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Dr FERDINAND PRANTL:

VÝSKYT RODU VOLBORTHELLA SCHMIDT V ČECHÁCH (NAUTILOIDEA).

ON THE OCCURRENCE OF THE GENUS VOLBORTHELLA SCHMIDT IN BOHEMIA (NAUTILOIDEA).

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Dr FERDINAND PRANTL:

Výskyt rodu Volborthella Schmidt v Čechách (Nautiloidea).

On the occurrence of the genus Volborthella Schmidt in Bohemia (Nautiloidea).

(Předloženo dne 16. X. 1948.)

Drobné schránky rodu *Volborthella* SCHMIDT, 1888 náležejí k nejzajímavějším a zároveň i k taxonomicky nejobtížnějším kambrickým zkamenělinám vůbec. O systematickém postavení a fylogenetický význam tohoto rodu byl do poslední doby veden prudký spor, který dosud není zcela jednoznačně rozřešen. Pouze zásadní otázka, zda lze totiž tento rod považovati za nejstaršího, dosud známého primitivního loděnkovitého hlavonožce *(Nautiloidea)*, je jak se zdá již rozřešen s konečnou platností, a to kladně.

Zeměpisné rozšíření rodu *Volborthella* SCHMIDT, 1888 je dosti značné. Je znám z SSSR (Estonska), Norska, Švédska, Polska, Kanady (New Brunswick) a j., a to vesměs z uloženin spodnokambrického (taconského) stáří. Pouze v Kanadě byl nalezen i ve vrstvách stáří střednokambrického. Nejnověji byl tento rod zjištěn i v střednokambrických paradoxidových břidlicích skryjských ($c\beta'_2$) oblasti skryjsko-týřovické. České nálezy shodují se svou morfologickou stavbou, velikostí i charakteristickým způsobem zachování ve všech podstatných znacích s genotypem rodu *Volborthella* SCHMIDT, 1888 (*V. tenuis* SCHMIDT, 1888) a odpovídají jeho popisu a vyobrazení, jak je podal F. SCHMIDT (1888), A. P. KARPINSKIJ (1903), a zvláště O. H. SCHINDEWOLF (1928, 1934) a R. THORSLUND & A. H. WESTERGÅRD (1938). Vzdor tomu nejsou s ním podle mého názoru zcela druhově totožné. Pokládám je za zvláštní novou subspecii nebo mutaci, pro kterou navrhuji pojmenování *Volborthella tenuis bohemica* nov. subspec.

VOLBORTHELLA SCHMIDT, 1888.

Genoholotyp, na základě jednoznačnosti, druh *V. tenuis* SCHMIDT, 1888.
Stratum typicum: Eophytonový pískovec (zona s *V. tenuis*), spodní kambrium (Esthonium).
Locus typicus: SSSR. (Estonsko).

Rod *Volborthella* SCHMIDT byl dlouho považován za monotypický. V poslední době rozlišil však O. H. SCHINDEWOLF (1934) v topotypickém

materiálu z estonského spodního kambria další druh, který nazval *V. conica* SCHINDEWOLF, 1934. Druh *V. tenuis* SCHMIDT, 1888 rozpadá se podle mého názoru ve dvě subspecie nebo mutace, a to typickou *V. tenuis tenuis* SCHMIDT a zde popsanou *V. tenuis bohemica* nov. subspec. První z nich je svým výskytem omezena hlavně na spodní kambrium (T a c o n i a n) atlantické provincie, zatím co biostratigraficky mladší forma česká byla nalezena v střednokambrických paradoxidových břidlicích skryjských ($c\beta'_2$) oblasti skryjsko-týřovické. Nálezy z střednokambrických paradoxidových břidlic v Kanadě (New Brunswick), označované dosud rovněž jako *V. tenuis*, bude třeba podrobiti revisi.

VOLBORTHELLA TENUIS BOHEMICA nov. subspec.

Holotyp, zde označený jedinec, vyobrazený na tab. I., obr. 1. (A).
Stratum typicum: paradoxidové břidlice skryjské ($c\beta'_2$), stř. kambrium.
Locus typicus: Luh u Skryjí.
Derivatio nominis: bohemicus (l.) = český, podle země původu.

D i a g n o s a: Subspecie nebo mutace druhu *Volborthella tenuis* SCHMIDT, 1888 lišící se od typu větším apikálním úhlem (13—16°) svých kuželovitých schránek.

P o z n á m k y a v z t a h y: Detailní popis a vztahy této nové subspecie nebo mutace jsou podány v anglické části této práce, k níž odkazuji.

V ý s k y t: paradoxidové břidlice skryjské ($c\beta'_2$); „Dlouhá hora" u Skryjí; Luh u Skryjí, cesta k *„parýzkám"*; Týřovice, naleziště *„pod hruškou"*.

Závěrem pokládám za milou povinnost poděkovati na tomto místě pp. Dr. J. JARKOVI a M. ŠNAJDROVI za laskavé přenechání materiálu k zpracování a tím i za umožnění této práce.

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The minute shells of the genus *Volborthella* SCHMIDT, 1888, belong among the most interesting but also taxonomically most difficult Cambrian fossils. Untill recently the systematic position of this genus has been very controversial and the question has not yet been finally answered. Only the fundamental question whether the minute shells of the genus *Volborthella* SCHMIDT, can really be considered the remains of the earliest primitive *Nautiloidea* seems to have been finally answered, and that in the affirmative. This has been due especially to the detailed morphological studies by O. H. SCHINDEWOLF (1928, 1934, etc.), to which I refer the reader.

The genus *Volborthella* SCHMIDT, 1888, has a fairly wide geographical distribution. We know it from the Cambrian deposits of the U. S. S. R. (Esthonia), Norway, Sweden, Canada (New Brunswick) and elsewhere. Quite recently this genus has been found also in the Bohe-

mian Cambrian of the S k r y j e a n d T ý ř o v i c e A r e a. As in many respects these specimens does not lack a special interest we wish to give of it a more detailed report.

The shells of this characteristic genus were found in Bohemia in the P a r a d o x i d e s S h a l e s o f S k r y j e ($c\beta_2$) and therefore in beds of indubitably Middle Cambrian age (A c a d i a n). In all other foreign Cambrian areas (with the exception of N e w B r u n s w i c k) the genus *Volborthella* SCHMIDT, 1888, is known only from the Lower Cambrian beds (T a c o n i a n). For this reason this genus is generally counted among the leading fossils of the Lower Cambrian (T a c o n i a n). The Bohemian specimens correspond in their morphology as well as in size and mode of preservation in all characteristic features to the genotype of the genus *Volborthella* SCHMIDT, 1888 (*V. tenuis* SCHMIDT, 1888) and to its description and figuring as given by F. SCHMIDT (1888), A. P. KARPINSKY (1903) and especially O. H. SCHINDEWOLF (1928, 1934) and others. Nevertheless they are in my opinion not quite conspecific with it. I consider them to be the representatives of a separate subspecies or mutation, for which I propose the designation of *Volborthella tenuis bohemica* nov. subspec.

The first find of *Volborthella shells* in the Cambrian of Central Bohemia was made by J. JARKA, but he unidentified them generically and recorded them in his paper only under the designation of *Problematicum* (J. JARKA, 1940). Subsequently only F. PRANTL (1942) placed his finds in the genus *Volborthella* SCHMIDT, 1888.

VOLBORTHELLA SCHMIDT, 1888.

Genoholotype, by monotypy, the species V. tenuis SCHMIDT, 1888.
Stratum typicum: Eophyton Sandstone, zone of *V. tenuis* (A 1 b), Lower Cambrian, Esthonian.
Locus typicus: U. S. S. R. (Esthonia).

Until recently the genus *Volborthella* SCHMIDT has been considered monotypical. Recently however O. H. SCHINDEWOLF (1934) has determined in the topotypical material of the species *V. tenuis* in F. SCHMIDT's original conception (1888) another species, which he called *V. conica* SCHINDEWOLF, 1934.

Though many authors had dealt with the species *V. tenuis* SCHMIDT, 1888, earlier than O. H. SCHINDEWOLF, yet none of them had established its lectotype before. Not even O. H. SCHINDEWOLF (1934) did so, though he emphasized that the most typical of SCHMIDT's syntypes were the specimens figured by him as fig. 29 and perhaps also as fig. 28 on pl. II (F. SCHMIDT, 1888). I propose therefore that the specimen figured by F. SCHMIDT in 1888 as fig. 29 on pl. II shall be considered in future the lectotype of the species *Volborthella tenuis* SCHMIDT, 1888, emend. SCHINDEWOLF, 1934.

In my opinion the species *V. tenuis* SCHMIDT, 1888, emend. SCHINDEWOLF, 1934, has to be divided into two subspecies or mutations. The ty-

pical *V. tenuis tenuis* SCHMIDT, 1888, occurs principally in the Lower Cambrian (T a c o n i a n) of the Caledonian geosyncline (Atlantic Province) in the conception of A. W. GRABAU (1936). The biostratigraphically younger *V. tenuis bohemica* nov. subspec. was found in the Paradoxides Shales ($c\beta'_2$) of the Middle Cambrian of Central Bohemia. The specimens in the Paradoxides Beds (A c a d i a n) of N e w B r u n s w i c k, called likewise *Volborthella tenuis* SCHMIDT will have to be redescribed.

VOLBORTHELLA TENUIS BOHEMICA nov. subspec.

Holotype, here described, the specimen (A) figured in fig. 1 on pl. I.
Stratum typicum: Paradoxides Shales of Skryje ($c\beta'_2$).
Locus typicus: Luh near Skryje.
Derivatio nominis: bohemicus Il.) = Bohemian, after the origin.

T h e m o d e o f p r e s e r v a t i o n of the Bohemian specimens does not differ at all from the characteristic fossilisation of the shells of *Volborthella* SCHMIDT as known from the classical localities of E s t h o n i a and elsewhere. The shells are without exception preserved only as casts without the slightest trace of the original outer test. The material of fossilisation of these casts is predominantly a very fine quartz silt with an argillaceous admixture and more or less impregnated with pyrite. Some casts show a stronger or slighter flattening or bend or also other deformations, all indubitably of post-mortal origin.

D i a g n o s i s: Subspecies or mutation of the species *V. tenuis* SCHMIDT, differing from the type by the greater apical angle (13—16°) of its conical shells.

D e s c r i p t i o n: Minute, slim conical shells of a circular cross-section, the surface decorated with a fine crowded tranverse striation. The apical angle of these shells varies in non or slightly compressed specimens between 13 and 16°. More deformed specimens showed of course much smaller (min. 11°) as well as much greater angles (max. 20°). Proximally these shells are generally damaged and incomplete. The length of the fragments collected varies generally between 4,75—5,35 mm. More complete shells with a length up to 8 mm. were found more rarely. The distal ends of the non or little compressed shells have a distinct, regular, conical depression whose walls form with the surface of the shell an angle of about 100—110°. In more compressed specimens this conical depression is of course more or less deformed and becomes even indistinct. In favourably preserved specimens the bottom of this depression has generally a minute, circular opening (0,16—0,18 mm. ∅). A similar, centrally situated, minute, circular opening is sometimes visible also on the surface of fracture where the proximal part of the shell was broken off.

T h e i n n e r s t r u c t u r e of the shells is the same as determined by O. H. SCHINDEWOLF (1934) in the topotypical material of the species *V. tenuis* SCHMIDT and *V. conica* SCHINDEWOLF from the Esthonian

Lower Cambrian. The material of fossilisation is as already stated predominantly a very fine quartz silt with a greater or lesser share of argillaceous admixture and generally also with fairly abundant pyrite, etc. The pyrite forms either irregular accumulations and impregnations or occurs in larger, very well developed authigenous crystals. I wish to mention here that the relative amount of quartz silt formed of minute sharp-edged quartz fragments is in these *Volborthella* shells incomparably greater than in the adjoining Paradoxides Shales of Skryje ($c\beta'_2$), which surround them. Consequently the cross sections of these shells appear in slides much lighter than the surrounding shales.

This material of fossilisation of the *Volborthella* shells of the Bohemian Cambrian shows in transparent longitudinal sections a very characteristic arrangement, indubitably according to a law, just as O. H. SCHINDEWOLF (1934) found it typical for shells of the genus *Volborthella* SCHMIDT. Except for the farthest distal end of the shell where the arrangement of the material of fossilisation is rather irregular we observe in longitudinal sections transverse, quite narrow lighter zones formed predominantly by fine quartz silt alternating fairly regularly with just as narrow or slightly broader daker zones composed predominantly of argillaceous particles. These zones include often also more or less diffuse impregnations of pyrite, which have the same orientation. The minute, sharp-edged quartz fragments and splinters in the lighter zones are besides mostly arranged so that their longer axis or side is generally parallel with the direction of the whole zone. These zones formed by the regular, characteristic alternation of coarser, lighter and finer, darker material of fossilisation are inclined obliquely from the lateral border of the shell towards its longitudinal axis, with which they form an angle of about 50°—55°. The axial tube, to which corresponds the central, minute, circular opening mentioned above, is because of its small diameter (0,16—0,18) rarely well exposed in the longitudinal sections. Most frequently its course is marked by a narrow, characteristic, continuous interruption of the zonal arrangement of the material of fossilisation. In its course the minute quartz grains and fragments lack their elsewhere regular zonal arrangement, and sometimes they even seem to be placed so that their long axis or side is approximately parallel with the length axis of the shell. The lateral limit of this central axial zone which according to O. H. SCHINDEWOLF (1926, 1934) corresponds to te filling of the axial tube in the genus *Volborthella* SCHMIDT is in the Bohemian material relatively sharp. In other cases the course of this axial tube is marked by a thin zone of more or less diffuse pyrite impregnation or only by a row of larger crystals of authigeneous pyrite.

R e l a t i o n s: The *Volborthella* shells of the Middle Cambrian of Central Bohemia, which I designate as *Volborthella tenuis bohemica* nov. subspec. agree in their shape, ornamentation, size and inner structure in almost all details with the description of shells of this genus given by F. SCHMIDT (1888), A. P. KARPINSKIJ (1903) and, more recently, by O. H. SCHINDEWOLF (1934). The only primary morphological difference from the species *V. tenuis tenuis* SCHMIDT, 1888, and *V. te-*

nuis bohemica nov. subspec. is the different apical angle (13—16°). The typical form *V. tenuis tenuis* SCHMIDT of the Lower Cambrian of Esthonia has slightly more pointed shells. According to O. H. SCHINDEWOLF (1934) their apical angle averages 8—12°. P. THORSLUND and A. H. WESTERGÅRD (1938) record even smaller angles (8—11°). The species *V. conica* SCHINDEWOLF (1934) from the same beds is characterised by a slightly greater apical angle averaging 16—17°. Thus the Bohemian specimens occupy with regard to their apical angle an intermediary position between *V. tenuis tenuis* SCHMIDT and *V. conica* SCHINDEWOLF. I did not find any other differences between them. Still, I consider this difference in the size of the apical angle sufficient to separate the Bohemian species under the separate designation of *V. tenuis bohemica* nov. subspec.

I am strengthened in my opinion by the fact that the Bohemian material comes from much younger beds (Paradoxides Shales of Skryje, $c\beta'_2$; i. e. Middle Cambrian) than the typical *V. tenuis tenuis* SCHMIDT and *V. conica* SCHINDEWOLF described from the lower layers of the Lower Cambrian. As emphasized by A. W. GRABAU (1936) a. o. the faunas of the Lower and Middle Cambrian have hardly any identical forms. Only a few genera are common to both formations. In my opinion it does not seem very likely that just the genus *Volborthella* SCHMIDT, 1888, considered by many authors to be allied to the ancestral form of all the *Nautiloidea* should have surpassed the other contemporancous forms in persistence. I am course aware that in a pelagic form as *Volborthella* SCHMIDT indubitably was, the mutations could go on much more slowly than in other forms. Thus I consider the Bohemian *V. tenuis bohemica* nov. subspec. an evidently younger evolutionary mutation of the *V. tenuis tenuis* SCHMIDT of the Lower Cambrian.

The difference between *V. tenuis* SCHMIDT and *V. conica* SCHINDEWOLF is in my opinion not greater than that difference between the typical *V. tenuis tenuis* SCHMIDT and *V. tenuis bohemica* nov. subspec. Consequently I think that the systematic importance of the species *V. conica* SCHINDEWOLF has been slightly overrated. In my opinion it would be more correct to consider also SCHINDEWOLF's species only a subspecies of the species *V. tenuis* SCHMIDT.

Remarks: The agreement in size, shape and inner structure between *V. tenuis bohemica* nov. subspec. and *V. tenuis tenuis* SCHMIDT enables me to agree in principle also with the other taxonomic and phylogenetic conclusions of SCHINDEWOLF concerning the genus *Volborthella* SCHMIDT, 1888. As however the examination of the Bohemian material did not contribute anything new of greater importance in this respect. I shall not discus them here. For the same reason I agree with O. H. SCHINDEWOLF (1934) that the conclusions of A. P. KARPINSKIJ (1903), G. GÜRICH (1934) a. o. concerning the primary narrowing of the "apreture" of the distal end of *Volborthella* shells are incorrect. Neither did I find anything which would speak in favour of the further divergent observations and conclusions of G. GÜRICH (1934) who like L. F. SPATH

(1936), A. M. MILLER (1934) a. o. rejects completely SCHINDEWOLF's interpretation of the morphological structure of the *Volborthella* shells and even denies that they belong among the *Cephalopods*.

The frequently observed greated or lesser deformation of the *Volborthella* shells of the Middle Cambrian of Central Bohemia is in my opinion always a post-mortal phenomenon due to pelomorphic pressure etc. The original perfectly circular cross-section of these shells is often compressed to an oval. The shells lying obliquely to the plane of stratification of the mother rock show frequently a bend, sometimes due to the superposition of two shells. Nevertheless I do not think it excluded that these pelomorphically caused deformations by pressure of the shells were produced only in the course of the diagenesis at a time when the original substance of their outer walls and inner septa was already washed out or otherwise removed. The original chemical composition of the shells of the genus *Volborthella* SCHMIDT, 1888, has not yet been found and remains still unknown. For the present we can only surmise its composition. All we know is that the substance was relatively strong. According to O. H. SCHINDEWOLF (1934) we can exclude chitine and related organic substances. The same author expressed at the same time the opinion that the VOLBORTHELLA shells were originally calcareous or at least predominantly calcareous. A. P. KARPINSKIJ (1903) was of the contrary opinion. The relatively abundant occurrence of authigeneous pyrite in the shells of *Volborthella* seems however to speak for its origin through postmortal reduction processes from some organic substance of which no details are known. But whatever the original chemical composition of the outer walls and inner septa of the genus *Volborthella* SCHMIDT it must have been in my opinion a substance easily and quickly removed by diagenetic processes. I base my conclusion on the fact that in no case have I been able to find on the surface of deformed casts of *Volborthella* shells furrows or fissures, or their casts, due to an original pelomorphic crushing of the outer wall, which otherwise would indubitably manifest themselves in one or the other manner. The analogy with the pelomorphically compressed and cracked shells of certain minute Paleozois *Pteropoda*, e. g. with the genera *Styliolina* KARPINSKIJ, 1894, or *Nowakia* GÜRICH, 1899, simply thrusts itself upons us. Where the shells of these *Pteropoda* were by pelomorphic pressure deformed or even crushed they generally show very characteristic, longitudinal, approximately median craks. These craks of their casts are generally fairly distinct also on the casts of these shells even where the original outer wall was later removed or washed out. I have not found anything similar on the shells of *Volborthella* from the Bohemian Cambrian.

Distribution: The genus *Volborthella* SCHMIDT, 1888, has a rather considerable distribution in the Lower Cambrian of the Caledonian Geosyncline (Atlantic Province) in the sense of W. GRABAU (1936). Originally it was described from the Eophyton sandstone (Zone of *V. tenuis*) (A 1) of the Lower Cambrian of Esthonia, and later it was found also in the adjoining Lower Cambrian areas in Sweden (Västergotland, etc.) (J. CHR. MOBERG, 1892), Southern Norway

(Mjösen District) (J. KIÄR, 1916) and recently also on the island of Gotland (P. THORSLUND and A. H. WESTERGÅRD, 1938). J. SAMSONOVICZ (1920) was the first to find the species *Volborthella cf. tenuis* also in the Lower Cambrian in the Góry Świętokrzyske in Poland. But F. LOTZE's (1929) report, later repeated also by P. H. SAMPELAYO (1933) on the occurrence of the genus *Volborthella* SCHMIDT, 1888, in the upper layers of the Lower Cambrian of Spain (North Aragonia) is according to O. H. SCHINDEWOLF's correction (1934) based on a mistake. From Canada the species *Volborthella tenuis* SCHMIDT is reported from the Protoolenus Beds (Henfordian) (C1b) in New Brunswick (G. F. MATHEW, 1889, a. o.) generally placed in the upper layers of the Lower Cambrian (Taconian). In this area the species *Volborthella tenuis* SCHMIDT continues, however, also into the overlying Paradoxides Beds which belong already indubitality to the Middle Cambrian (Acadian). According to A. W. GRABAU (1936) the Protoolenus Beds (Henfordian) mentioned above belong likewise to the Middle Cambrian. Setting aside the question as to the stratigraphical position of the Protoolenus Beds, New Brunswick remains thus up till now the only area from which the genus *Volborthella* SCHMIDT, 1888, has been known from layers of a Middle Cambrian age. But the Paradoxides Shales of Skryje ($c\beta'_2$) of Central Bohemia are also indubitably of a Middle Cambrian age, and in them *Volborthella tenuis bohemica* nov. subspec. has been found.

Occurence: In the Middle Cambrian of Central Bohemia *Volborthella tenuis bohemica* nov. subspec. has been found up till now only in the Area of Skryje and Týřovice. It is not yet known from the Area of Příbram and Jince. In the Paradoxides Shales of Skryje ($c\beta'_2$) *Volborthella* shells generally occur only sporadically, and it is for this reason that they seems to have escaped observation until recently. Only in one case a greater number of specimens has been found together forming a true *lumachella* on the surface of stratification of the shale (leg. Dr J. JARKA). In my opinion this accumulation was brought about mechanically, i. e. by the washing together of dead *Volborthella* shells in one place by sea currents etc. This would also account for the fact that the proximal part of some of the *Volborthella* shells still embedded in the rock was broken off, presumably already in the course of transport.

In the Area of Skryje and Týřovice *V. tenuis bohemica* nov. subspec. has become known up till now from three localities.

Skryje, locality *"Dlouhá hora"*. Here this form was found by J. JARKA who records it under the designation of *Problematicum* (J. JARKA, 1940). *V. tenuis bohemica* nov. subspec. occurs here in a typical association of the Paradoxides Shales of Skryje ($c\beta'_2$) of which I list:

Sao hirsuta BARR., *Solenopleura prantli* RŮŽ., *Solenopleurina týřovicensis* RŮŽ., *Agraulos ceticephalus* BARR., *Skreiaspis spinosus* (JAHN), *Condylopyge rex* (BARR.), *Pleuroctenium granulatum* (BARR.), *Perenopsis integer* (BARR.), *Phalacroma nudum* (BAR.), *Ptychoparia striata* (EMMR.), *Ctenocephalus coronatus* (BARR.), *Conocoryphe sulzeri* (SCHLOTH.), *Ellipsocephalus hoffii* SCHLOTH., *Paradoxides pusillus* BARR., *P. rugulosus* HAWLE and CORDA, *P. minor* (BOECK), *P. inflatus* HAWLE *and* CORDA, *Hyolithus signatulus* NOVÁK, *Ceratocystis perneri* JAEKEL, etc.

Luh near Skryje, locality on the way to *"Parýzky"* (leg. Dr J. JARKA). Lumachella. Of the accessory fauna only the species *Skreiaspis spinosus* (JAHN) has been determined.

Týřovice, BARANDE's classical locality *"pod hruškou"* (leg. M. ŠNAJDR, Ing. R. RŮŽIČKA and the author). From among the rich association of this locality I list here only:

Sao hirsuta BARR., *Solenopleurina týřovicensis* RŮŽ., *Solenopleura prantli* RŮŽ., *Agraulos ceticephalus* BARR., *Skreiaspis spinosus* (JAHN), *Condylopyge rex* (BARR.), *Perenopsis integer* (BARR.), *Pleuroctenium granulatum* (BARR.), *Phalacroma nudum* (BARR.), *Ptychoparia striata* (EMMRICH), *Ctenocephalus coronatus* (BARR.), *Růžička emmrichi* (BARR.), *Conocoryphe sulzeri sulzeri* (SCHLOTH.), *C. sulzeri granulata* (HAWLE and CORDA), *Ellipsocephalus hoffii* (SCHLOTH.), *Paradoxides minor* (BOECK), *P. rugulosus* HAWLE and CORDA, *P. (?) orphanus* BARR., *P. jahni* POMPECKIJ, *P. pusillus* BARR., *P. inflatus* BARR., *Hydrocephalus carens* BARR., *H. saturnoides* BARR., *Hyolithus signatulus* NOVÁK, *Trochocystites bohemicus* BARR., etc.

From this it is evident that the association in which *Volborthella tenuis bohemica* nov. subspec. occurs at *"Dlouhá hora"* near Skryje and at the locality *"pod hruškou"* at Týřovice are in fact identical. According to J. JARKA (1940) this association belongs to the upper layers of the Paradoxides Shales of Skryje ($c\beta'_2$).

Praha, September 1948.

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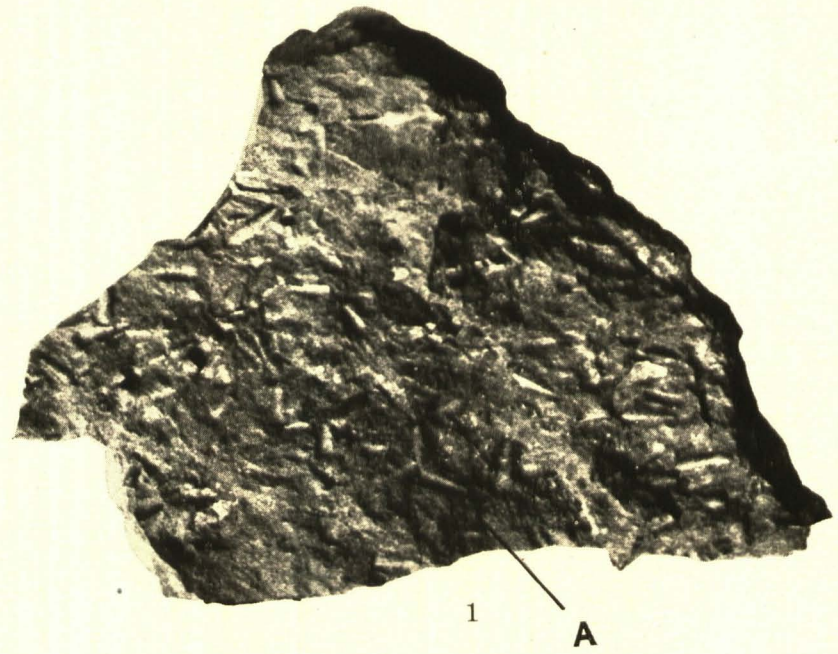
EXPLANATION OF THE PLATE:

Volborthella tenuis bohemica nov. subspec.

1. A slab of the Paradoxides shale ($c\beta_2$) showing numerous specimens of *V. tenuis bohemica* nov. subspec., A = holotype, 3 ×. Locality: Luh near Skryje, outcrop on the way to *"Parýzky"*.
2. Longitudinal section of a specimen, 10 ×. Locality: Luh near Skryje, outcrop on the way to *"Parýzky"*.
3. Longitudinal section of another specimen, 10 ×. Locality: *"Dlouhá hora"* near Skryje.
4. Longitudinal section of third specimen, 10 ×. Locality: Luh near Skryje, outcrop on the way to *"Parýzky"*.



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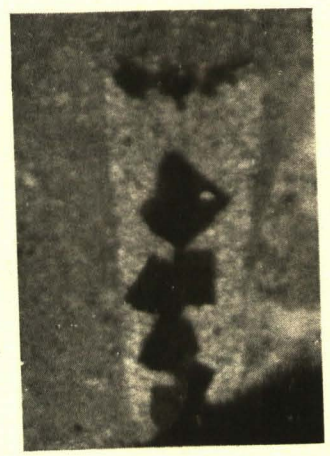

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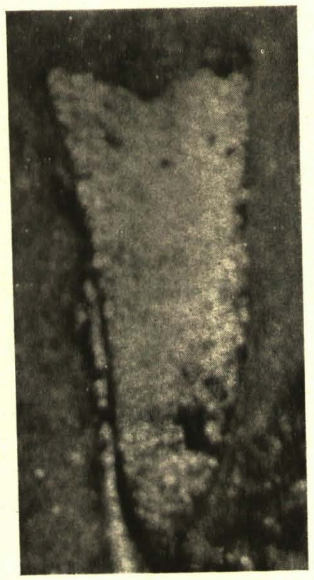

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