usually the center of such fillings. It is dark-brown and has a light-brown streak. The thin section displays a dark-brown color in transmitted light and cracks of perfect prismatic cleavage. In a powder preparation its fragments are yellowish with a brown hue; larger fragments are rich brown with yellow translucency at the margins. At places weak pleochroism can be observed which varies in the range of the above-mentioned hues. It is also characterized by its high birefringence concealed by a rich brown color. Many of the properties described above are common to ilmenite or nigrine. That is the reason why K. Komárek undertook a chemical investigation of the rutile in the chemical laboratory of the National Museum in Prague. The mineral was fused with potassium bisulfate, the melt was dissolved in dilute sulphuric acid and Ti and Fe precipitated as hydroxides. After the separation of Ti with tartaric acid Fe was precipitated with H_2S as sulphide. Upon washing with ammonium sulphide solution the FeS was dissolved in HCl , the solution oxidized by HNO_3 and pure ferric hydroxide separated with ammonia. Fe was determined iodometrically after dissolving the hydroxide in HCl with the result of 0.82 %. Thus the sample was rutile containing

Table 9.

Rutil, Hutě near Bechyně		Rutile (Hanawalt II-1089)	
I.	d.	I.	d.
5	3.18	10	3.24
4	2.45	7	2.49
		2n	2.31
1	2.25	3K	2.26
3	2.14	4	2.19
1	2.02	3	2.05
		2B	2.01
		4B	1.877
		2dB	1.779
8	1.67	10	1.682
4	1.60	6n	1.622
		2K	1.500
3	1.46	2n	1.470
3	1.44	4n	1.450
		8	1.357
6	1.34	7C	1.338
		2C	1.306
		½ K	1.260
		4n	1.238
		2C	1.194
1	1.16	5n	1.163
1	1.14	4C	1.141
		2C	1.103
3	1.09	4n	1.095
3	1.07	5C	1.077
		5n	1.041
4	1.03	6C	1.031
		5C	1.022

only 0.82 % of Fe, and not ilmenite which was described thence by V. Čech and by R. Rost (6, p. 276), unless this is a case of occurrence which had not been apparent on the samples at hand.

In addition to the chemical analysis a spectral analysis was carried out under the conditions described above by the laboratory of the Precious Metals Commission in Prague, which yielded the following results of elementary content:

- | | |
|------------------------------------|------------------------|
| I. Essential (above 1 %): | Ti |
| II. Subordinate (above 0.1 %): | Ca, Mg, Zn, Al, Si, Fe |
| III. Insignificant (above 0.01 %): | V, Mn |
| IV. Traces (less than 0.01 %): | Cu |

The analytical results are in agreement with the data for rutile with isomorphic fractions of V, Mn and Fe. Mechanical admixtures were formed by silicates, most likely amphibole, and by traces of sulphide (Cu).

The X-ray investigation (see the X-ray powder pattern on Table XV, Fig. 4) produced values which were compared with those for rutile shown in the tables of J. D. Hanawalt (11, II — 1089). The agreement of both sets of values is apparent from Table 9.

Garnet

(inventory No. 34,511—34,512) accumulates in some parts of the skarn rock in larger amounts; it occurs in grains about 5 mm long, red-brown to light-brown. Similar accumulations of garnet grains can be at times observed even in fissure fillings of the rock. The garnet grains are faintly pink in a thin section and display numerous irregular fissures. Its fragments float in Clerici's solution on the surface and sink only slowly in Rohrbach's solution which indicates a density of slightly above 3.44, corresponding to the well-known hessonites. Also the coloration complies with that of calcium-ferrous and aluminous garnet, probably with an admixture of Fe^{III} . According to these properties the sample may be considered as closely related to the hessonite.

The origin of the skarn rock in the layer system of biotitic paragneiss can be explained on the basis of a catazonal regional metamorphosis of the original carbonate rock, according to F. Kratochvíl (25, p. 520) of a dolomitic limestone with impurities of clay substances. The fissures were filled with minerals in the last part of the development, the minerals being components of the rock itself. The paragenesis of the described minerals in the skarn rock is a rare case of this sort in Czechoslovakia.

Calcite from Chvalovice near Netolice (Vodňany county, České Budějovice region)

Toward the end of the last century a shaft was opened for the exploitation of graphite W. of Chvalovice, SSE. of Netolice. The graphite outcropping here also in the creek valleys between Chvalovice and Horní Chrástany and Dolní Chrástany forms here according to older reports one

or two lenticular intercalations placed concordantly in the system of layers of biotitic paragneisses. Its occurrence is only a more northerly continuation of graphite deposits in the vicinity of Černá and Mokrá, WSW. of Český Krumlov. The Chvalovice graphite deposit is placed in the anticlinal of biotitic paragneiss and it originated undoubtedly by a regional metamorphosis of coal deposits. The Chvalovice graphite is fine flaked, with a high luster and its occasional exploitation was considered as relatively promising.

The sample of botryoid calcite comes from this deposit (inventory No. 41,311, F. Humler, Davle. legit); it forms imitative sinter layers about 0.75 mm thick or stalactitic formations in lentil-shaped elongated, as much as 9 cm high cavities of a grey crumbling rock. They are finely botryoid on their surface and have a cream-white color. The surrounding rock is formed by very fine flakes of shiny graphite of the average size of 0.05—0.10 mm, heavily distorted and gathered in tiny clusters. The latter are placed in the grey-white mass formed by a fine-grained limestone with an admixture of quartz grains and of fragments of biotite. The neighbourhood of graphite beds is usually quite extensive decomposed and accompanied by limestone layers. It is probably a case of a transitory layer where graphite forms an admixture of limestone. With regard to the shale character of the rock and to its composition it can be assumed that the rock is a graphitic schist which was later penetrated by fine-grained calcite from the vicinity. The calcite formed in the newly-formed cavities originating from its gradual dissolution imitative forms of miniature stalactite caves.

The spectral analysis of the calcite was carried out under the above-described technical conditions in the chemical laboratory of the Central Institute of Geology in Prague as well as in the laboratory of the Precious Metals Commission in Prague, and yielded the following results:

	CIG	PMC
I. Essential (above 1 %):	Ca, Mg	Ca
II. Subordinate (above 0.1 %):	Al, Mn, Si	Al, Mn, Si, Fe, Sr
III. Insignificant (above 0.01 %):	Na, Fe, Ti	Ba, Cu
IV. Traces (less than 0.01 %):	Cu, K, Ba, Zr, Ni, V, Pb	Na, Ag

The results of both spectral analyses agree with the composition of calcite with a number of isomorphic admixtures (Fe, Mn, Ba, Mg, Pb, Sr) and with a mechanical admixture of silicates, oxides and sulphides (Cu, Ag) from the surrounding paragneiss.

Diopside from Černá in the Šumava Mts. near Horní Planá

(Český Krumlov county, České Budějovice region)

In a deserted quarry SSW. of Černá in the Šumava Mts., WSW. of Český Krumlov, which had been opened W. of the elevation 818 in a limestone intercalation in the crystalline, interesting specimens of erlane were discovered with abundant diopside; according to the new research

made by O. K o d y m jr. (22) the vicinity of Černá is built by the so called variegated series of the crystalline in the width of 5 km, which is composed of biotitic, at places of sillimanitic paragneisses, both dark and light with a predominance of quartz, but furthermore of limestones, erlanes, graphitic gneisses, graphite and amphibolites. The diopside collected in the erlanes (inventory No. 41,547; V. Šípek, 1955 legit) is light grey-green, somewhat lighter than in other localities in contact limestones. It is distinctly coarse-grained, mostly bulky and cleavage, dull, only on cleavage planes faintly lustrous. Groups of tiny grains of pyrrhotite sometimes occur among the diopside individuals (inventory No. 41,543; V. Šípek, 1955. legit). Microscopically, large transparent unidirectionally elongated grains without pleochroism with perfect cleavage along (110) marked by long and sharp cleavage cracks can be found. At places also the parting along (001) as well as along (100) can be observed. The angle of extinction subtended with the cleavage cracks along (110) on the faces of the vertical zone related to (010) varies about the value of 35° . The index of refraction lies in the range of 1.670—1.690. All these properties agree with those of diopside with a small fraction of Fe.

The spectral analysis was carried out under the same technical conditions as above by the laboratory of the Precious Metals Commission and it yielded the following results of elementary content:

- | | |
|------------------------------------|----------------|
| I. Essential (above 1 %): | Mg, Ca, Si |
| II. Subordinate (above 0.1 %): | Al, Mn, Fe, Ti |
| III. Insignificant (above 0.01 %): | Ba, Pb, Cu |
| IV. Traces (less than 0.01 %): | Ag, Na |

The result of the analysis agrees with the data for diopside with numerous isomorphic admixtures (Fe, Mn, Na, Ti, Al). The sulphides (Fe, Pb, Cu, Ag) formed probably the mechanical admixture; of these pyrrhotite was directly identified. The X-ray investigation (see the X-ray powder pattern on Table XV, Fig. 5) furnished data which were compared with those to be found in the tables of J. D. H a n a w a l t (11, II—1384) for diopside from Storrington Twp., Ontario. It follows from Table 10 that the two sets of values are in good agreement. If we compare the data obtained by the X-ray study with those for pyroxenes of the isomorphic series of diopside-hedenbergite, as shown in the publication of J. K o u ř i m s k ý (24, Table 2, p. 133, Table 3, p. 134) it can be seen that the majority of the data of structure plane spacings as well as the intensity of most lines corresponds to diopside with a definite participation of Fe. In any case, the Černá diopside is a member of the diopside-hedenbergite series, rather poor in iron. The occurrence of diopside at Černá points to a rich clay and silica admixture of the original non-metamorphic limestone which supplied the material for its origin in the course of metamorphosis. By its general appearance and by its properties the Černá diopside resembles closely some diopsides from the Western Moravian crystalline; by its coarse-grained character it resembles the somewhat richer-hued green diopside from the vicinity of Dolní Lišná near Jimramov but by its coloration also some samples from Horní Újezd near Jaroměřice.

Table 10.

Diopside, Černá in Šumava Mts.		Diopside, Storrington Twp., Ontario	
I.	d.	I.	d.
3	3.29		
10 dif	2.97	10	3.00
10 dif	2.53	8	2.51
2	2.29		
4	2.20		
4	2.12		
		5	2.04
3 dif	2.02	5	2.01
2 dif	1.83	3	1.83
		3	1.79
3	1.75	2	1.74
dif	1.66		
5	1.62	6	1.62
6 dif	1.51	1	1.52
5	1.42	1	1.42
4	1.33		
4	1.29		
1	1.26		

IV. MINERALS OF ORE DEPOSITS AND VEINS

Chalcopyrite from Prostřední Lhota near Nový Knín (Dobříš county, Prague region)

The shale region of Jílové is in the wide neighbourhood of Nový Knín cut thorough by numerous quartz veins, many of which became famous as gold-bearing. Particularly between Prostřední Lhota and Kobylníky even at present many signs reminiscent of the former gold mining can be found; they are located in quartz veins running through the partly aplitic granite, or else they bear marks of former gold-washing. In the vicinity of Prostřední Lhota, SE. of Nový Knín there occurs in these quartz veins rather abundant chalcopyrite (inventory No. 39,594; A. Javorský, Prague legit). In the grey, fine-grained vein quartz there occur abundant granular aggregates of chalcopyrite, bright-yellow or brass, usually variedly iridescent. In quartz cavities tiny crystals of chalcopyrite of the disphenoidic type can be found, often rather complex as they form monstrous formations. Some grains of chalcopyrite show clear marks of onsetting decomposition giving rise to a fine malachite fringe.

The spectral analysis was carried out under the above conditions by the laboratory of the Precious Metals Commission in Prague and it yielded the following results:

- I. Essential (above 1 %): Cu, Fe, Si
- II. Subordinate (above 0.1 %): Ca
- III. Insignificant (above 0.01 %): —
- IV. Traces (less than 0.01 %): Mn, Mg

According to the analysis the sample was chalcopyrite free from isomorphic admixtures with a considerable fraction of mechanically enclosed quartz and with remnants of silicates from the surrounding amphibolic schists. SiO_2 in the amount of 1—5 % can be found in many chalcopyrites from the vicinity of Gelnice in eastern Slovakia, from Clausthal in the Harz in Germany and from some localities in Cornwall in southern England. It is of interest that no Ag and Au can be found here even in trace quantities, which are otherwise rather frequent in Czech chalcopyrites.

Table 11.

Chalcopyrite, Prostř. Lhota		Chalcopyrite, Waldo, Franklin (Hanawalt 67)		Chalcopyrite, Franklin, N. J. (Harcourt, p. 76)	
I.	d.	I.	d.	I.	d.
4	3.28				
8	2.998	1.0	3.03	0.7	3.03
		0.4	2.62	0.2	2.62
8	1.84	0.9	1.86	0.4	1.86
2	1.80				
1	1.65				
6	1.58	0.7	1.59	1.0	1.59
2	1.56				
2	1.534	0.4	1.52	0.2	1.52
1	1.451				
4	1.370				
1	1.344				
4	1.318	0.5	1.32	0.5	1.32
1	1.295	0.6	1.294		
2	1.249				
2	1.224				
1	1.210				
5	1.203	0.6	1.205	0.5	1.205
2	1.181				
1	1.151				
7	1.073	0.6	1.074	0.5	1.075
3	1.066				
1	1.046				
1	1.033				
6	1.015				
2	1.011	0.2	1.010		
4	1.002	0.4	0.930		

The X-ray investigation of this chalcopyrite (see the X-ray picture in Table XVI, Fig. 6) furnished data which were compared with those given in the tables of J. D. Hanawalt (11, No. 67) and in those of G. A. Harcourt (12, p. 76) for chalcopyrite from Franklin, New Jersey, USA. The results are in good agreement, as shown in Table 11.

Chalcopyrite from Prostřední Lhota originated along with quartz in the hydrothermal stage, similarly as in other Central Bohemian ore veins. Along with chalcopyrite molybdenite can be found very rarely in the same locality.

Marcasite from Kašperské Hory
(Sušice county, Pilsen region)

The well-known veins of gold-bearing quartz in the vicinity of Kašperské Hory fall in the zone: Jílové—Kasejovice—Kašperské Hory—Volyně which were at one time exploited NE. and W. of the community. The gold content is associated strictly with the quartz veins running through gneiss while the neighbouring veins in granite are barren. Marcasite was found in the goldbearing vein quartz (inventory No. 39,825; A. Javorský, Prague

Table 12.

Marcasite, Kašperské Hory		Marcasite, Ottawa County Oklahoma, USA		Marcasite, II — 1904		Marcasite, Creighton, Ontario	
I.	d.	I.	d.	I.	d.	I.	d.
6	3.38			.6	3.44	3.0	3.47
10	2.66	0.80	2.67	.4 B	2.96		
7	2.38	0.30	2.40	1.0	2.70	6.0	2.715
7	2.28	0.30	2.31	.2 B	2.55	2.0	2.42
2	2.04			.7	2.41	2.0	2.32
6	1.89	0.30	1.94	.7	2.31		
9	1.74	0.30	1.91	.2 B	2.10		
3	1.709	1.00	1.75	.2 n	2.05		
5	1.675			.4 B	1.94	1.0	1.925
3	1.662			.6	1.91	4.0	1.762
6	1.557	0.15	1.58	.1 R	1.868	1.0	1.692
5	1.519			.9	1.758	2.0	1.600
2	1.500			.3 n	1.720		
3	1.484			.5	1.690	2.0	1.520
6	1.417			.4 n	1.673		
				.6	1.593	1.0	1.370
				.4 B	1.534		
				.5 n	1.518	1.0	1.158
				.5 n	1.501		
				.6 n	1.428	1.0	1.092
				.5	1.367		
				.5 B	1.218	1.0	1.033
				.2 R	1.209	1.0	.991
				.4 n	1.205	3.0	.957
				.5 n	1.190		
				.5	1.159		
				.2 B	1.138		
				.2 B	1.106		
				.6 n	1.093		
				.4 B	1.073		
				.5 dB	1.055		
				.6 dn	1.034		

legit); the finder originally assumed it to be arsenopyrite, a view supported by its relatively light color.

In the grey-white ore quartz, at places hornstone-like with abundant remnants of limonite in the cracks, there occur relatively infrequent fine-grained aggregates or fan-like shapes composed of 1 cm crystals with an imperfect form, belonging to marcasite. It is of a light-brass color, the larger pieces are rich-brass or blue-green. Also in the dark-grey granite of medium grain scattered about 1 mm crystals can be sometimes found, which are occasionally gathered in granular aggregates. The crystals have generally a tabular habit and are grooved in wide intervals. These are the well-known marcasite crystals flattened along (001). It was shown chemically that the mineral contains no arsenic and thus arsenopyrite does not come into the question.

The X-ray study was carried out by J. K o u ř i m s k ý by the powder method of Debye-Scherrer. Apparatus Chirana-Mikrometa, radiation $\text{CoK}\alpha_{1,2}$, filter Fe, $\lambda = 1.787$ kX, potential 26 kV, intensity 30 A, exposure 240 min. The X-ray results are shown in Table 12. The values obtained were compared with those for marcasite given in the tables of J. D. H a n a w a l t (11, II—3366, II—1904) for finds from the USA, and in the tables of G. A. H a r c o u r t (12, p. 90, No. 96) for finds from Craighton, Ontario in Canada.

The apparent agreement of the values obtained with those for other marcasites seems to confirm its identity. It is a new mineral in Kašperské Hory.

As for the origin of marcasite in the veins it has been shown experimentally that it originates from solutions more acid and represents a metastable modification of iron disulphide with the rhombic dipyramidal symmetry. According to the general type of occurrence the Kašperské Hory marcasite is an endogenous hydrothermal product and belongs to the youngest crystallization phase.

Marcasite from Stříbro (Stříbro county, Pilsen region)

Finds of fine-grained and crystalline pyrite have been known for long to have been made in the hydrothermal ore veins of the Pb-Zn formation, running in the neighbourhood of the Kladruby granite near Stříbro, W. of Pilsen, through Algonkian shales. A new mineral from these veins is marcasite (inventory No. 41,780—41,782; the Ministry of Metallurgical Industry and of Ore Mines, Prague, 1958 donavit). Its relatively abundant crystals are tiny and they sit on the grey-white vein quartz, frequently heavily druse-like or foliate. In the ore quartz with numerous cavities and cracks there occurs along with marcasite also dark-brown to light-brown sphalerite in the form of tiny 2—5 mm wide isolated granules forming occasional groups or veinlets. Less frequent here is galena, at least in the samples obtained. All specimens obtained contain always also pyrite which is paragenetically older than marcasite. Pyrite forms either granular groups or 1 cm crystals in the cavities; the crystals are of the (100) form with straight smooth faces and with a lighter brass color (inventory No.

41,780). At times even small druses formed by cubic octahedra with a high metallic luster can be found (inventory No. 41,781/2). The marcasite crystals have a columnar habit and are elongated along the brachydiagonal axis. They are very simply bounded mostly by the faces of prism *a* (014) made obtuse by the (110) faces. The prism *a* faces are always markedly grooved along the *a* axis; the prismatic faces are relatively straight, smooth, only locally distorted or weakly parquettted. The crystal color is brass, practically always with iridescent colors of blue-green, bluish or even bright yellow. The crystals reach the average size of about 0.6×0.4 mm only, their thickness being only 0.3 mm. They are usually grouped in smaller druses, formed by several individuals, or else they sit in dense clusters in the form of spherical aggregates on the quartz. The described crystal shape of marcasite is relatively rare. However, it was known already to J. B. Presl (32, p. 173) who described the same forms but richer by one face, from Banská Štiavnica in Slovakia (l. c. Fig. 387) or from Derbyshire in England (l. c. Fig. 386).

The spectral analysis of marcasite from Stříbro was carried out under the above technical conditions by the laboratory of the Central Institute of Geology in Prague and it yielded the following results:

- | | |
|------------------------------------|--------------------------------------|
| I. Essential (above 1 %): | Fe, Al, Ca, Si |
| II. Subordinate (above 0.1 %): | Pb, Mg |
| III. Insignificant (above 0.01 %): | Na, Sb, Zn |
| IV. Traces (less than 0.01 %): | Ag, As, Cu, K, Ba, Cr, Mn, Ti, Ni, V |

The results obtained point to the opinion of the sample being marcasite with an isomorphic admixture of trace quantities of As and Ni and with a considerable amount of mechanically admixed sulphides (Pb, Zn, Cu), carbonates (Ca) and of femic silicates from the surrounding Algonkian shales.

The origin of marcasite on the Stříbro ore veins took place under the conditions described for the genesis of marcasite from Kašperské Hory. Marcasite from Stříbro is a younger mineral than pyrite on the crystals of which marcasite sits. After the crystallization of pyrite from a neutral or weakly acid solution above 110°C the solution began to cool off and probably its chemical character changed to become more acid. Therefore marcasite crystallized from the solution in the youngest phase of development.

Hematite from Herlíkovice near Vrchlabí (Vrchlabí county, Hradec region)

From the well-known and at times worked magnetite deposit near Herlíkovice, N. of Vrchlabí in the Giant Mts. specimens of hematite specularite, and of red ocher have been obtained (inventory No. 39,734; A. Javorský, Prague 1932 legit). They are frequently accompanied by radial aggregates of barite. On the western slope of the Herlíkovický Žalý (elevation 958), N. of Herlíkovice, in the place of the so called Labe pass, two old drifts are known, worked in the crystalline shales. Yet in the second half of the 18th century magnetite was worked out here along with chalcopyrite and galena. The work was then interrupted and renewed

only toward the end of the last century. Even before the first world war trials were undertaken to renew the exploitation. According to the detailed survey carried out by R. Kettner (19) the Herlíkovice deposit is analogous to the rich magnetite deposit near Kryžatka (formerly Schmiedeburg) on the N. slope of the Giant Mts. In fact it is the westernmost occurrence of iron magnetite ores in the Giant Mts. as beginning at Kryžatka amphibolites and limestones with magnetite can be pursued to Smrčí, W. of Horní Malá Úpa, over the Vlhký Důl, SSW. of Sněžka, to the Hannapetrova paseka, NNE. of Vrchlabí all the way to Herlíkovice. According to R. Kettner (19) we are dealing here with an originally sedimentary paleozoic bed of iron ores placed most probably in the diabase tuffs which was contactly metamorphosed by an intrusion of acid granite, forming at present an extensive zone of straw-yellow orthogneisses with coarse-grained parts, with striking porphyry phenocrysts of meat-red feldspar. The magnetite forms a rather elongated lenticular bed placed concordantly in the dislodged crystalline and it contains abundant inclusions of limestone and of rocks with garnet and scapolite. The ore proper was formed by medium-grained magnetite with an admixture of calcite, dolomite and amphibole. The newly-obtained specimen is a fine-grained aggregate of dark-brown hematite with dark-brown to red-brown streak. At places it contains dark-green fine-flaked parts of chlorite and in its cavities, as large as 15 mm, minute, frequently bipolarly developed crystals of brownish to transparent quartz, arranged usually in neat druses. The test made with a strong magnet showed that also in this sample, macroscopically composed of hematite only, there is a certain quantity of magnetite.

In order to determine the texture of the aggregate ore microscope was resorted to. In a polished section there are clearly visible octahedric magnetite individuals surrounded by amphibole. In each of them two main components can be easily distinguished: the inner of magnetite, forming a somewhat dulled nucleus with a smaller reflecting power, and an outer hematite in the form of a heavy fringe around the magnetite nucleus. Hematite penetrates in the form of narrow channels to the very center of the nucleus, it is markedly anisotropic and has a distinctly higher reflecting power. The vicinity of magnetite grains is usually impregnated with fine-powdered hematite which can be recognized by the striking inner reflexions. An examination in the polarization microscope reveals that the ore grains are uniformly dispersed; they have the average size of 0.3 mm and have a rounded isometric shape. In ordinary light they are blue-grey, in transmitted light they are black with a bluish tinge. The powder of red-brown hematite on the circumference of magnetite grains indicates the presence of initial but rather far-progressed decomposition of magnetite.

It follows from the above observations that we are dealing here with a rather progressive metamorphosis of primary magnetite into hematite caused by external factors, as can be well seen macroscopically by the change of black color into dark-brown. Basically it is a case of oxidation of magnetite which manifests itself by its gradual martitization. The complete metamorphosis of magnetite into martite has never been observed on the sample obtained. The spectral analysis of hematite was

carried out by the laboratory of the Precious Metals Commission under the above conditions and it yielded the following results:

- | | |
|------------------------------------|------------|
| I. Essential (above 1 %): | Fe, Si |
| II. Subordinate (above 0.1 %): | Ca, Al, Sn |
| III. Insignificant (above 0.01 %): | Pb |
| IV. Traces (less than 0.01 %): | Mn, Mg |

The result shows that the sample was hematite and magnetite with isomorphically admixed trace quantities of Mg with a mechanical admixture of silicates, most likely of amphibole and chlorite, of oxides and sulphides (Pb).

The X-ray study (see the X-ray powder pattern in Table XVI, Fig. 7) produced values which were then compared with those for hematite from the Vesuvius in Italy and from Workington in the USA, as published in the tables of J. D. Hanawalt (11, II—1929) and in those of G. A. Harcourt (12, p. 86). The agreement of all the values is apparent from Table 13.

The flaky chlorite appearing in the spaces between magnetite grains originated probably from a metamorphosis of amphibole. It is rich green in color, displays marked pleochroism between light-green and yellowish. More rarely can we observe in a thin section also remnants of the original green amphibole between the grains of magnetite; the former is also markedly pleochroic: n_{α} — light-yellow, n_{β} — dark-green, $\alpha < \beta$. It extinguishes roughly parallelly and has always a positive sign of elongation. Its progressive chloritization is everywhere well apparent, a sign of onsetting decomposition of minerals.

Another sample from this locality (inventory No. 39,733) contains hematite in the specularite form. In a crack of light-green sericitic gneiss there occur abundant tiny flakes of specularite mixed with red-brown ocher and surround yellowish quartz crystals. Along with them there can be found a radial aggregate of 2 cm heavily affected crystals of white or finely-pink barite.

Paragenetically oldest appears to be quartz. Only after it hematite and finally barite crystallized.

The magnetite deposit near Herlíkovice is placed in a series of transitional mica-gneisses of Algonkian age, forming the main component of the Sudetian nappe of the Giant and Jizera Mts.

There occur intercalations of quartzite, limestone and amphibolites (metamorphic diabase rocks). Thus, also in the light of results of O. Kodym and J. Svoboda (23) R. Kettner's (19) view about the origin of this deposit remains valid. It is probably a case of a sedimentary bed of hematite ores associated with diabase tuffs (an analogy of the sedimentary beds in Central Bohemian Barrandien), which underwent a repeated contact and regional metamorphosis. This is proved by not only the occurrence of amphibolic rocks formed by a metamorphosis of diabase tuffs but also by the fact that magnetite can be found here free from iron silicates so characteristic of deposits of the skarn type. There took place no afflux of ore content from the magma here but rather a simple metamorphosis of the existing bed. The magnetite originated

Table 13.

Hematite, Herlíkovice		Hematite, Workington, USA and the Vesuvius		Hematite, G. A. Harcourt, p. 86	
I.	d.	I.	d.	I.	d.
		0.2	4.06	0.3	4.06
4	3.31	0.5	3.67	1.0	3.66
4	2.93				
6	2.67	1.0	2.694	7.0	2.69
8	2.49	0.8	2.512	4.0	2.51
4	2.19	0.6	2.202	2.0	2.18
4	2.09				
6	1.82	0.8	1.837	3.0	1.835
6	1.68	0.9	1.691	5.0	1.68
6	1.61	0.5	1.597	0.5	1.58
2	1.54				
7	1.48	0.7	1.483	1.0	1.485
6	1.45	0.7	1.450	2.0	1.44
1	1.409				
3	1.37	0.2	1.347		
3	1.31			0.5	1.30
3	1.279				
3	1.259	0.4	1.256	0.3	1.255
		0.1	1.225		
1	1.211	0.1	1.2112		
1	1.184	0.4	1.1285	0.3	1.182
1	1.165	0.4	1.1604	0.3	1.160
5	1.14	0.4	1.1384	0.3	1.136
4	1.122				
4	1.104	0.6	1.1008	0.5	1.100
7	1.092				
1	1.08				
6	1.055	0.6	1.0534	0.5	1.055
5	1.049				
		0.2	1.0368	0.3	1.030
1	1.013				
5	0.988	0.5	0.9869	0.3	0.987

most likely by a metamorphosis of hematite or limonite and at present changes back to hematite under the influence of external factors.

*

It is my pleasant duty to thank now to all the workers of the Chemical Laboratory of the Central Institute of Geology in Prague for carrying out the spectral analyses and X-ray investigation, to Miss V. Čáslavská for preparing X-ray powder patterns, to the workers of the Laboratory of the Precious Metals Commission in Prague for carefully carrying out some of the spectral analyses, to Dr. K. Komárek, the head of the chemical laboratory of the National Museum for the determination of Ti, and particularly to all my co-workers from the Mineralogical department of the National Museum Dr. J. Kouřimský and Dr. V. Šípek for valuable remarks which helped to improve the paper presented.

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Notes. — SGÚ RČS denotes the Státní geologický ústav Republiky Československé (State Geological Institute of the Czechoslovak Republic).
 ÚÚG denotes the Ústřední ústav geologický (Central Institute of Geology).

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- Table XIII. Calcite crystals from Srbsko near Beroun (Min. Dep. Nat. Museum in Prague, inv. no. 37.784. Photo A. Pilát, Prague. Nat. size 19×16 cm. Size of the largest crystal 4×4 cm).
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