JÁN TURAN – LÍDIA TURANOVÁ

Uhličitanová mineralizácia ložiska Nižná Slaná

14 obr., 8 tab.

A b s t r a c t. Carbonate bodies at Nižná Slaná are composed of alternating siderite, ankerite and limestone layers. Their typical features include bedding and distinctive lamination. From a mineralogic point of view, siderite and ankerite occurrences amidst laminated limestone are particularly interesting. Because elite and present ia atargbsal jarts at @e d4gxzsit. Ns•rieh cazboeatas — etc aed kuatoboritc — occur locally . Tbs IJ astoac b ago mriCbed ia h€o aad Ps. Tbs data obiaieed oa the occurrs forays of distribution u wall m miaszal aad cbsatical coap‹aittas of t¥s tad carbmtatas suggest that their formation was controlled by sedimentary, diagenetic and metamorphic processes.

Key words: carbonates, mineralization, West Carpathians

Úvod

Within the framework of vtskuoza$ck élob Mch s$skuza caatrAtayck Zdpsda$ck Xarpdt and MiacrBac asoaśoe in the form of ócraycłs bndłk gozacnŁa pmbtckał ay v$skuzn ubhtztanoycj zauz¢rałizńas in k› zsku N"zźaśSIaaśajsbo o¥otf. kz›bsXo ł2iżaś Sboś bolo joda$m z v$zaama$ck łodfsk aidońtoy}cb ród. Even in s0dasooetż, in tasc tt1movńbo programme rudod¥o łaofctvs aa Skry¢znŁu, to have maJs po¥zsgovsf fzżta side-ńtu in tozato zńvods (Xtużz, 1993). ,

vzt'ab k ¢icroyei bridlicbai a v kooedaoes dédedka $zñspisf k ricgcaiu gczzdzy stratiforzaa$cb Mg-Fc logfsk v S zza rMz›bzx£

RNDr. JÁN TURAN, CSc., RNDr. LÍDIA TURANOVÁ, CSc., Geologický ústav Prírodovedeckej fakulty UK, Mlynská dolina, 842 15 Bratislava

Sampling samples and methodology research

A substantial part of the samples was taken from nine deep structural faults that **penetrated** the Nižná Slacá deposit, Samples were also taken from accessible parts of the mine at the X horizon, intermediate horizon, XI and XII horizons from the Manó and Gabńcla sections, as well as from the surface parts of the deposit and old mining works in the Riznbcrga area.

To determine the nature of the deposits, individual carbonates were separated by flotation in water or in liquid solvents, or both, and refined them electro-magnetically using Cook apparatus.

The original samples prepared in this way were analysed using either a manometric or derivatographic method, or using AAS. The content of trace elements was determined by spectrochemical analysis. The distribution of elements was monitored using an Edax PV 9IŒI microanalyser and a JSM-840 electron scanning microscope.

Angles, 1cb range, mature and vx$joœnã vzfaby

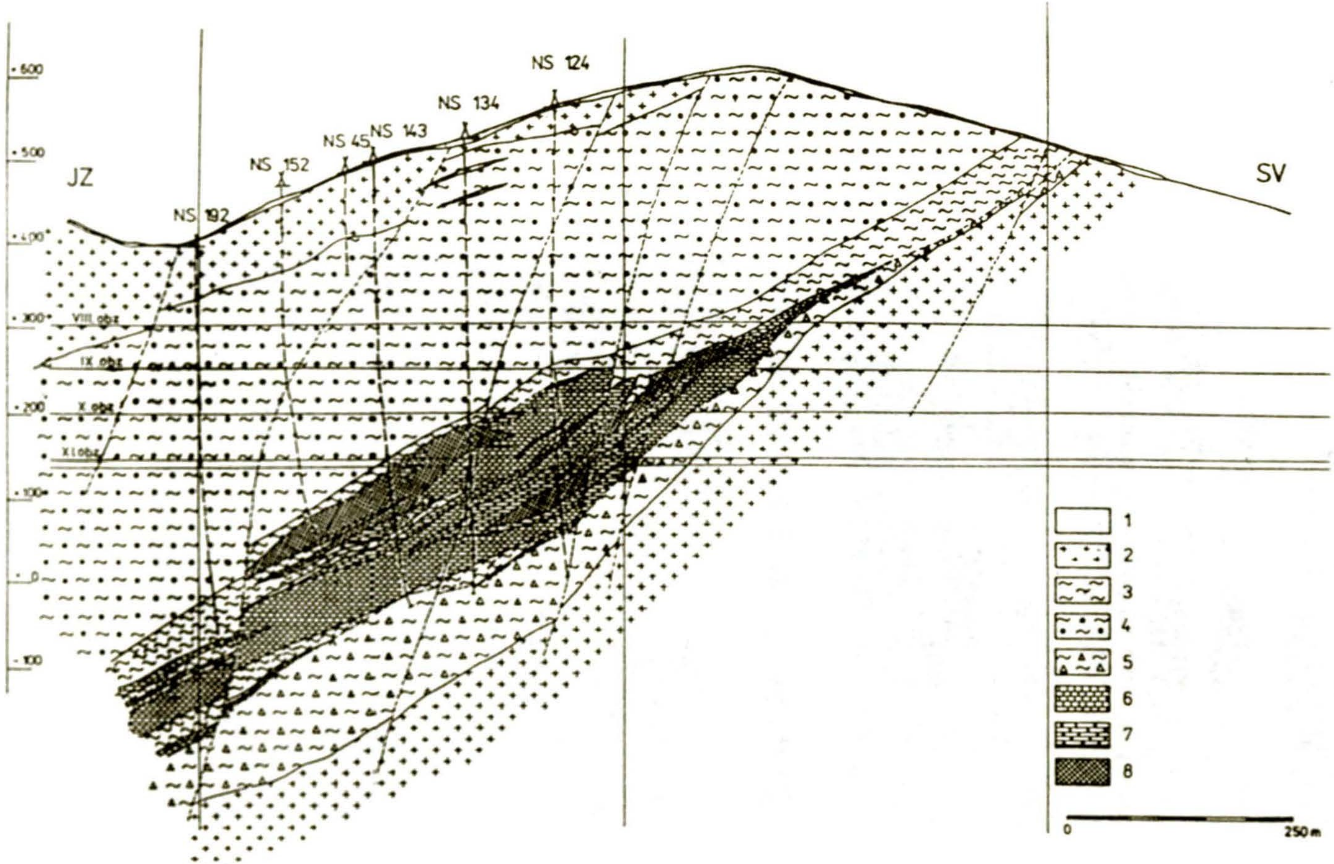
Stavbauhlićitanovÿchtelies

The carbonate bodies of the Nižná Slaná deposit are composed of alternating layers of siderite, ankerite and limestone. Around the carbonate layers, there are usually black shales and lydites, sericitic-graphitic phyllites, quartzites and sandstones, and porphyroids on the surface (Fig. 1).

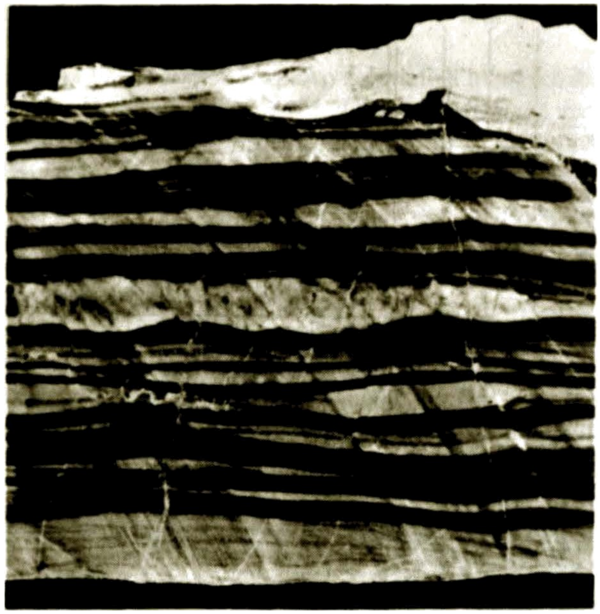
The typical rhythmic alternation of siderite, ankerite and limestone layers in the vertical section described by Liavsxî (1974). It is necessary to emphasise that the striking feature of carbonate bodies in Nižná Slancja is their laviccite and laminated structure, which occurs in limestone (Fig. 2), sandstone (Fig. 3) and shale (Fig. 4). The shale is concentrated mainly in the central and upper parts of the carbonate bodies, where they form several parallel layers with a thickness of 2 to 30 m. It is not uncommon to find even larger, up to 100 m thick sidcrit layers. In addition to the carbonate telescope, but also outside of it, there are numerous millimetre-sized sidcritu.

Carbonates of the dolomite-ankrite series form more or less distinct layers at the edge of sedimentary basins, but they also occur directly in sedimentary layers. The ankylite layer at the edge of the dolomite layer is not always the same thickness, but varies from a few centimetres to several metres. However, as a rule, the thicker dolomite layers also have a thicker ankylite layer. The boundary between ridcrit and ankcri is accessible, macroscopically distinguishable, and statistically evaluated, *so* it can be used for line drawing.

In the micritic, vÿray.nc laminoeanum, strongly contaminated with ankcritc, organic detritus (nhr. §), fragments of nstrakóduv and fibres of strumat‹›lit‹›v (Mišin kstnc pndanie) occur, which indicate shallow waters, lagoons, or shallow more.



Obr. 1 Nižná Slaná, priečny rez ložiskom Manó, rez 32 (podľa Mlynára in Slávik, 1967, upravil Turan)
1 — hlina, sutina, 2 — porfyroidy, 3 — grafiticko-sericitické a sericitické fylity, 4 — sericiticko-grafitické fylity s lyditmi, 5 — podložné sericitické fylity, 6 — vápenec, 7 — ankerit, 8 — siderit



¢Xsr. 2 Tenkowstcuziat$ •dpcnsc with basic Ima•$mi laminami forming pigments of organic origin. Poto: 1s OsvxLo

¢Xsr. 3 In t•znc lamin• •n . heavily contaminated§ aakcrit 0 obcattom n«raqnatnčbo z*yšku up to 40%. In tn¥a•9cb lanindch ¥a zacbo•al organic detritus. Foia: L Osvazo

A significant amount of organic matter forms a layer that concentrates mainly in the upper part, but also in the subsoil (especially in the western part of the deposit). Jcho pc›dr‹›bncjšfm Jtódiom ss zistiJo, žc obcahujc, aj kod ka vo vcfœi azalozn mnoMtvc, spravidla okulo 1 %, ticä sidcrit a aokcnt. Sidcrit, together with ankcntoœ, forms small grains or clusters of grains in vcfzai tcnkých, only 0.X of the mass of strong parallel wuvičkách, which are repeated in the prcfilc vápsncovcj poloby mnnhon1Wnn (Fig. 6).

On the surface of the rock, veins of ublitgaov are visible. Their quantity always depends on the quality of the dispersed carbonates. Calcite veins are only found in locations where dolomite veins also occur. In sidc-ritcvých locations, sidcritoyč veins occur most frequently, although an-kcrit‹›vć veins are also abundant. In nadln+nnm and podložnoœ vãpcaci æ sidcritcvć ani ankcritovć veins do not occur.

Similar to quartz, the quartz-sulphide veins occurring in all these carbonates are concentrated only where suitable tectonic conditions were created, when there was a sufficient amount of carbonate and sulphide in the ore.

Carbonates (sidcritovo-ankcritovć 7Jlky) are also found outside carbonate clasts, in black shales (Fig. 7), in mctapsamituch and p‹›rfyrcid‹›ch. However, this fact is not surprising, as sidcritovo-ankcritovć carbonates are also found in these rocks, most frequently in the form of columns, which are not visible to the naked eye.

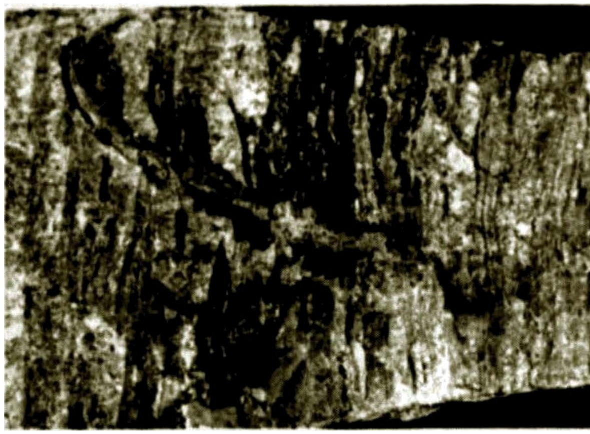
Despite the fact that the positions of limestone, anthracite and sidcntu, which are repeated many times in the vertical section of the 7th layer, have a stratiform character and are often succeeded byThe stratiform character is lost, and the patterns of the vertical relationships are not clearly defined. The oldest are considered to be limestone, which is the result of hydrothermal processes occurring on the surface and also in the mountains, and should be studied in a geological context.
›x.nikai Fc- Mg carbonates, sidcrit and ankcrit, but n4zory on vckový szfah mcJy.í sìücrìi‹›m and ankcrił‹›m are mzdiclnc. Nicktorf authors assume that the types of sidcrit and ankcrit (Izv. mctasomatick) originated in the jcdncj ctapc mincralirâcic. Others, such as H‹ i›š (I'X4I, I'X›I), state that these are two distinct types of mineralisation, mutually ‹xlüclcnć tckl‹›nickým hiätom. However, the author states that æra/ujc d‹› jcJncj mincraliyačncj clapy vzik y4klaJnóhn g +ilnfhn sidcritu. ILavsxv (I‹y74), T‹:-m• T‹!m••›••ż (ł98ł) poæžujt Òlnć forms ukliÒtanov za mctam‹›rfnć m‹›hiliyäiy
y. him.kch‹› ‹›kt›lia, čn rJłamcná, 7z mcdzi lýmito dvoma lypmi sidcritu jc značny ča»rý ‹xiiiup.

If prcdţx›kladámc scdimcntárnn-diagcncticky origin pznárnych uhlićïian‹›v. muxfmc prcdţx›kładai' aj viac-mcncj súćasný wik vtşænca a hbvncj maxy sid«rilu a ankcrii u.

Siderit

7 › šl **ruktúrn‹›-icxł** úrncht› hfaJiska **m‹›7n‹›** sidcrit ni7noslaaskćht› l‹›žiska **araJit'**
k **d›‹›m tyţx›m: ł. rãkladný sidcrił (îzv. mcłaa›matický sidcril),** 2. **ž‹lný** idcrił.

tllaxmú mass l‹›źîska t•'t›rí **/JkIadnj** lyy **sidcrilu (nbr. 4). Jc jcmn‹›yznný,** nickcdy
a7 afaniłický, dark. The most common ts'urf **tcnkć,** **cœ** 'î **cm m‹wnć** lavicc, **z'zicJkavcjšÎc**



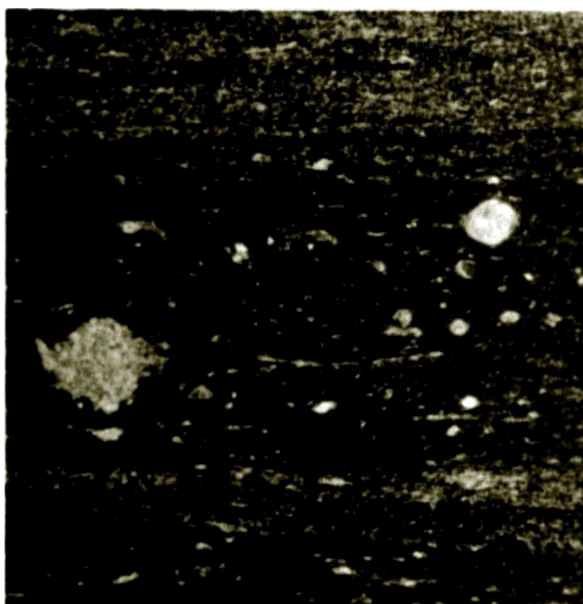
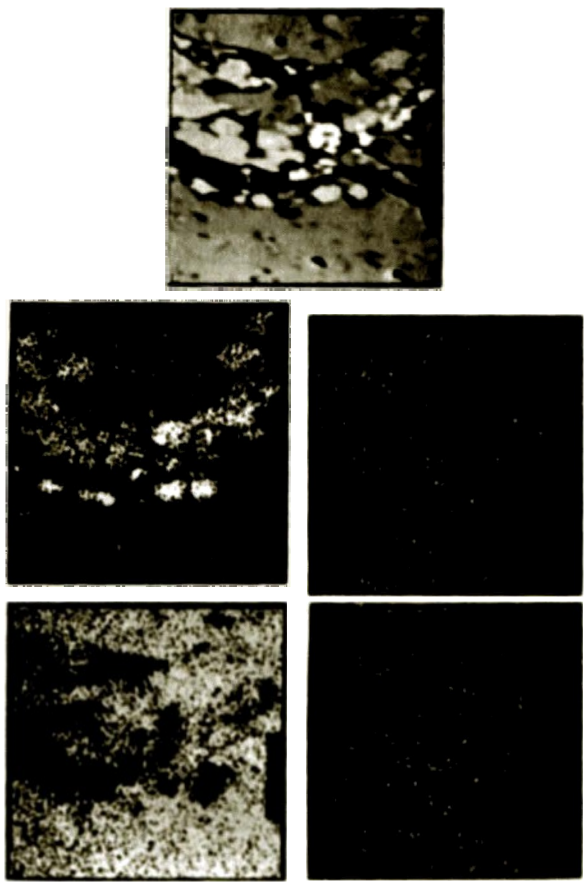


Fig. 4 3cautoezan{' zśMada¢ iyp sżdcńłu, k›Ł€lnc flastednc rckryśt•lizo•ant (svctlcjśic ć•ai) sac4u aż u paralelaou Icxtdrou. Boto L Osvxzo

Fig. 5 Tfaavć Isoiiny s b‹:jm, p:¥ocrac dobzc zachovan@ orgsnick{m dctńtom (dlomky itd a vtśkicn atnxnalolńm). Detail from photograph 5. Selection Ał P‹so L Osvxto

It is typically 10–15 cm thick. It has a typical parallel texture with thin veins of jmnolupcúovitého scricitu (originally volcanic natriá) and dark pigment of organic origin (Fig. 8). The grain size is irregular, allotriomorphic in shape, usually with a high frequency of prismatic grains. The grain size depends on the degree of recrystallisation. The recrystallisation of the basic siderite is quite intense, the size of the recrystallised siderite grains usually ranges from a few hundredths of a millimetre to a few millimetres, in which case the siderite acquires the character of strong siderite.



f ›r. 6 ?w¥ c+de mu and ankcnlu related to dark laminations in vm vt{cncj (photograph from ckkIrdxs‹ndlus mtkr¢+-nal zJtora . fi¢xn l3 Jo•cf'z:t a.

a — kc›mpcvú a. nradgcnte €¥Xl x, h — ptcdnó duinhócta I'c. c — pkdná dtsznhúcsa !¥fn. d — ptodnó dis!nhúcza CF, c — {›I‹4ná dcl nhúcsa '\ g

2iln{ siderite is coarse-grained, light brown and honey-coloured. It forms 2ilky with a nose of several centimetres to 1 m, which protrude *through the* siderite, but can also conform to the surroundings.

Siderite, together with ankerite, is also slightly present in laminated limestone, in the form of small, usually irregular grains or clusters of dark laminations rich in bituminous matter (Fig. 6). Under a microscope, it can be distinguished thanks to its lamellar structure, pronounced relief and optical characteristics (high refraction and refraction, pseudoabsorption in the frame) characteristic of siderite.

Tables 1 and 2 show the mineral and chemical composition of basic siderite and 2i1a siderite, as well as basic statistical characteristics. Ankerite is present in both types. The frequency of ankerite in siderite is high, reaching 70%, while its average content is low. The most significant difference between basic and fil-nem siderite is observed in the representation of insoluble residue, which reaches almost 10% in the basic type of siderite, while in 2il siderite it is only 2% on average.

It is noted that the Ni2noslansk siderite is highly iron-rich and also has a high MnO content. The MgO content decreases proportionally with the increase in FeO and MnO content. The MgO content in neither type of siderite generally exceeds 10%, but it appears that 7c 2i1n{ siderite is slightly more carbonated than the basictype of siderite. In some samples, e.g. NS-55/86, there are signs of certain zonality (Fig. 9), but overall, the MgO content in the Rytmo-Slansko siderite is more balanced than in siderite from other deposits in the Spiš-Gemer Ore Mountains.

Table Siderite (basic type) — **mineralogical** and chemical composition

x FcCO - 86.82% x
NZ - 9.73%

$F_{ank.}$ = 76,92 %
$\bar{x}_{ank.}$ = 5,66 %

	n	x	Range	Mcdiãn	S	V W
FcO	18	M,%	**53,15 — 60,59**	56.50	2.t3	3.76
gÕ	is	«.is	i,0z — +,as	**3,99**	**1,59**	**38.18**
C• *	!3	0.44	0.02 — 1.10	0.42	0.36	82.04
MnO '	13	3.M	**2,26 — 5,70**	**3,24**	0.84	**25.28**
COM	**18**	**39,16**	— 40.02	39, t3	042	1.33

Vysw{)ã"V y. g - § **j<rv,** x - pricmcmy ¢›bsah, S - **fiandardná c<lchy! ka·** V - vanatn$ kmF›cicnI.
- **ncreip9itn ?*y$ok.** P - **frequency** V **skytu**

The content of l'cG, MgO and .COC was determined =• ••‹ **kOu ITlctdclou and prcpr›Zitanj na lfXI "<** uhlifiian. Analysed by: U<<. fLWDr. 1. Tuxxm. Cfc., M. ItA€"LiRnVA. Cicologirky t\st•v Prfr‹xI¢wcdcckcj **fakully LK** in Bralistaw

Obcah CaO and MnG idol **determined** by mctG$ou AAS. Analy7.¢wali: Ing. V. 5zafiJxo. Clue.. A. ¢iAlaaYov1 Geological Institute **of the Faculty of Science, UK** in Bratislava

Tab. 2 Siderit žilný — minerálne a chemické zloženie

$\bar{x}$ $FeCO_3$ = 91,96 %
$\bar{x}$ NZ = 2,39 %

$F_{ank.}$ = 71,11 %
$\bar{x}_{ank.}$ = 3,57 %

	n	$\bar{x}$	Rozsah	Medián	S	V %
FeO	13	53,54	47,48 — 58,18	53,15	3,45	6,45
MgO	13	6,54	2,95 — 11,21	6,83	2,68	40,89
CaO +	8	2,79	2,45 — 3,13	2,95	0,26	9,28
MnO +	8	0,70	0,31 — 1,20	0,70	0,38	53,99
CO_2	13	39,94	38,87 — 41,31	40,02	0,78	1,96

Vysvetlivky ako pri tab. 1

The composition of the ore is characterised by the presence of Ba, Cu, Mn, Pb, V and Ti, whose content ranges from tens to hundreds of ppm. The siderite, which is present in the process of precipitation and recrystallisation acting as a nucleating agent, is significantly poorer in the content of trace elements (Fig. 10).
A marked difference can be observed in the representation of Ba, Cu, Pb, Ti and V.

Veľmi zaujímavé sa ukázali analýzy sideritu viazaného v čiernych bridliciach. V niektorých prípadoch tento siderit obsahoval približne 3x viac Mn ako siderit z uh- ere až okolo % MnO, thus representing a significant proportion of the inorganic content (Table 3).

Chemical composition of iron bound in thin layers of laminated vápenca sa pohybuje v rozmedziach chemického zloženia hlavnej masy sideritu a žilného sideritu (tab. 4).

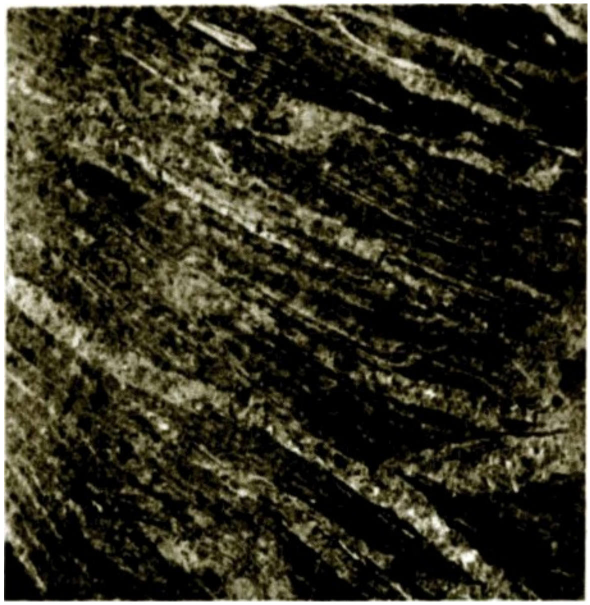
Tab. 3 Siderit z čiernych bridlíc — chemické zloženie, základné štatistické charakteristiky

	n	$\bar{x}$	Rozsah	Medián	S	V %
FeO	11	44,34	27,43 — 50,20	47,39	8,34	18,81
MgO	11	5,67	0,88 — 11,02	5,32	3,06	53,89
CaO	11	0,45	0,08 — 1,50	0,32	0,40	88,18
MnO	11	9,79	6,15 — 22,45	7,12	5,40	55,18
CO_2	11	39,79	38,34 — 41,51	39,77	0,94	2,37

Explanations: • base tidaj‹w, ? • pricmsm$ öuab. S - standard deviation. V • **•ariafny** ¥r<f•cicnt Vxorky f<›li anafyzzwand' na miknxnalyzdtorc I AX PV 9tN.

The analyses were performed on lQł ' uMłhtan.

Andyxovali: I' DnUscoUŃ €iĆIDŚ. kh '.Ł **TĆ •xzv1 6+eologisty dsłev Primdovodoctcj fakułly'**



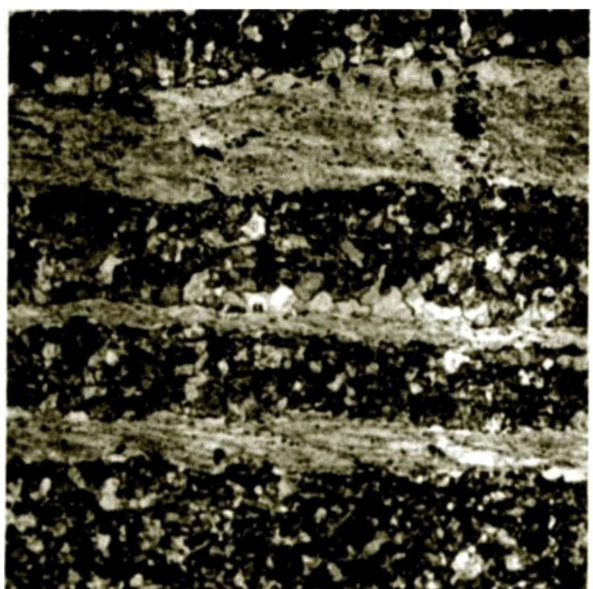


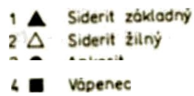
Fig. 7 Ćicrns brdłk• with po0słaymi ieakymi adsńto•o•asksńto•ymi pflohami. kto d vgćhr<›u mśpskeuj0

Fig. 8 Jsmnozmnt sdcńl s v$zezts pk›das {srakl Icxttrou. T}picŁ$m znaŁom is md ¥tnadaats Icn $¥Xóh aidcritu (tma•óe $¥flotty) až suetlajdfmi p>l‹zbami scńcłtu. 'v0ćścnic N < 'Zna

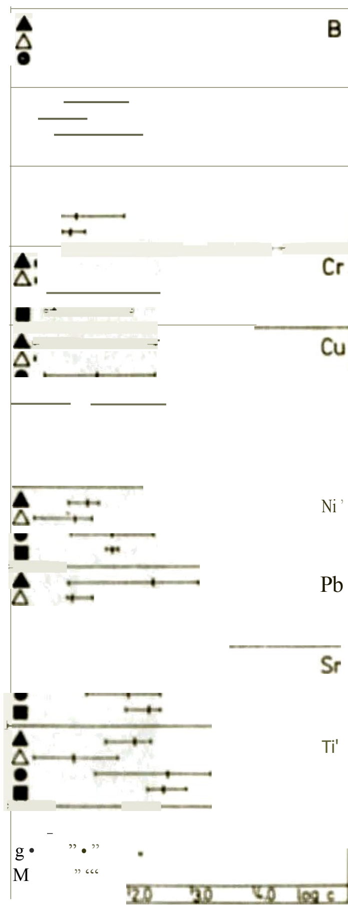
’I'ah. 4 hidenl z poi6h ve v4prrici — chcmic¥d zkdcnic. iJklodnf £izitiiirkd ciuntieriiuky

	n	x	Romah	Medián	S	VX
l•ef3	10	50.	45.40—54.B	50,86	2,54	4,99
MgO	10	S,19	2,88 — 10,60	4.40	t,fl	N,67
CnO	10	I.!0	0.00- JOO	0.45	1,40	126,88
MnO	10	3.17	2A —4.t2	3,t0	0,M	I7,t I
CO y	10	39.é6	39,02 — 41,19	39,54	0,64	1,61

Explanatory notes to Table 3



Obr. 9 Slabo sa prejavujúca zonálnosť sideritu. Kompozícia z rastrovacieho elektrónového mikroskopu. Zväčšenie 750 x. Foto D. £LATTt4 MVA.



tXsr. 10 Pnn•wnic c ssahu stash pr•tm • sadentc, enkcntc a •d nci

I — silent. zJkladn} lyjs. 2 — hint aadcm. 3 — sakcnt. 4 — —

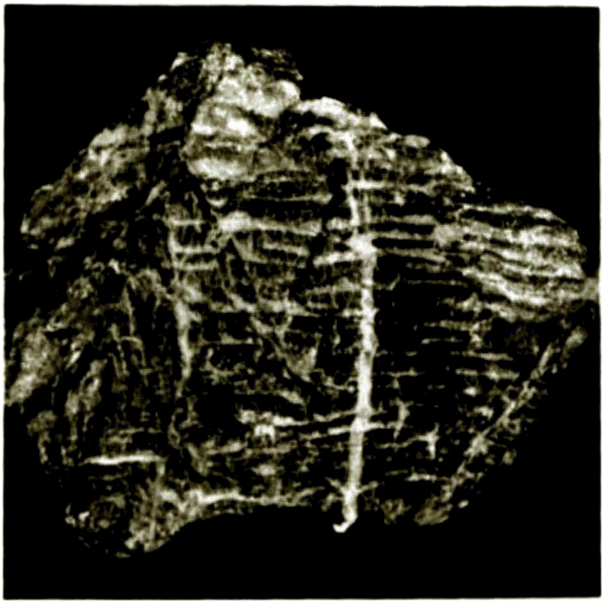
Ankerite

Ankerite occurs in the Nifnoslaosko lotisko, as does siderite, in two types:
1. basic ankerite (i.e. metasomatic ankerite), 2. 2iln{ ankerite. From a quantitative point of view, the first type of ankerite completely dominates.

In the basic type of ankerite, we find fine-grained siderite, known as tiger ore (Fig. 11), i.e. non-balancing siderite with a high Mg and Ca content, characterised in detail by samples from this deposit (I-£xnuã, 1960; Rouomix, 1989). It has been shown that both ankerite and fine-grained siderite form a transition zone between siderite and ankerite (Fig. 11), very similar to the transition zone between magnesite and dolomite, as defined by Tuann - Vwõová (1979) for the magnesite deposit in the Podre-êany — Kofice strip. I-fnnuã (l96fi, 1961) considers these tenur characteristics to be significant evidence in support of his theory on the application of solvation-aposial effects in the formation of the Nifnoslanský deposit.

Ankerite usually forms numerous, but only a few centimetres thick, layers, spatially most often associated with the locations of so-called metasomatic ankerite and siderite.

Ankerite, together with siderite, also occurs in laminated limestone, as well as in éier-slates. Its form in these rocks is the same as that of siderite, but its irvantitatfvac representation is usually rare.



Ohr. I) Prcch‹x1nt zone between s+dcnt¢n<+u (€••cIM ćasĘ a ankcnł (tm•\4 ćasĘ [x*lnhc›u, in’. łigcrcrz Pra 'd kilku tvriri anLc nt. I'c›in I I hx•al I›

MincrśJy dolozoitovo-ankcritoyćbo radu st zaMûpcnć v podstatc iba ankcńtoœ, ojcdinclc Fc-dolomitom.

Ankcńtu samples often contain sidcńt, frckvcoÒu jcbo výskytu in ao-kcritc, as well as chczoické >lnfirnir and jcho ytklnrlnë ff0ţisłirŁń cbaraktcristiky **uvtdzaœc** in tabufkc 5.

Table 5 Anżcńl (basic type) — mincrślnǿ and cbcmîcké xIœcni«, xAkladać łlntfstirk¥ charactcńsliky

$\bar{x}$ CaMg, $Fe(CO_3)_2$ = 81,33 % $F_{sid.}$ = 23,20 %
iNX - t6.67Œ - 3.0tŒ

			Rozsah	Medián	S	V9&
FeO		16,73	3,80 — 24,72	18,06	4,94	29,54
MgO	43	t0.79	5,63 — 19,36	9,92	3,19	29,56
CaO	43	Æ.12	25,58 — 29,90	27.99	0.W	2.67
MnO	16	2,12	0.95– 5.26	1,80	0.9	44.Œ
CO_2	43	44,28	42,55 — 46,94	44	1,05	2J8

Explanatory notes as in lab. ł

The Fc content in the sample is high, most often ranging from IN to æ e‹ Fell, with a minimum of 6.5%. The FcO content of less than 10% was not detected in the lużisko part. The presence of Fc-dolomite and dolomite can only be observed in the ukra-j‹›vých parts of Io7îska at the contact with vtpcncami.

If we compare the FcO (and MnO) content in Nilzinlansk anhcrite with the content of these elements in anhcrite from Rudnany in Slovakia, we find that the Fcł3 and Mn‹› content is significantly higher.

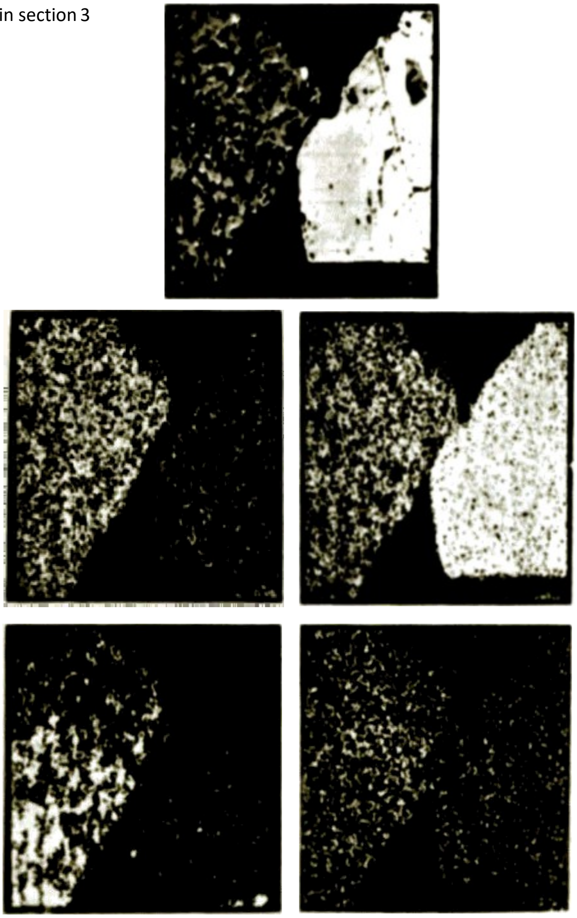
It turned out that with an increase in FcU content, the growth rate o f MníJ reached 2.ł %. However, it is surprising to find that the nickel content in the ore is not significantly higher than in the tailings (Fig. f›), even though it is **higher** than in the concentrate. **The** high frequency of black bridges is significant in **Tao's classification** (1965) as kulnoborıï. Rur<licl in the content of MnčJ in the ankcńtu documents and photographs 12 a-c, on which: /c›hrazcná k‹›mpozJcîa vzrky a plcšnć rlisłńhfirir prvkov Mn, Fc, IN a Mg v zrnc ankcril u (A) a *idcritu (B) scparoyanć ze vzrky NS-3ł/3ó.

íłhsah stupových elements in ankcritc (Fig. ł0) jc poroynaîcíny with the content of trace elements in r4¥lndnr•m siderile, opr‹zi chlorine anŁcril obs hujc p•xisiatne *Mac Mr. VIšl jc i ‹á›sah Ba, Ł”c›, Ni and V, and on the other hand, the content of Mn, which is associated with the presence of Sr in carbonates and Ca (whose content is significant in the radc sidcrił — ankcrit — Fc-dc›lcmit — váspcncc) and with the exception of ncuhličitanovćhu ţx›diclu.

Table 6 Ankcnt from fîcmych brîdlic — chcmick5 do7<nic, zâkladn5 CtatistirkZ ch•rakıcrîstiky

	n	x	Rozsah	Mcdiân	S	VW
FcO	3	I2W	t0.46 — t44l	12,11	1,88	8,16
MgO	3	8.97	7.67 — 10.01	9,22	1,19	13,27
CAO	3	2.8d	19,41 — 23,21	22.9t	2.1t	9.67
MnO	3	13.88	11,50 — 15,84	14,29	2,20	15,84
CO	3	43.18	42,82 — 43,86	42.86	049	1,36

Explanatory notes as in section 3



tlt*f. l2 ÛfftÂ $tdc nlu 8 8nh8n!u f kuıno!u*n!8 I 8cpbfVnnfld f ÖcrftşTh ftndlİc (folognfle / clckl fiîflrntht› mıkroannı Iron . l'‹uu 11. tam iz

a — knmpr•ricıa. zvsddcnıc . ¥'I x. h — }›IcdnJ drctnhücıa '\Xn. r — pk tnJ dıstnhürıa I'c. d — plcdnJ dclrshûcıa Ca. c — plo6n5 dı•fnh6cıa '\4g

Pdprncc

The limestone formations in the subsoil and above the soil surface are characterised by structural features. For greater characterisation, the texture is examined together with its surroundings, i.e. with the surrounding areas. In limestone, unlike in sidcritc and aakcńtc, the occurrence of rckrystalîzdcic can be explained by the fact that calcite in poroyoaaf with ankcńtom and sidcritoro is thermically the most stable. Its technical strength is roughly equal to that of sidcrit and ankcnt.

For limestone deposits, it is characteristic to find small fragments, randomly oriented particles from the immediate surroundings (Fig. II).

Lime mortar is usually clean, with an insoluble residue content of 2 to 30%, and an average insoluble residue content of 16.22%. Lime with a coarse texture is usually cleaner, with a CaCU content of up to 9%.

We confirmed the presence of sidcrit and ankcrit in the calcined lime by weighing the organic matter, as we captured the carbonates in the heavy fraction. 's separation in heavy liquids provided us with sufficient moo7ztvo side:rituvých and ankcrit‹›vých zźn for further study.

The presence of siderite and ankcrit in limestone locations was determined using mantic, derivatographic, optical methods by measuring indices and using the Edax microanalyser.

The mineral and chemical composition of limestone, as well as its basic physical characteristics and the frequency of occurrence of impurities and inclusions in limestone, are listed in the table. 7. The column of the limestone is very dense, usually with a high content of clay and organic matter.

The limestone is characterised by high Yeah FcíJ and MnčJ, mainly due to the presence of carbonates (sidcrit, ankcrit) in the limestone, with occasional pyrite. In some parts of the deposit, where c›xďteć lxxi-

i :II› 7 \ aȚ<ntc — mincrtlnc and chcmické rłažcnic, zdkladnY Ctaeclicżf charabtcnGtiky

f('a('(), 77.St /T

x̄ NZ = 16.22 %

$\bar{x}_{ank.}$ = 67,90 %

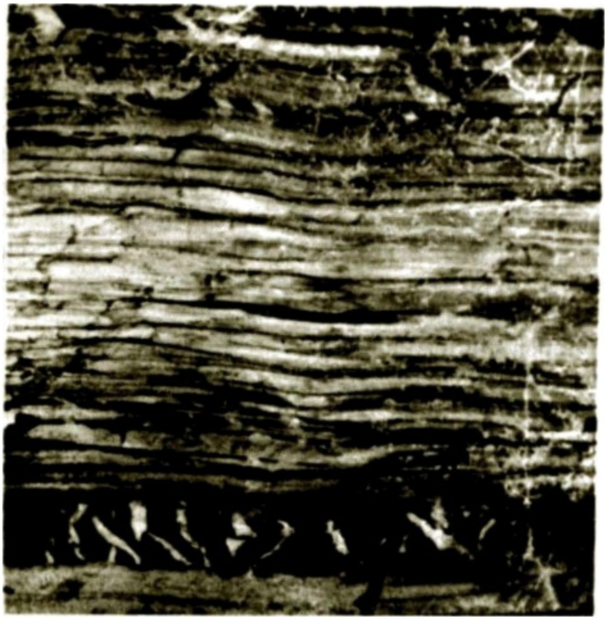
$\bar{x}_{ank.}$ = 5,21 %

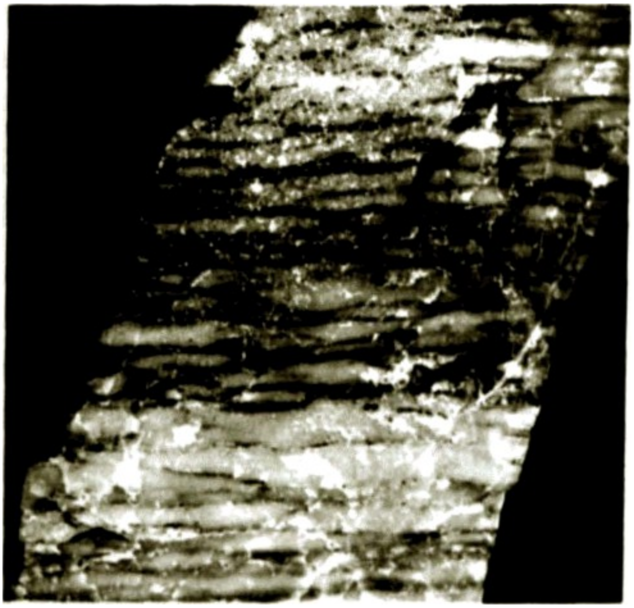
$F_{sid.}$ = 22,20 %

$\bar{x}_{sid.}$ = 0,62 %

	n		Rnzmti	Medián	S	V %
‹”a‹›	22	*9.07	44.12 — 54.80	52.80	1.07	2.15
MgO	22	I.J3	0.00 — 2.07	0.62	0.15	11.60
Fc‹›	22	4.93	0.65 — 12.72	3.20	1.fij	32.93
MnO*		0. łt	0.53 — 1.57	0.93	0.26	26.10
CO_2	22	44.03	4*.74 — 1 I,vț	43.77	0.27	0.hț

Vysvetlivky ako pri tab. 1





¢Xsr. 13 Vfzaznc laminated •dpcncc with Icnkou wstvićkzxs Fc-doł¢xniłu (imwś ćasf} with v$taznjm xactdpsnfm sckuridgmycls filick doI‹xnitu (bick) s«kmćncho pd•odu in the position of the rJkładncho type ankcntu. Fołо L Osvxco.

Fig. I4 Tcnk€nmtcwtar}' jcmnołamin‹:nran} vtpcnec c hojnjm zageńpcnfm kcmatitu v tmavjch laminśch.

The grains, **which** may be **Fc or** Mr, **vary** in size. The hematite flakes **are usually evenly distributed in the cement, but they may also** be **concentrated in** the pores, 1 mm thick (Fig. 14).

However, **even calcite deposits** have **a** higher **content of FcO and MnO (Table 6),** which **is many times higher than the content of these elements, for example,** in **the** limestone **deposits of** the Carpathians (Less, 1989; Łam«ovż, 1989).

The trace element content in limestone, apart from a significantly higher Sr content and a lower
Mn content, is roughly the same as in the ankerite, and sometimes even in the siderite mass (Fig. 10).

Table ß 7'wż calcite — chemical composition, basic physical characteristics

	n	x	Extent	Medina	S	In %
CnO	Œ	S3.W	52.44 — S4.76	53,43	0,78	ł,4S
MgO	20	0.02	0.Œ- 02I	0	0.05	312.43
f'cU	20	1.61	0.46- ĘŒ	1.73	0.8S	SZ.9t
MnO	20	0.92	0,53 — 1,26	0.92	0. l9	20.t4
CO_2	20	43.73	43,59 — 43,84	43.7ł	0.fB	0.7

Explanatory notes as in Table 3

Discussion

Nižacslanský Inž*skc **jc všohcnc pnvaž‹vané ya hydrntcrmálnc** — mctasomatickc. A^ »‹›«w (195fi), Vax‹•x (ł97tł) and /aLšf authors predicted that idc ‹› hiohcrmné formations, in which æ r‹›yzriicrtncnic *dcritnvých and ankcritnvých **ţx›lùh** riadilt› prcd‹›vsčtkým prcdrudnou icktcniknu a alcktfvnnu mciasnmatńynu. Ncprfîcmnr›sl' c›rjţanickych zvyšk‹›v sa pripčs‹wala na wuh mctasnmatt'îze.

In the latter case, it was possible to obtain a microcrystalline, lamellar, clean ancitric ojcdinclÿ výsŁyt organic dctńtu, which Mišis **(ïL«nc pndaaic)**
identified as fragments of ossicles and fibre-like tree trunks. The organic detritus points to shallow water, lagoons, or shallow seas. However, their silence in the laboratory confirmed that there was no evidence of organic origin. In the opposite case, we would have to find organic remains in small areas of coal deposits, at least in the vicinity.

The theory of the macroscopic origin of the fossils is supported by a number of false facts. These are mainly the presence of fossils in the soil, which are not typical for these types of formations. There is not a single word in Latvian that could be considered a direct equivalent, but the character of the word is similar to that of the Latvian word. Okrcm in the carbonaceous body, but also outside it, and occurring in an insignificant amount of small particles, it only has a marginal position.

One of the important arguments for assessing the general condition of this deposit is the fact that no sedimentary layers were found in the laminated deposits in the overburden or in the subsoil, although veins and veins of sidcńtu c ankcńtu are represented in the solitary sideńtových and ankcńtových polob4ck. In the vicinity of boron deposits, e.g. in black shales, small veins of sidcńtovć and aokcńtovć occur in cases where the concentration of these minerals in the dispersion form is significantly high. The fact that the representation of carbonates in veins is governed by the quality of the dispersed carbonate mineralisation indicates the origin of the carbonate veins, which are the result of metamorphic processes.

It was also found that the limestone in the peripheral parts of the deposit, which is "unsuitable for metasomatism", contains ankont and siderite. The occurrence of these minerals in limestones is limited only to distinct laminated positions with dark pigments of organic origin. In limestones without dark laminations, on the contrary, hematite is locally present. Siderite in dark laminations is accompanied by chlorite, **goethite** and abundant pyrite.

The spatial relationship of sidcrit to dark laminations indicates that a lithological factor played a significant role in the formation of Fc (Mn) carbonates, which **require** a reducing environment **for** their formation. Organic matter played a decisive role in the formation of the sidcrit deposit in Nižncj Slancj.

The presence of these minerals in this deposit can be explained by the decomposition of organic matter, from which carbonates and silicates were formed during the diagnostic and metamorphic stages. These rocks within the deposit created a reducing environment, but they could also provide the CO necessary for the formation of carbonate minerals.

From a geochemical point of view, the association of sidcrit — ankcrit — pyrite is excluded. P‹xlfa Mor vx ct at. (t992) the presence of sulphur ions blocks the formation of sidcrit, but causes the formation of pyrit. Sidcrit can only be formed by xa vhcdnŷch ț›udmicnuk (presence of COC and after depletion of Gfry.

In our case**,** it was a micro-reducing environment, already in the diagnostic stage, which was conducive to the formation of sulphur and anchors. In the case of planktonic furic organisms, there was, at least in the early diagnostic stage, a decrease in IJ, and the medium was suitable for the formation of sidcritu.

According to Bnx•r.ax (UTI), in the post-acidification stage, after complete consumption of acid, sulphides are formed, and their **release** into the methane layer can cause a sudden increase in acidity. **BrRNFR (UI)** and M‹v›•xna (ł962) **describe** the occurrence of sulphides in the Adamson-Carbon deposits in the USA, to which they attribute a diagnostic value. The authors assume that in the reducing environment created by planktonic organisms, all oxygen and post-oxidative and even manganese were consumed.strcdic A›l‹› vhtxlnć on the formation of sidcritu and other **minerals** - r‹xlochrezïtu, vivîanitu, glaukcniïu ald.

On the other hand, the presence of hematite in the sediments at **Inžisko** Nižá Slanã indicates that, at a certain stage of development, cixidic processes also took place in the sediments.

Basic types of uMićitaa0v st si svojfm cbcœickÿœ dožcnfoi, stupßom zocčistcaia and cbsahom 6topových prykov vcfœi błJzźc. The **increased** content of Mn and, to a lesser extent, P, in the soil, plants and **fruits** indicates that the soil is rich in these elements, which are important for plant growth and development.

It is unfortunate that æ ratiaf failed to realise the potential of uhlßa and kyslfka z. uhlićitanov of this deposit.

Záver

Based on the current state of knowledge, it is difficult to draw any conclusions about the origin of the H<leza deposit and the conditions *for the formation* of carbonates in the Nižná Slaná deposit. However, it is not necessary to look for explanations in deep magmatic sources, as has traditionally been the case.

The transport of hydrothermal solutions with a high Fc (Mn) content from deep magmatic sources explains the overall localisation of sidcritovo-ankcritovo positions within the karh‹›, but mainly the fact that in the Lužice basin, the predicted hydrothermal output is never exploited using the existing technology.

The deposit has a distinctly stratiform character. We assume that the sedimentary-volcanic complex will provide sufficient material for the formation of carbonates. Sedimentary-diagenetic and metamorphic processes played a decisive role in the formation and shaping of the lower part of the tectonic deposit.

Ni7nt›sIanskć ridcrity and ankcriîy are characterised by relatively stable chemical properties. The Fc and Mn content is high, but the Mg content is lower than in most siderite deposits. Both siderite and ankcrit are rich in Mn. However, the limiting factor for the utilisation of this raw material is the content of 8iU Air Ph and Ickálnc i Sh.

Literature

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Explanations to figures

Pig, I litné Slam, section acrraa hgan6 dspmit, section 32 (after MtynnR in STvix, 1967, modified by

I — loam, talta, 2 — 3 — gzaphitc•acñcitc and ssricitc phyilitcs, 4 — scricite-graphitic and graph›Hcphyilit«s wits lydites, s — subjacsnt asricitc phyilites, s — lieastons, 7—ankcritc, 8 — sidcritc

Pip 2 Thin-bodied limestone incrusted with numerous dark laminas cotourad with organic pigment. Photo: L Ozvxto

Fig. 3 Distinctly laminated, very impure limestone with a mineral residue content of as much as 40%. Organic detritus was crushed in dark laminations. Photo: L. Osvwco

Fig. 4 Pine•graiftad, basic type of cidsritc, kxally partly zecrystallizad (lighter }aNx) with pzssszwd parallel structure. Photo: k OsVAto

Fy $ Dan laminate with abundant fairly wet prmcrved organir dciriius (uirocod fraginenti sud cirornnioliie fibrei). Cf c-up view: Hngn. D x, parnlkl nirols. Plioto: 1- OsvnLo

Rg, 6 Sidsrilc and ankcritc graina bound to dark laminas ki limestone (electron-mksoprobc photograph). Photo: D. Mtaduzx
a — ¢omp‹uition, magic. 6¢€I x, b — Pc annal dktzibutkxi, c — ?da ams! distzihulion. d — Ca annal dktribution, e — fdg amsl distrihulion

Pig, 7 Black sMlss with a number of thin sidcrilc•ankcriIc byszs which m‹utly follow schisi ity. They arc oficn f‹flded in detail. **Plato:** L Osvazo

P 8 Pus-gzained aîxtcrîtc of d tiscti•s plaajazaNl uztxtaze. Ita fyp al fcat•zs is aîdczî‹e laysa (dark) re ted attcraa •ak I' icr asrxztc . Pt rallal a Btaso L Osvxzo

Magn

750 x. Photo: D. BARÁTHOVÁ

t'ig. 10 Comparison of iron elements in side riie, arikerilc and limestone 1 — siderile, hasic type, 2 — vein sideritc, 3 — ankerite, 4 — limesiiine

D'g. I I 'Franucn+ ronc hctwccu and cdcdlc (Wght) and mnkcn+c (dart) lz)cr, sm-czMcd ñgcncc. 'tic ñgñT veinlei consists of ankcrile. Photo: I.. Osvat.ti

Fig. 12 Sidc rile and ankc rite (kutnohon ie) grains 6cpu rated frc›m hlark shales (c incl mn-mir mprot›c photographs). Photo: l3. Jxslts
a—competition, magn. 3/XI x. h — Sdn areal distribution, c — l'c areal distribution, d — ¢â areal distribution, c — Mg areal distribution

Fig. 13 IJisiinctly laminated limestone with a thin layer of limestone (dark) and a layer of hasir-lypc ankcrilc interlaced with abundant sccrclien vcinlcts nf secondary dolnmilc (white). Photo: t.. f1vwl.a

Fig. 14 Finely intercalated limestone with dark hemilite laminations. Photo: l.. C?swxto