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THE CORRECTION TO STRATIGRAPHY OF THE CRETACEOUS FORMATION IN THE OHŘE REGION

Zdeněk ŠTAFFEN

Orlické muzeum, Pardubická 1, 565 01 Choceň, Česká republika
Corresponding author's e-mail: museum.chocen@centrum.cz

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ABSTRACT

In 1965 the PD-1 mapping borehole was drilled in the classical location in Březno u Loun in the Ohře facies region. It was examined by many authors with various results. In 2006 the revision of these results was performed in archival samples. Carbonate content and insoluble residue minerals were determined. The gathered data were compared with similarly examined boreholes in the Bohemian Cretaceous Basin. The correlation showed that in the western and eastern Poohří region the profiles with different stratigraphy level were compared. After the elimination of this discrepancy the actual stratigraphy of the Poohří region can be easily compared with the other regions of the basin. The Č. Zahálka's statement of the equivalency of the sediment filling of the Ohře facies region and the Jizera formation in the Kokořín region is correct. This fact was validated by the Pd-1 borehole profile, where, due to a tectonic coupling, yet unknown, missing part of the youngest sediments of the Teplice and Březno formations (the real zone Xd) was conserved.

KEYWORDS: Cretaceous sediments, stratigraphy, carbonate content, correlation, Ohře region

1. INTRODUCTION

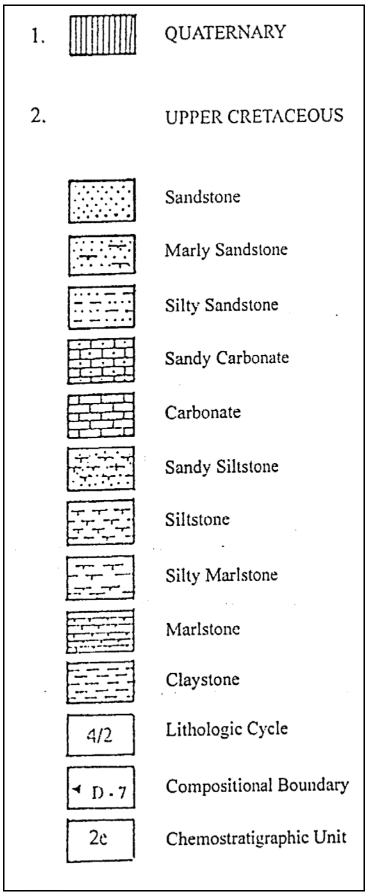
In 1979 in the Anthology of the Liberec North Bohemian Museum (Sborník severočeského muzea) Miroslav Váně expressed a fundamental idea of stratigraphic segmentation of the Upper Cretaceous sediments in the Ohře facies area, supported by the comparative geologic time chart of western and eastern parts of this region. Except the classical locations, this report will deal with the profile in Březno u Loun that is a stratigraphic example of the Poohří region's western part.

Based on a detailed research of the Březno profile and following evaluation of the PD-1, BE-1 and BE-2 trial holes the above author (Fig. 1) tried to place this profile conclusively in the overall stratigraphy of the above area and its correlation with the eastern part of the Poohří region.

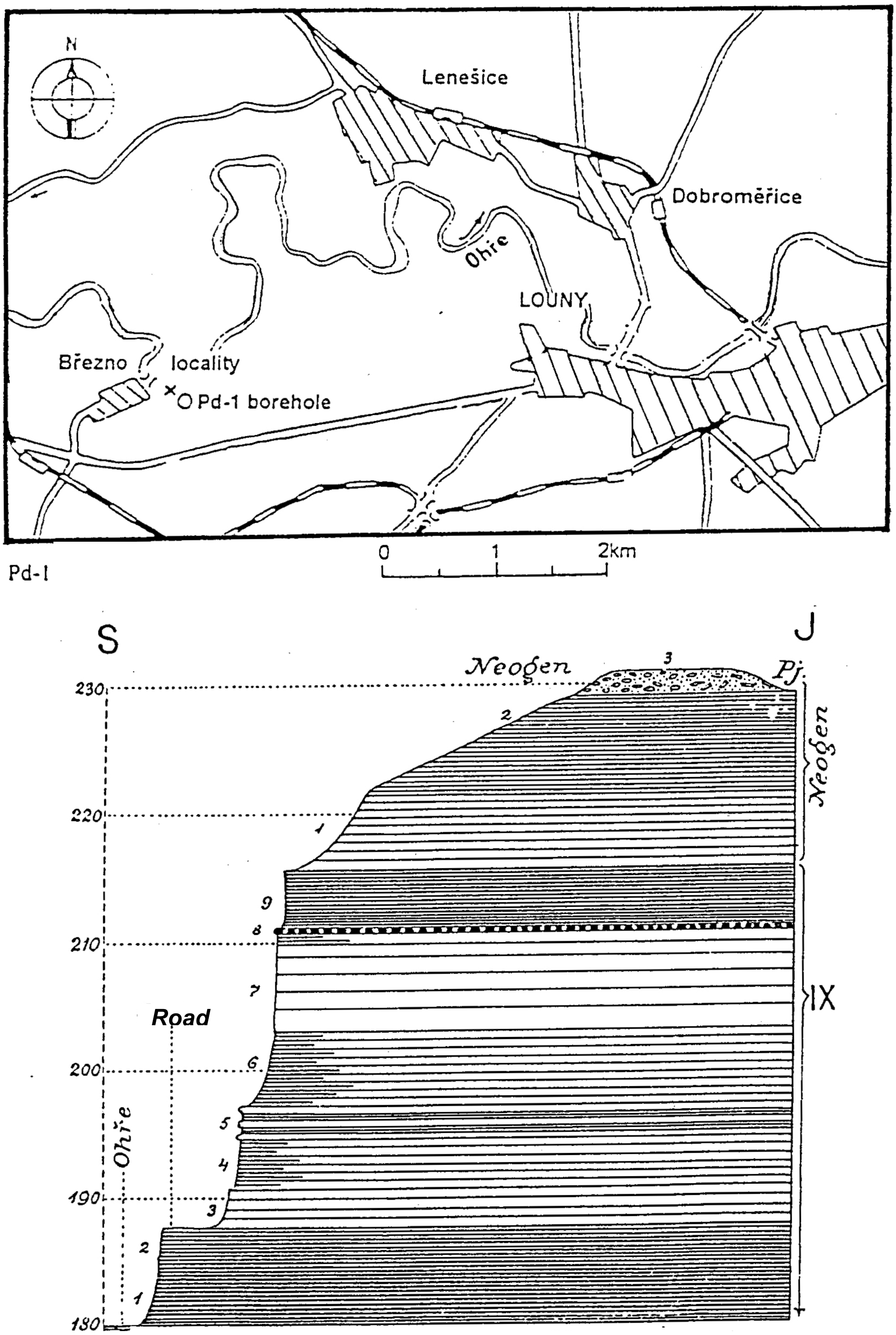
Based on the gathered data from the evaluation, the author of the stratigraphy assumes that the Xd chalkstones in the Roudnice region are an equivalent to the marlite of the same stratigraphy classification in the western part of the Ohře facies area. Their lithologic metamorphosis is explained by him as radical facies changes of these sediments. The author considers the cross-correlation of these positions to be historically very difficult and warns against their forcible indexing that can cause errors. These are the errors M. Váně failed into his geologic time chart, published in the Geological Survey Reports (Zprávy o geologických výzkumech) in 1997.

This is suitable time to remind again the quotation from the Č. Zahálka's work (1894): "Strata

Table 2 Lithology types. Notes to the following figures of autor.



Č.Zahálka 1899



Height ratio 1 : 500

Source: Journal of the Royal Czech Society of Science.
Mathematics and natural science class, 1899.

Fig. 1 Profile of Březno hill.

facies changes were omitted. The omission occurred as the zones have not been traced step by step from one landscape to another, but the strata were compared in remote areas…". Č. Zahálka considers the Ohře area to be continuous lithologic and facies passage of arenaceous strata of the Jizera formation in the Polomené Mountains into the clay (marly clay) development of the same formation in the Roudnice and Poohří regions. Detailed mineral and chemical examination of the VP series boreholes and the above mentioned pivotal Pd-1 borehole enabled not only a cross-correlation of these boreholes, but also a comparison of their material profiles with the other facies regions of the Bohemian Cretaceous Basin examined before (Štaffen, 1999). This cross-correlation proves that many of Č. Zahálka's presumptions on the facies metamorphosis presence in the Jizera formation on the territory of the Poohří region is true.

2. CHEMOSTRATIGRAPHIC EXAMINATION OF BŘEZNO U LOUN PD-1 TRIAL HOLE

Based on the ascertained stratigraphic inconsistencies among the Ohře facies area and other regions of the Bohemian Cretaceous Basin, stated by mineral and chemical analyses of the comparative boreholes, the revision of results of the Březno near Louny Pd-1 borehole was started. Rock samples were obtained by the employees of the Czech Geological Survey in Prague (ČGS Praha) from the sample archives in Lužná near Rakovník. The procedures used for the preparation of the material were those described in the older works on mineral and chemical examination of cretaceous rocks (Štaffen, 1999). The content of carbonates was established (with prevailing calcite); from the insoluble residue after this establishment using the X-ray diffraction analysis the minerals of this sample were identified; the minerals are mostly quartz, feldspars, micas, clay minerals and ferrous minerals.

3. CARBONATE CONTENT EXAMINATION

Carbonates in the samples were withdrawn from the Pd-1 borehole, similarly as in other places in the basin, mainly represented by the mineral calcite. Content of carbonates was analyzed in the past within the documentation for the borehole (Macák, 1969). Later on their content was published by Váně (1979). This way there was a possibility of comparison of the results of particular authors and also the methods of estimation used by them. The last examination was carried out by the method of dissolving by means of monochloroacetic acid in 0.5 N concentration. The details of this method are described in the older works (Štaffen, 1999, 2002). The results of the established carbonate contents in the samples of the Pd-1 borehole are graphically illustrated in Figure 2. Choosing an optimum sampling interval for the examined samples, the detailed curve of carbonate content was established in the borehole profile. It is necessary to point out that its morphology substantially differs from the similar curve published by Váně in 1979. Nearly identical curve with simultaneous examination of the carbonate content (established calcite, magnesite) was obtained by Macák (1969). Just the impossibility of this curve correlation with the borehole profiles in other place of the basin caused that the equivalence of the curve shape with the basin chemostratigraphic profiles was not identified. The details of this curve enabled its unique correlation with the curves of carbonate contents of the selected boreholes located in different facies areas of the Bohemian Cretaceous Basin. The possibility of the correlation of the Pd-1 borehole curve with the carbonate establishment curves and the stratigraphy of these boreholes is unique.

The upper part of the curve in the Pd-1 borehole (Fig. 2) represents indeed the lithologic equivalent of the Rohatce Formation in other place of the basin, i.e. the zone marked as Xd. The zone depth extent can be established from the borehole aperture to the depth of approximately 18 m. Carbonate contents (mainly calcite) identified in this zone range from 20 – 30 %, which is a common value in the zone Xd ("resounding inoceramus calcareous sandstones") in other places of the basin. Also the examination of the carbonates withdrawn from the profile in Březno u Loun shows the range from 8 to 32 %. The labeling of this borehole zone as the Rohatce region strata by Čech and Švábenická (1992) is in agreement with the borehole chemostratigraphic profile.

Also the discussed Turonian-Coniacian boundary (Váně, 1997) debated in the depth of 34.4 m based on the first indication of the *Cremnoceramus waltersdorfensis* species (Andert) is accentuated by a characteristic development of the carbonate curve morphology and fine sand interbed in this footage. Besides the carbonate content this limit is defined by a substantial minimum of kaolinite content (Fig. 3), presence of glauconite, biodetrite and maximum of siderite resting in the upper part (Fig. 4). The outstanding value fluctuations can be traced also in the curve showing the development of specific weight (Fig. 5). This limit is also a clear boundary in the marlite strength. In the upper part there are more silty and compact sediments, in the bed there are dark, easily crumbling marlites. From the stratigraphic point of view above the stated Turonian-Coniacian boundary in the depth of 34.4 m there are silty marlites of the zone Xc, in the bed there are soft, dark marlites of the zone Xb. At this point it is necessary to remind the opinion stated by Váně (1997) on the Coniacian origin of the sediments in the zone Xc in the Poohří region. The difference in their strength is given by the reduction of the calcite content in the sediments in the zone Xb that usually does not exceed the value of 20%. This mineral and chemical development is typical for the Bohemian Cretaceous Basin and can be easily correlated.

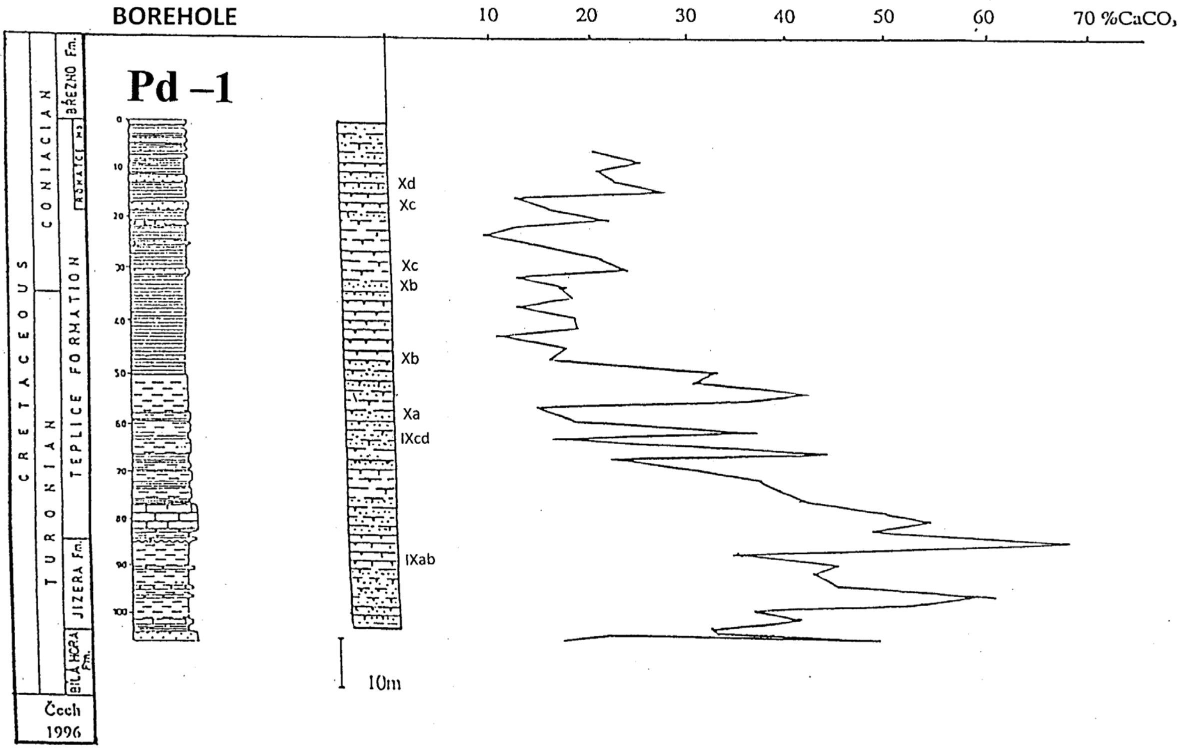


Fig. 2 Borehore PD-1 Březno – content of $CaCO_3$.

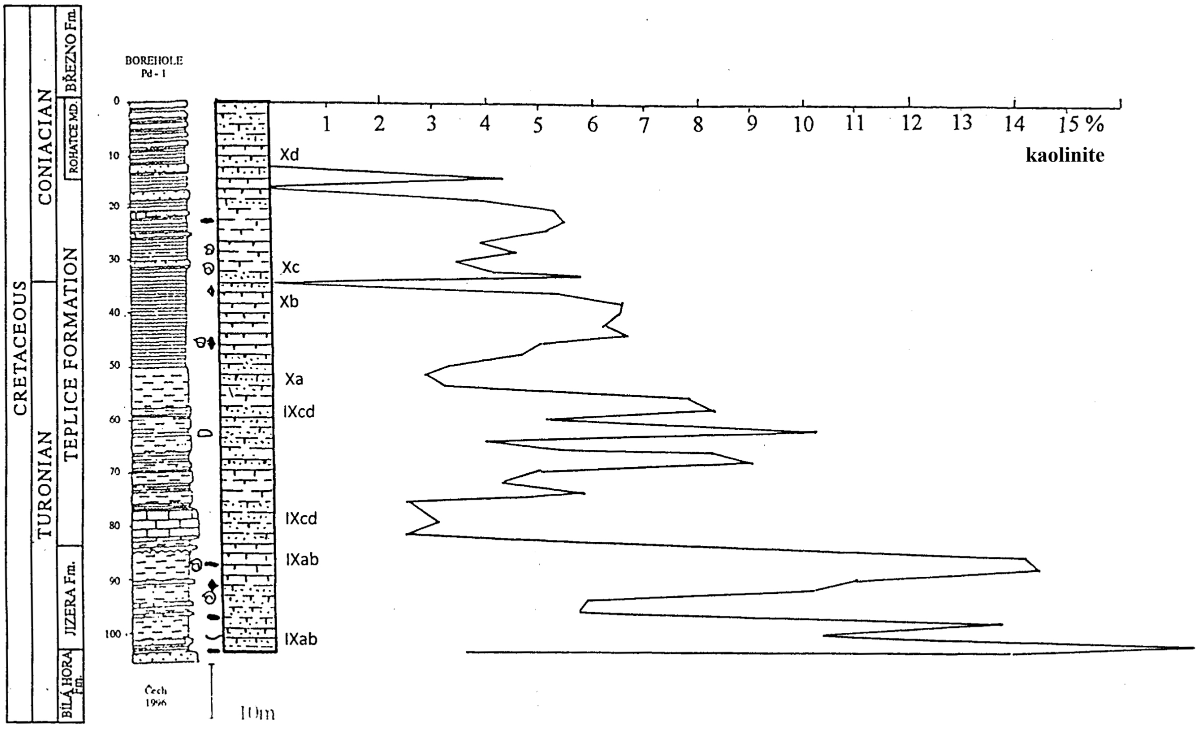


Fig. 3 Borehore PD-1 Březno – content of kaolinite.

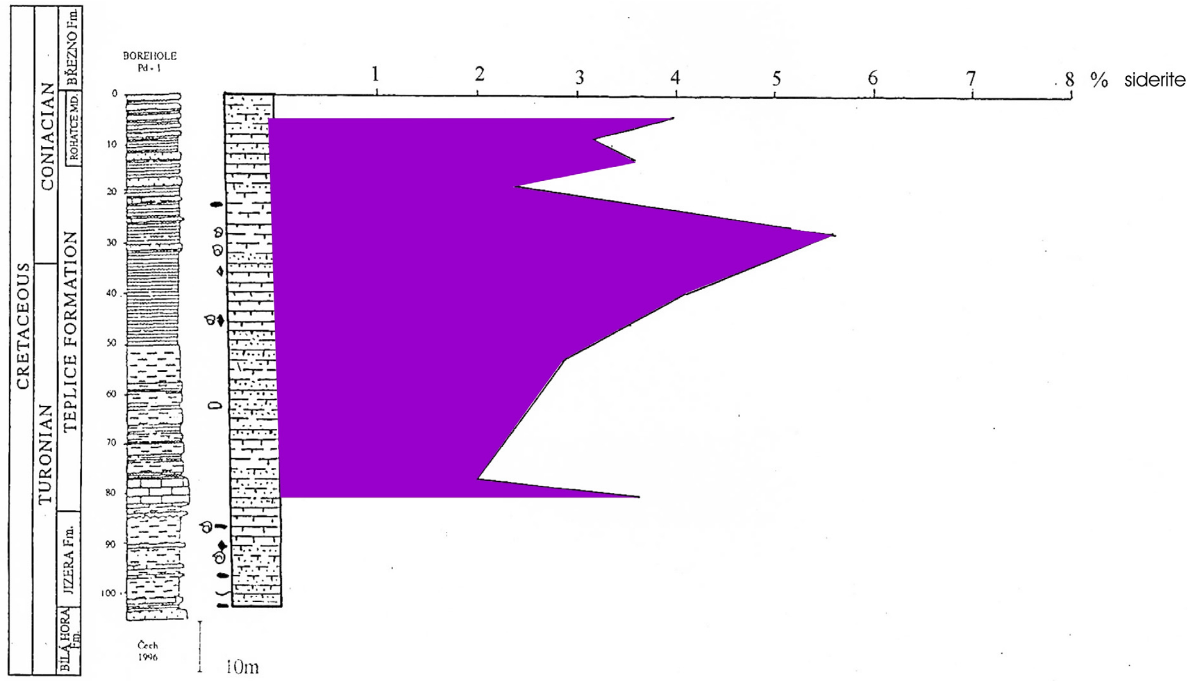


Fig. 4 Borehore PD-1 Březno – content of siderite.

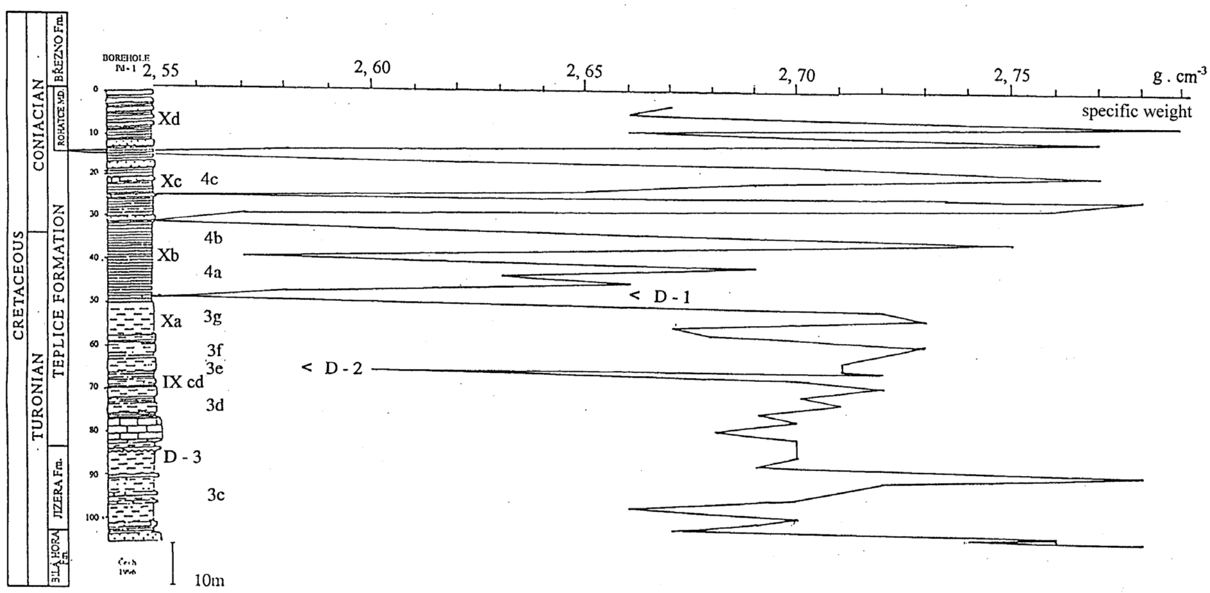


Fig. 5 Borehore PD-1 Březno – value of specific gravity.

The relevance of mineral and chemical changes of this stratigraphic boundary is confirmed by the identified kaolinite content (Fig. 3). The substantial drop of its content splits the quantities of this mineral into two self-contained units represented by their substantial maxima (Fig. 3). The first mineral and chemical unit (content maximum) is limited by the lower stratigraphic boundary in the level Xa/Xb. Its upper limit is created by an anticipated Turonian-Coniacian boundary (Xb/Xc) at the level of 34.4 m. Upper and lower kaolinite content mineral and chemical border in the marlite zone Xb is created by its significant declines. In the upper part of the 34.4 m footage a similar development of the curve of kaolinite content of the second mineral and chemical unit representing the zone Xc can be traced. Its limiting minima on the curve are located on the Turonian-Coniacian boundary (Xb/Xc - lower) and on the base of the Rohatce region formation (Xc/Xd - upper).

The same curve morphology discernible units can be traced also in the ascertained specific weight values that, by means of their minima, uniquely define the range of the above stated stratigraphic units (Fig. 5).

In the depth of 49 m in the Pd-1 borehole there was a substantial mineral, chemical and stratigraphic border that can be easily correlated in the whole Bohemian Cretaceous Basin. This is a border that was historically differently called by various authors. However, the best-known name is probably "glauconitic contact stratum" or Zahálka's zone Xa (Fig. 2). On the curve of carbonate content the first (in terms of increasing borehole depth) substantial calcite content maximum that, comparing to the carbonate-lean upper part zone Xb, exceeds the value of 40 %. Usually this position is also easily traceable in the drilling logs, where it represents the coming of the value of measured rock electric resistance.

The depth of this border (Xa) varies in the basin, starting from several centimeters to the value of 20 – 25 m in its central part. In the Pd-1 borehole this position is created by sand marlites of 12 m. Its base part is highlighted on the curve by the minimum of calcite content decreasing to the value of 15 % and highlighted deferring of the separate curve tops between the Xa upper part and IXcd bed in other places of the basin. However, this seemingly unimportant curve delay can be traced in the whole basin and is characteristic for this position.

The significance of the Xa boundary (glauconitic contact stratum) is highlighted also by the identified variations of the content of other minerals. They are mainly obvious in the classical sediment component. This boundary, operationally marked as D-1, shows a substantial reduction of the content of classical quartz (Figs. 6, 6a) that drops to the level of 20 %. This way it creates the upper "quartzose" maximum level, whose lower level is situated on other significant mineral and chemical boundary. This boundary is operationally marked as D-3 and is located in the mineral and chemical discontinuity between two chalkstone sets of an oscillatory character in the curve carbonate maximum. Paleontologists (Čech, 1992) sometimes rate this boundary as newly established stratigraphic border of the Jizera and Teplice formation in the whole basin (Figs. 7, 7a).

Similarly as the classical quartz, also the content of mica (common mica) creates a substantial minimum on the border Xa (Fig. 8). As well as with quartz, this drop is an upper level of the mica maximum, whose lower level is also located in the mineral and chemical boundary marked as D-3. Next to the classical quartz and mica (common mica) the first time the traceable content of opal-CT, starting from the boundary-line of the zone Xa ("glauconitic contact stratum"), can be found. Its content increases in the upper part ant its presence is permanent. The changes of hematite content in the mineral and chemical boundary Xa (D-1) are also relevant (Fig. 9). Its amount in the zone Xa upper part substantially increases. Separate quantitative units are also created by a K-feldspar content (Fig. 10).

In the bed of the "glauconitic contact stratum" (Xa) the sediment lithology substantially changes within the whole basin. Their strength increases, which is seen in macroscopically traceable oscillations with several-meter thickness and variation in their grey color that is lighter in carbonate maxima and darker in case of a minimum content of calcite. Concurrently, a continuous increase of $CaCO_3$ content occurs and chalkstone complex is gradually created, which is apparent in the outstanding carbonate maxima of the oscillation character, whose calcite content reaches 60 – 70 % in its maxima. This chalkstone complex and its curve of carbonate contents morphology are typical in the whole Bohemian Cretaceous Basin. Comparing to the Poohří region stratigraphy, where the chalkstone complex is ranked to the Březno formation (Coniacian) and rated as zone Xd, this carbonate complex in other parts of the basin is correlatable in its whole surface scope (Figs. 7, 14, 19, 20); a representative of the top part of the Jizera formation (Zahálka's zone IX, Soukup's zone IXcd).

In the Pd-1 borehole this chalkstone complex creates a bed of the zone Xa - 23-m thick set with a striking oscillation of strength and grey color to the depth of 84 m, where there is a drop in rock strength and change of the upper part, strongly calcificated, sand silty marlites into crumbling dark marlites that in the chemostratigraphic structuring represent the above mineral and chemical discontinuity, operationally marked as D-3 (Štaffen, 1999, 2002). Many authors consider this boundary to be a boundary of the Jizera and Teplice formation (Čech, 1992). The correctness of this supposition is a paleontologic question. However, from the lithological point of view in other parts of the basin the top part of this chalkstone set is

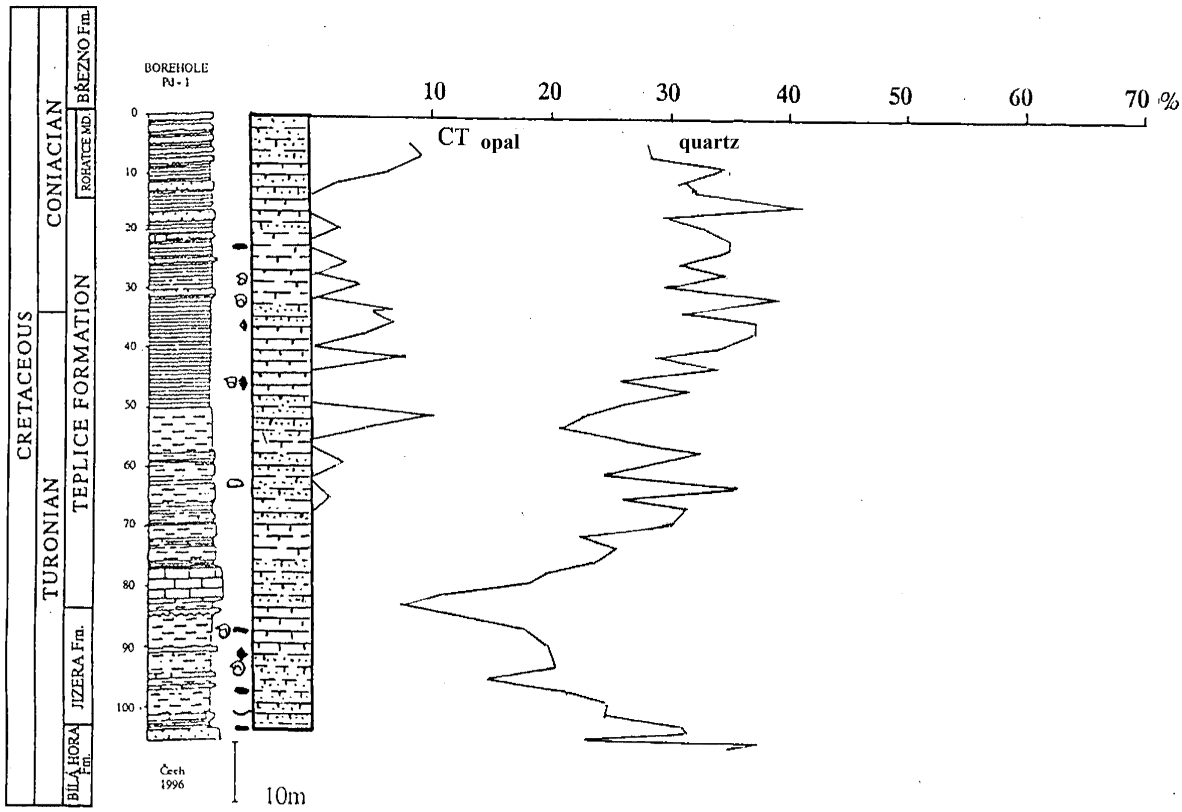


Fig. 6 Borehore PD-1 Březno – content of CT-opal and quartz.

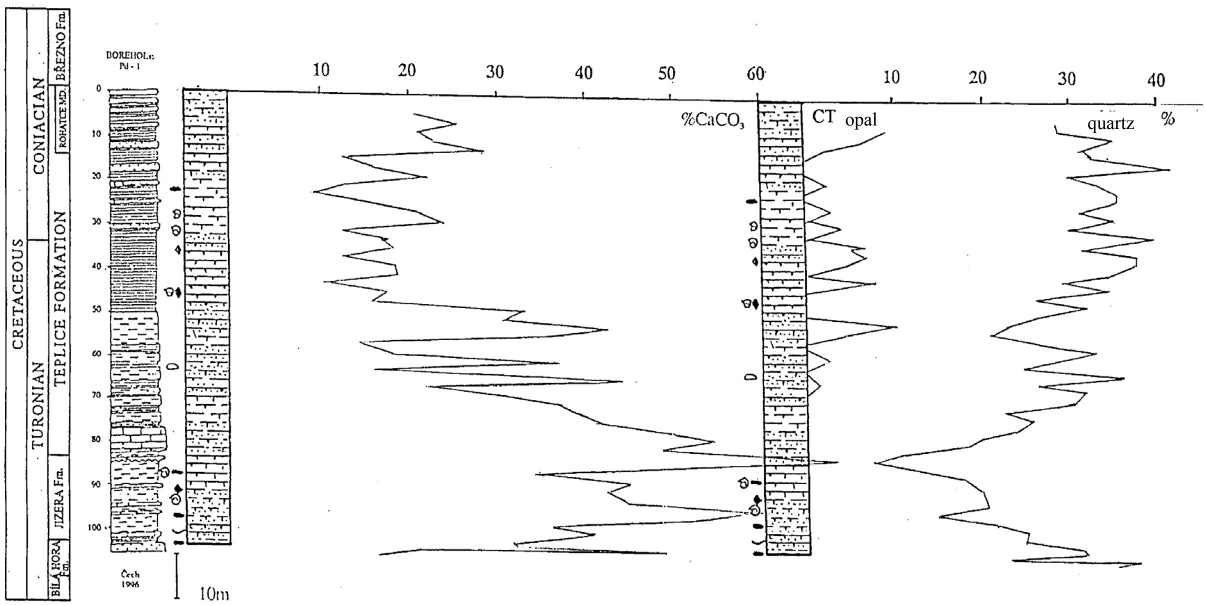


Fig. 6a Borehore PD-1 Březno – correlation of content $CaCO_3$/quartz.

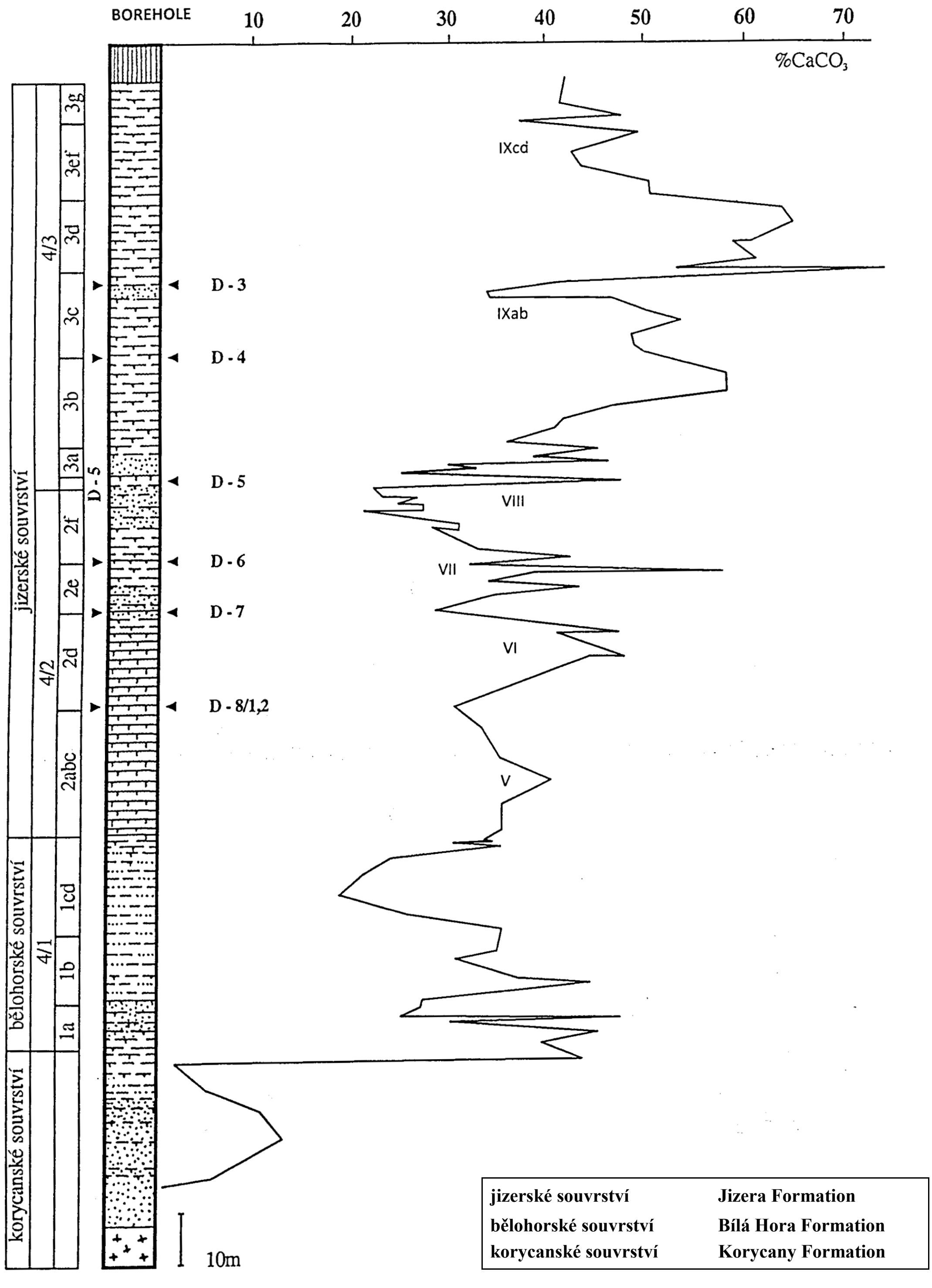


Fig. 7 Borehore SN-5 Blansko – curve content of carbonates.

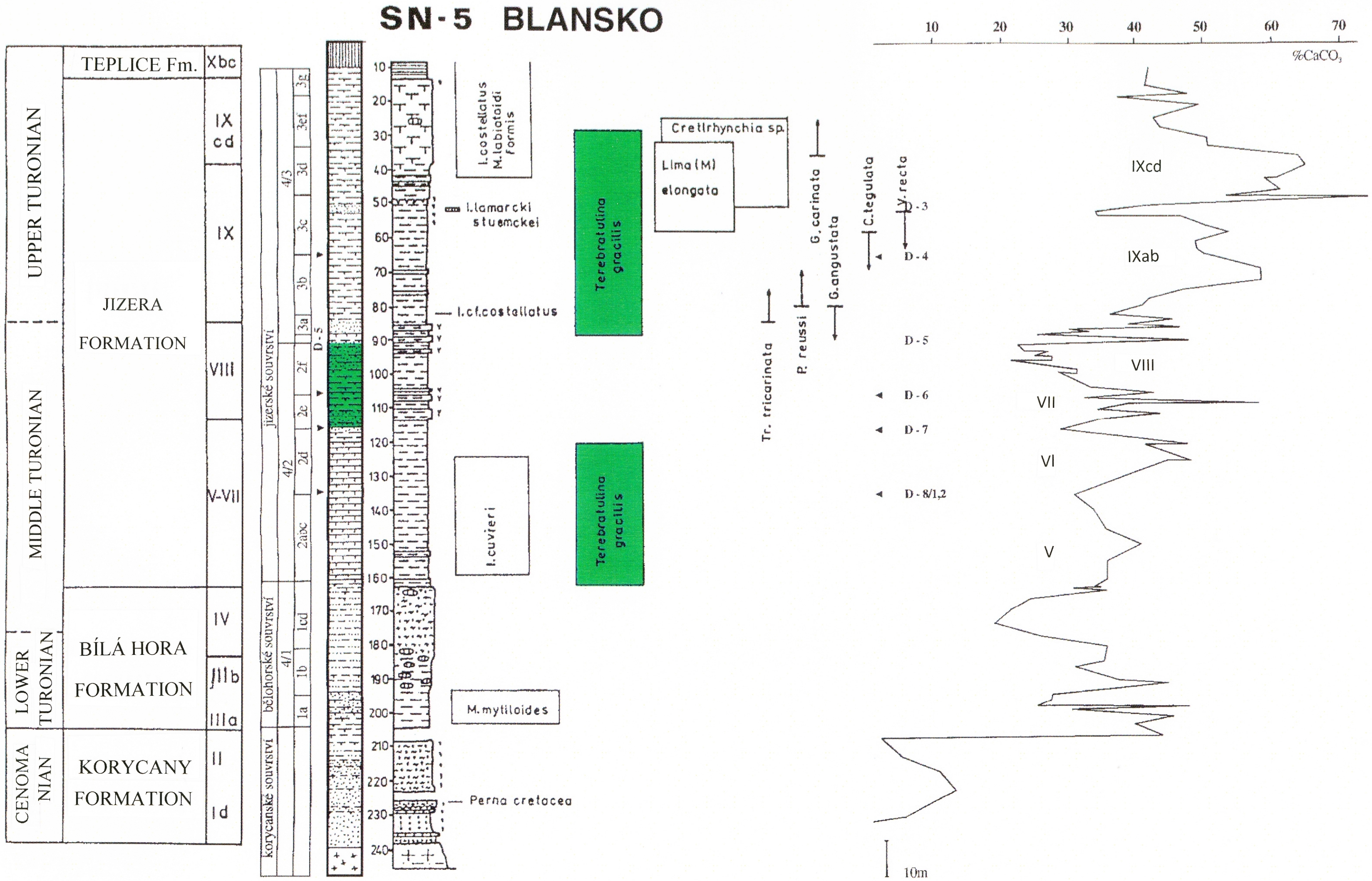


Fig. 7a Borehole SN-5 Blansko – correlation of curve O_k with paleontol. content.

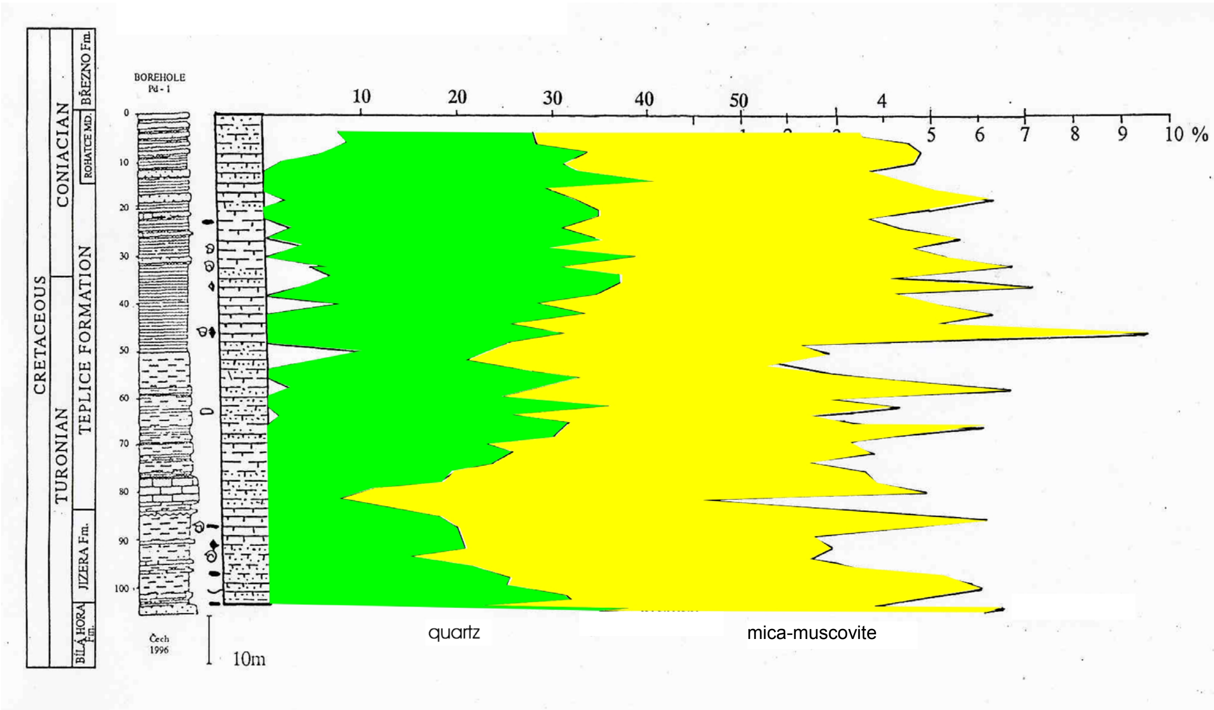


Fig. 8 Borehole Pd-1 Březno – content of mica (muskovite).

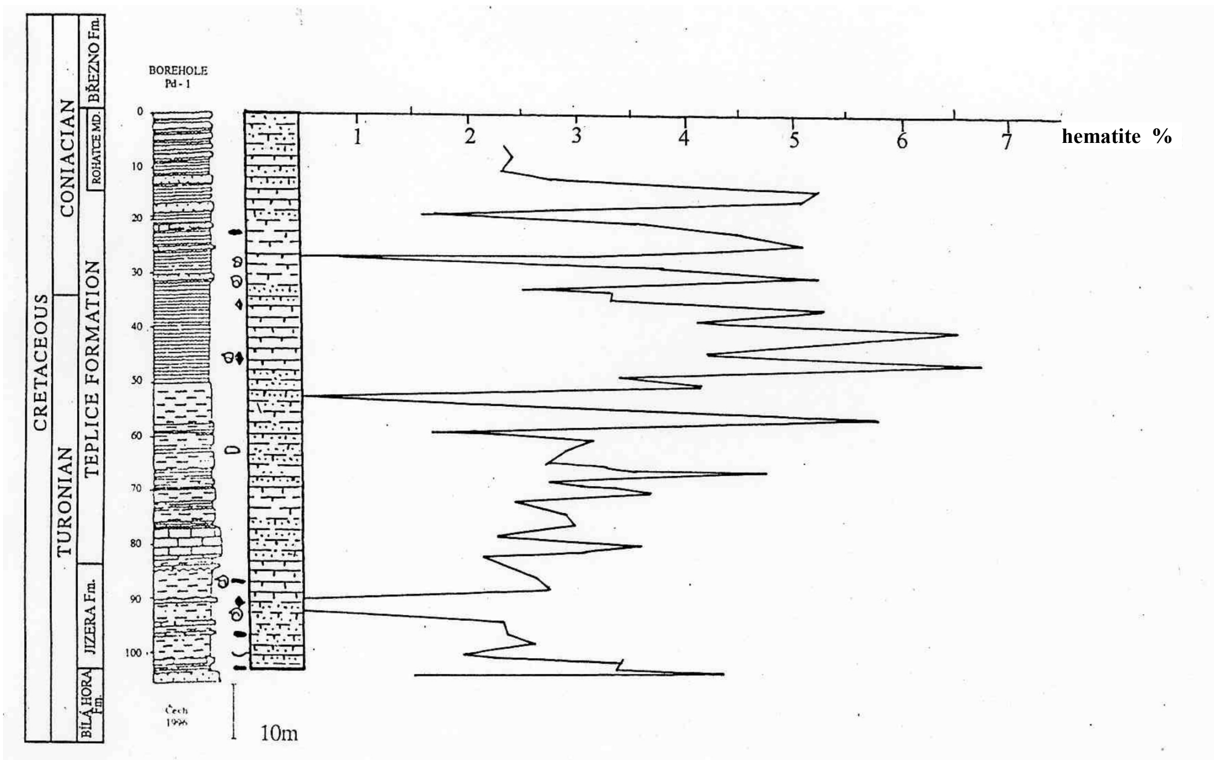


Fig. 9 Borehole Pd-1 Březno – content of hematite.

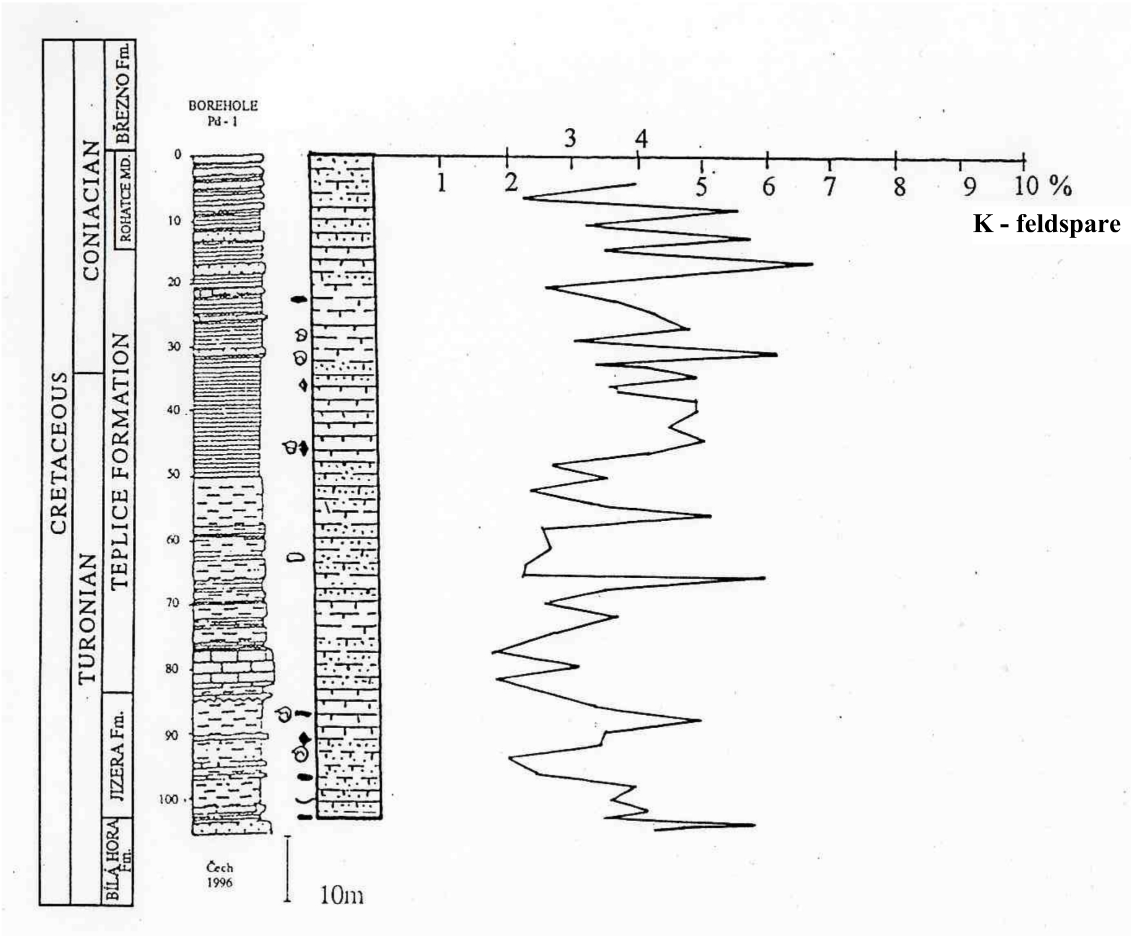


Fig. 10 Borehole Pd-1 Březno – content of feldspare.

an equivalent to the highest part of the Jizera formation (kalianas sandstones, Soukup's zone IXcd). The validity of this boundary is confirmed not only by the identified values of $CaCO_3$ content, but also by the contents of other minerals, partaking in the composition of these sediments. It is first of all the content of classical quartz (Fig. 6) that creates a substantial minimum in this border, dropping below 10%. The classical mica (common mica) content curve morphology has a similar development (Fig. 8). Starting from this boundary, the content of siderite also slowly increases (Fig. 4) that culminates on the Turonian-Coniacian stratigraphic boundary.

In the mineral and chemical discontinuity bed (operationally marked as D-3), featuring the above calcite minimum inside the chalkstone complex, the carbonate content again increases. Their amount in the upper part reaches previous values, i.e. 50 and more percent (Fig. 2). This part of the borehole profile in the depth of 84 – 102 m shows signs of the spread of ocean character sedimentation disorders that are common in this part of the Poohří region. They were recorded in the neighboring boreholes of the VP series and others, where in the starting sediments of the Jizera formation the zone V is reduced and the spread of ocean in zones VII – VIII occurs. It is also missing in the Pd-1 borehole profile of the zone V-VIII. From the paleontologic point of view this part of borehole is considered to be a "real" Jizera formation. The question is whether the sandstones at the end of the Pd-1 borehole profile are already the Bílá Hora formation or washed away and misshaped the Jizera formation zone VIII. However, comparing to the basin, this formation in the Pd-1 borehole smoothly continues into the upper part, over so-called coprolite lamina that is in the Poohří region mistakenly considered to be zone Xa. Above this boundary that is in other places of the basin located in the upper part of the zone XIII, the zone IXab smoothly continues. It features a base chalkstone position known in the Poohří region as "body" and from a stratigraphic point of view it is considered to be zone Xb. There is a section of carbonate oscillations in its upper part (in the Poohří region Xc). In the upper part of this zone there is the above significant D-3 mineral and chemical border that is located on the curve of Pd-1 borehole carbonate content in the depth of 90 m (Fig. 2). Above this border, considered by paleontologists to be the Jizera and Teplice formation, the Xd chalkstone set is located in the Poohří region. However, this set is an equivalent of the highest part of the Jizera formation elsewhere in the basin. The

Table 2 Lithology types. Notes to the following figures of autor and Dr. Váně.

terciérní jíl	Terciery Clay
slínovce	Marlstone
jílovité vápence	Clay Limestone
glaukonitické pískovce	Glauconite Sandstone
opuky	Marly Chert
jílovce	Claystone
pískovce	Sandstone
sedimenty permokarbonu	sediments of permocarbon
glaukonit	Glauconite

Jizera formation is ended in Pd-1 borehole in the depth of 57 m by a glauconitic contact stratum (Xa), whose location is identical with the border Xb/Xc establishment (Váně, 1979; 1997). This way the Jizera formation in the Pd-1 borehole creates a complex of oscillation carbonate maxima, the highest part of which can be supposed to be the calcite content oscillation in the depth of 60 – 70 m in the bed of the last mineral and chemical border substantial carbonate maximum ranking to the zone Xa.

The sediment mineralogical composition in the bed and upper part of the Xa boundary (glauconitic contact stratum) and its significant changes create conditions for the presumption that the boundary has a stratigraphic importance. This border was considered to be the Jizera and Teplice formation before. The importance of the general change of the sediment composition over and below this border ranks it among an equivalent mineral and chemical discontinuity (D-1) with a bed border inside the chalkstone komplex (D-3) that is considered to be the Jizera and Teplice formation. However, the sediment mineral and chemical composition demonstrate that this is a separate material complex between these boundaries. It is obvious that the most of significant mineral and chemical changes occur on the zone Xa border (glauconitic contact stratum).

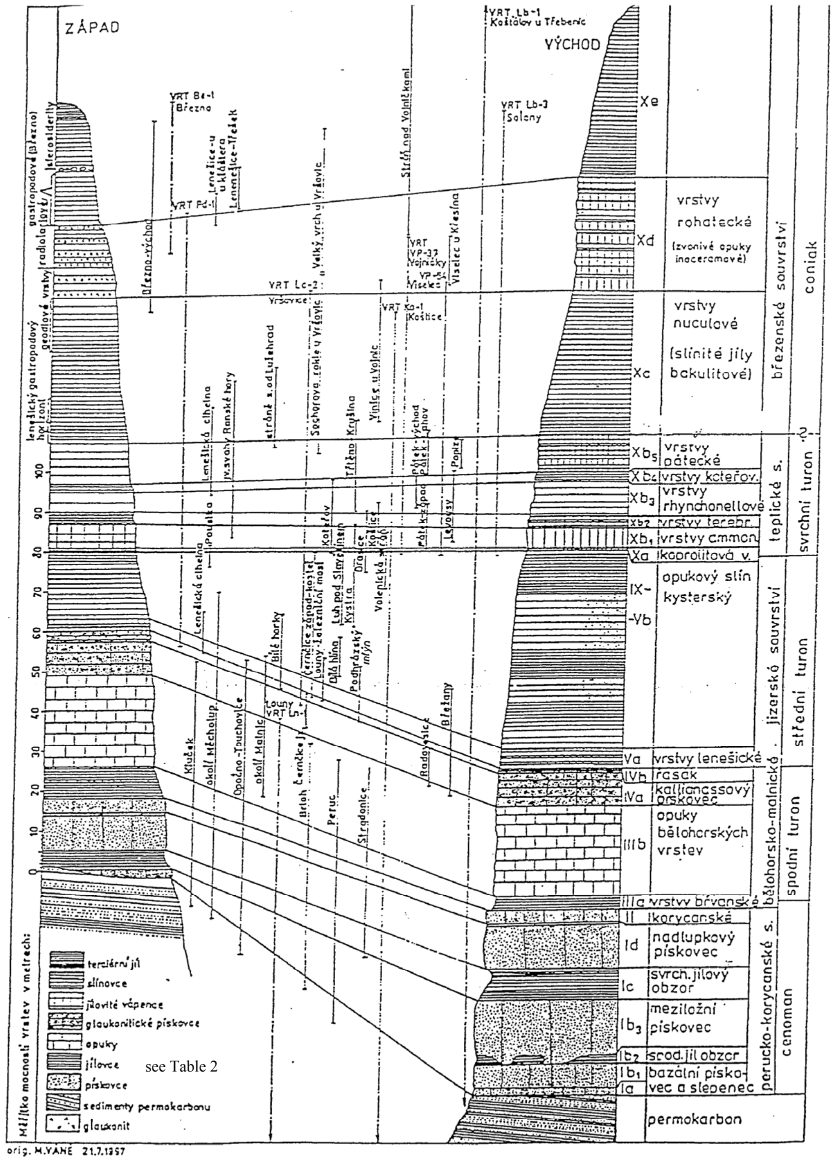
In the upper part of the Xa boundary on the curve of carbonate content we can easily observe a classical basin mineral and chemical development, i.e. the above mentioned carbonate-lean zone Xb, zone Xc and the discussed zone Xd that is, in case of the Pd-1 borehole, the real equivalent to this zone in the basin and the Rohatce formation. This way the development of the curve of carbonate content morphology (calcite) in the Pd-1 borehole does not differ from a common development of this curve in other examined facies regions of the Bohemian Cretaceous Basin.

Table 3 Glossary of terms used in the originál figures Dr. Váně.

"řasák"	"řasák" - original Czech term.
bazální pískovec a slepenec	Basal sandstone and conglomerate
bělohorsko-malnické	Bílá Hora - Malnice Formation
březenské souvrství	Březno Formation
cenomon	Cenomanian
cesta	road
cihelna	brickworks
coniak	Coniacian
jizerské souvrství	Jizera Formation
kallinasový prskavec	Callinasa sandstone
koprolitová v.	Coprolite tiny beds
korycanské	Korycany strata
meziložní pískovec	interbed sandstone
nadlupkový pískovec	over shale sandstone
opukový slín kysterský	Kystra marly chert marly
opuky bělohorských vrstev	Marly chert of Bílá Hora Formation
permokarbon	Permocarbon
perucko-korytanské s.	Peruc-Korycany Formation
Poohří	Ohře region
slinuté jíly bakulitové	bakulites marly clays
spod. jíl. obzor	Lower clay horizon
spodní turon	Lower Turonian
střed	middle
střední část	middle part
střední turon	Middle Turonian
svrch. jíl obzor	Upper clay horizon
svrchní turon	Upper Turonian
teplické s.	Teplice Formation
teplické souvrství	Teplice Formation
vrstvy rohatecké	Rohatec strata
vrstvy ammon.	Ammonite strata
vrstvy Břvanské	Břvany strata
vrstvy koteřov.	Koteřov strata
vrstvy lenešické	Lenešice strata
vrstvy nuculové	Nuculus strata
vrstvy pátecké	Pátek strata
vrstvy rhynchonellové	Rhynchonella strata
vrstvy terebr.	Terebratula strata
vrt	borehole
východ	east
západ	west
západní část	west port
zvonivé opuky inoceramové	ringing inoceramus marly cherts

4. DISCUSSION

In the stratigraphic segmentation of Cretaceous Formation of the Ohře region elaborated by M. Váně in 1997 there are two opposite ideal stratigraphic profiles in graphical projection of the area. The western profile is considerably best represented by the examined Pd-1 borehole (Figs. 11, 12, 13).



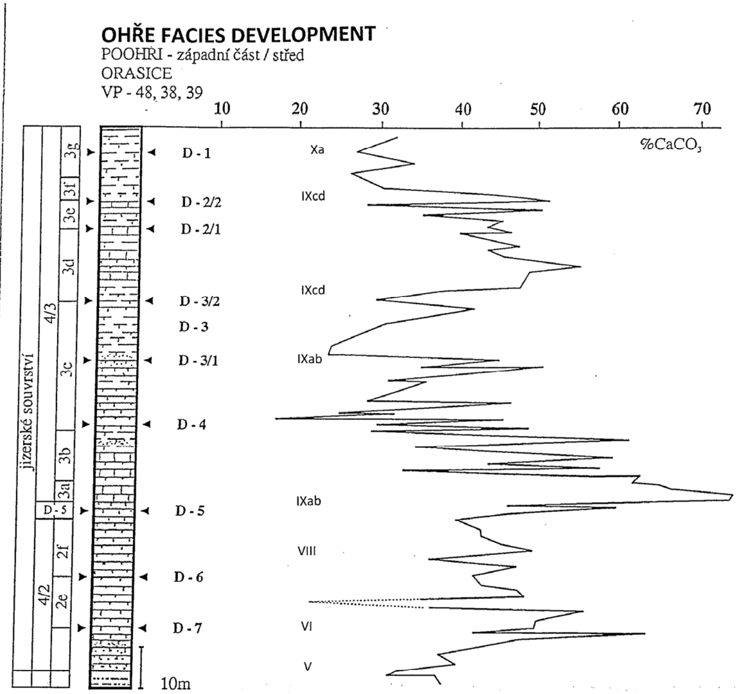


Fig. 11 to Fig. 20 are published in their original form since it is the old original hand-drawn images by Dr. Váně.
Is accompanied by a glossary of special terms (Table 3).

Fig. 11 * Borehole Pd-1, correlation west part of Ohře facial region..

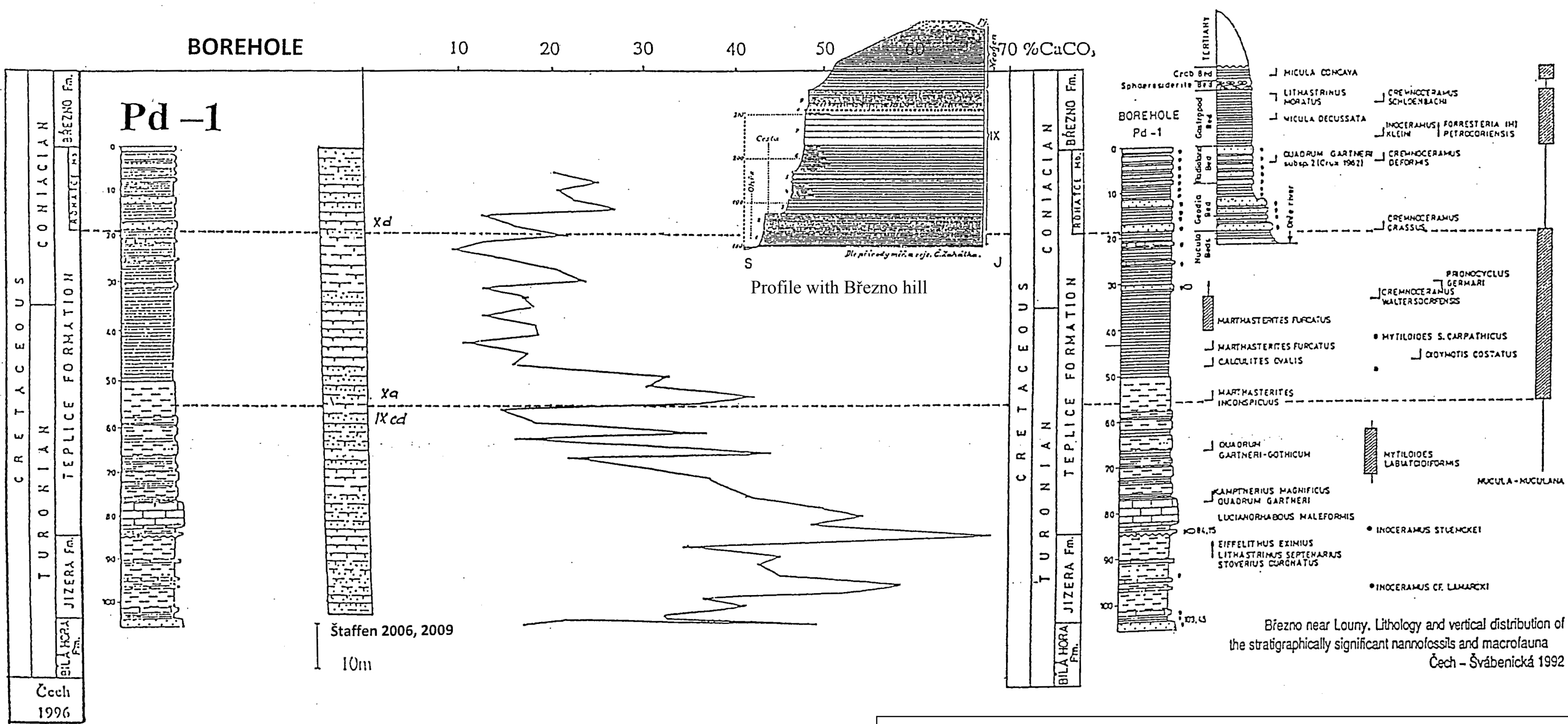


Fig. 12 Borehole Pd-1, correlation of content carbonates and paleontol. content.

Fig. 11 to **Fig. 20** are published in their original form since it is the old original hand-drawn images by Dr. Váně.
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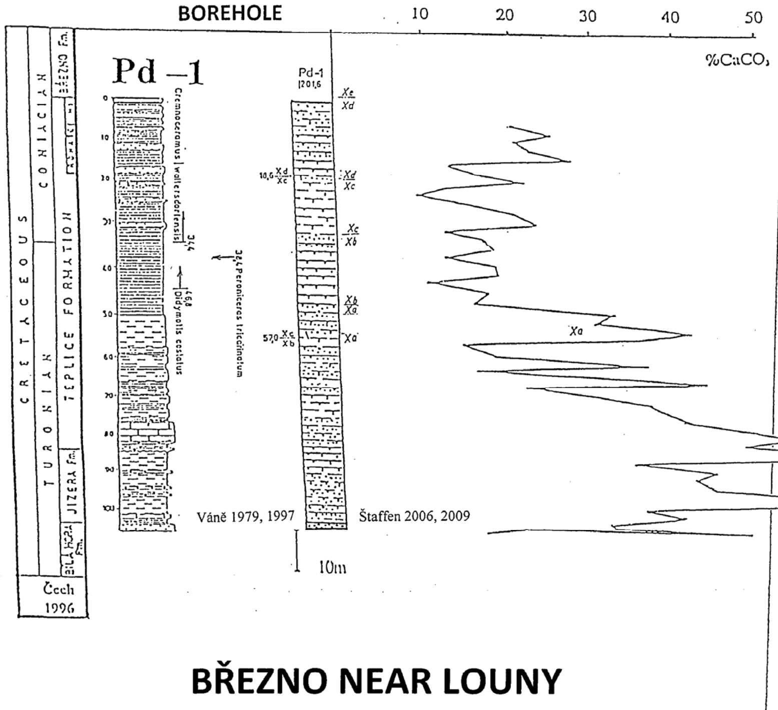

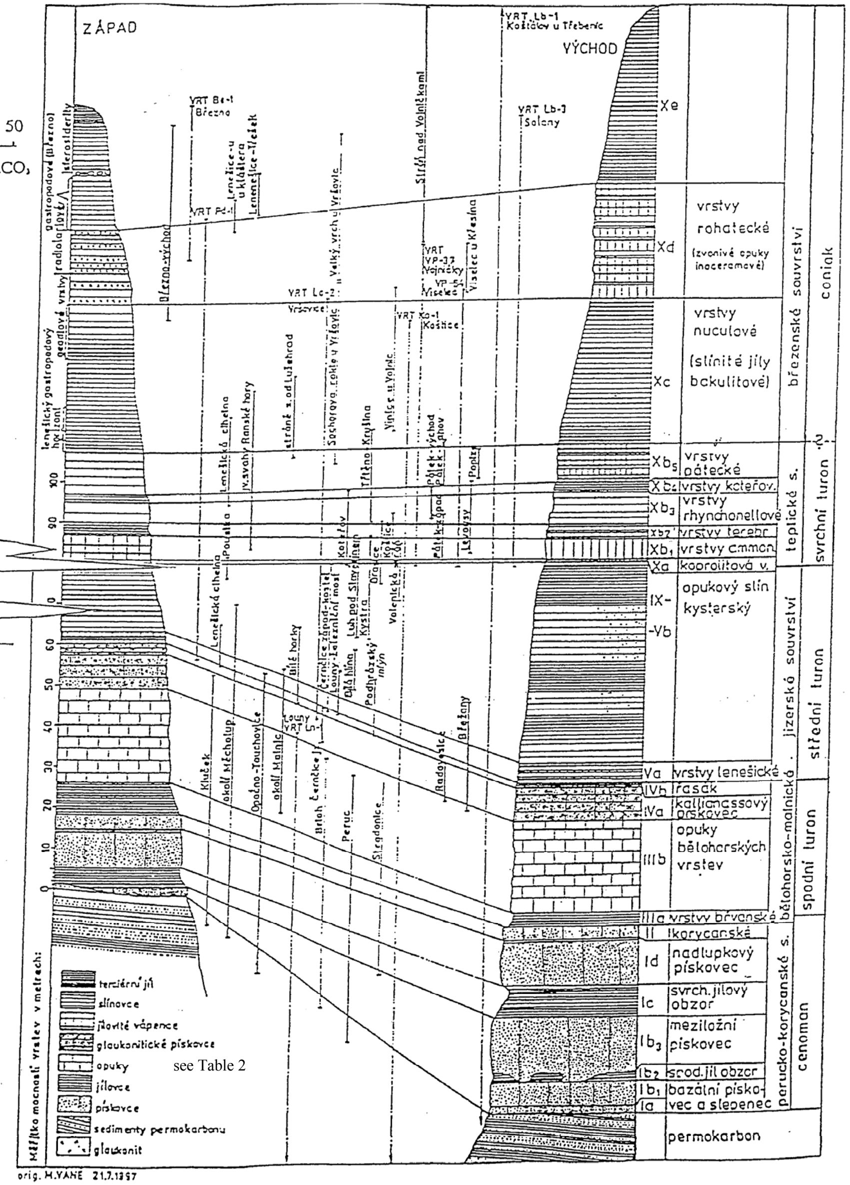

Fig. 11 to **Fig. 20** are published in their original form since it is the old original hand-drawn images by Dr. Váně.
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Fig. 13 Borehole Pd-1, development of stratigraphy structuring west part.

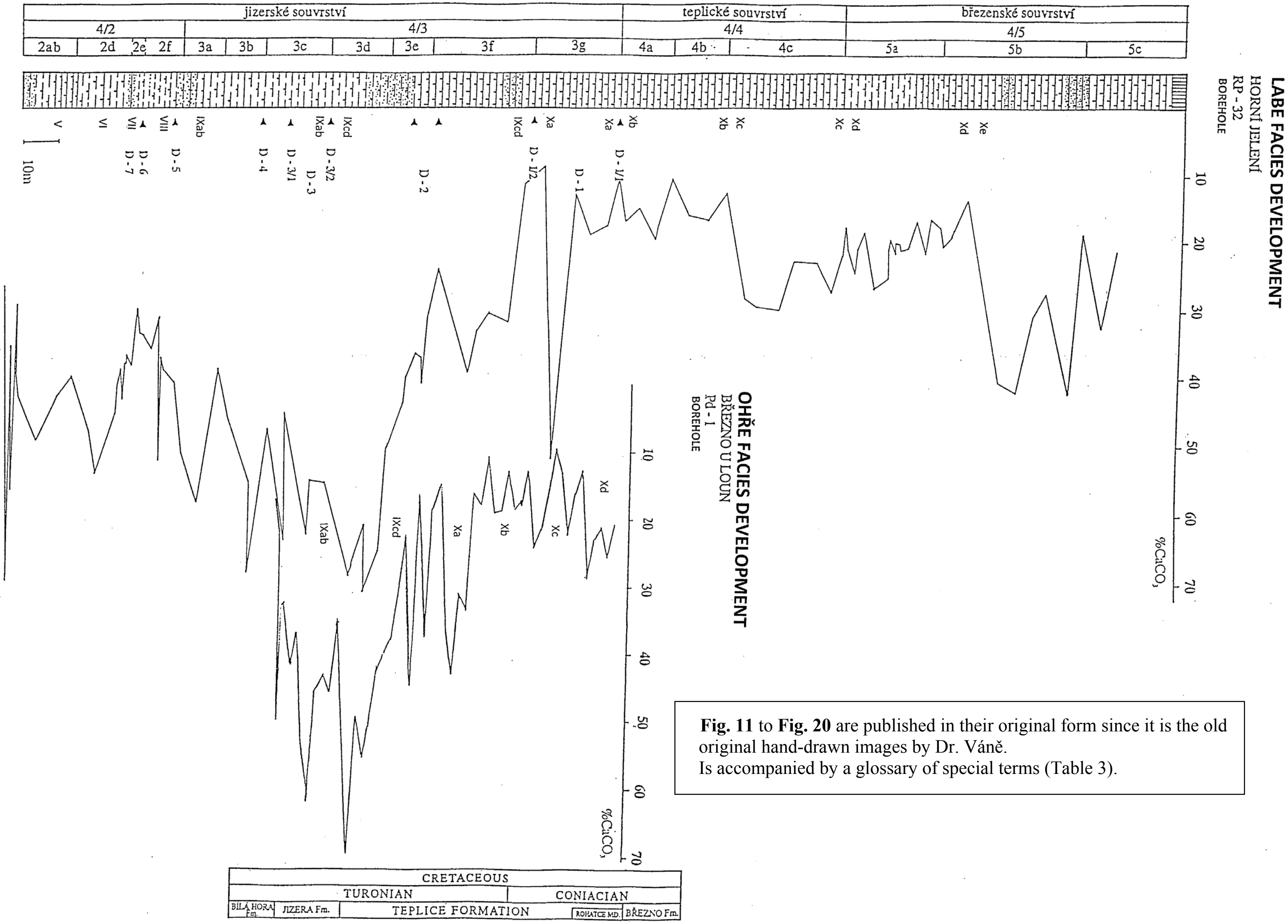


Fig. 11 to **Fig. 20** are published in their original form since it is the old original hand-drawn images by Dr. Váně.
Is accompanied by a glossary of special terms (Table 3).

Fig. 14 Borehole Pd-1, correlation profile with Elbe facial development.

The eastern profile of this table is nearly ideally corresponded by means of the profiles of the VP series boreholes located to the East from Zahálka's "Milešovka strip", i.e. from the line connecting Solany, Vojnice, Koštice and Levousy. From the examined boreholes of the above series it is clear that approximately from this line to the East the depth of the Jizera formation towards the Roudnice region increases. The highest thickness of this formation was traced by the boreholes in the neighboring of Libochovice, Břežany n. O. and Orasice (Figs. 15, 16, 17). The reason of the depth increase is the presence of the zone V that is to the West from the above line reduced or completely missing on the base of the Jizera formation. The uppermost part of the borehole profiles of these drills is in all the cases represented by a huge oscillation carbonate maximum (chalkstone complex) that in other areas of the basin explicitly represents so-far acknowledged the Jizera formation (Zahálka's zone IX, Soukup's zone IXcd).

Also the development of the curve of carbonate content in the bed of this excessive mineral and chemical komplex in Poohří region corresponds to the development elsewhere in the basin. The bed of the zone IXab is characterized by carbonate maxima and minima oscillations varying in a several-meter succession. The thicknesses of their set reach approximately 50 m and are ended by a huge carbonate maximum marked in the Poohří Xb stratigraphy ("body"). Elsewhere in the basin under this chalkstone 10-15-m thick positron there is a glauconitic lamina that is a beginning of the zone VIII, VII. In the Ohře facies area this lamina is indicated as "coprolitic" and stratigraphically it is rated as the uppermost part of the local Jizera formation, i.e. equivalent to Xa glauconitic contact stratum elsewhere in the basin.

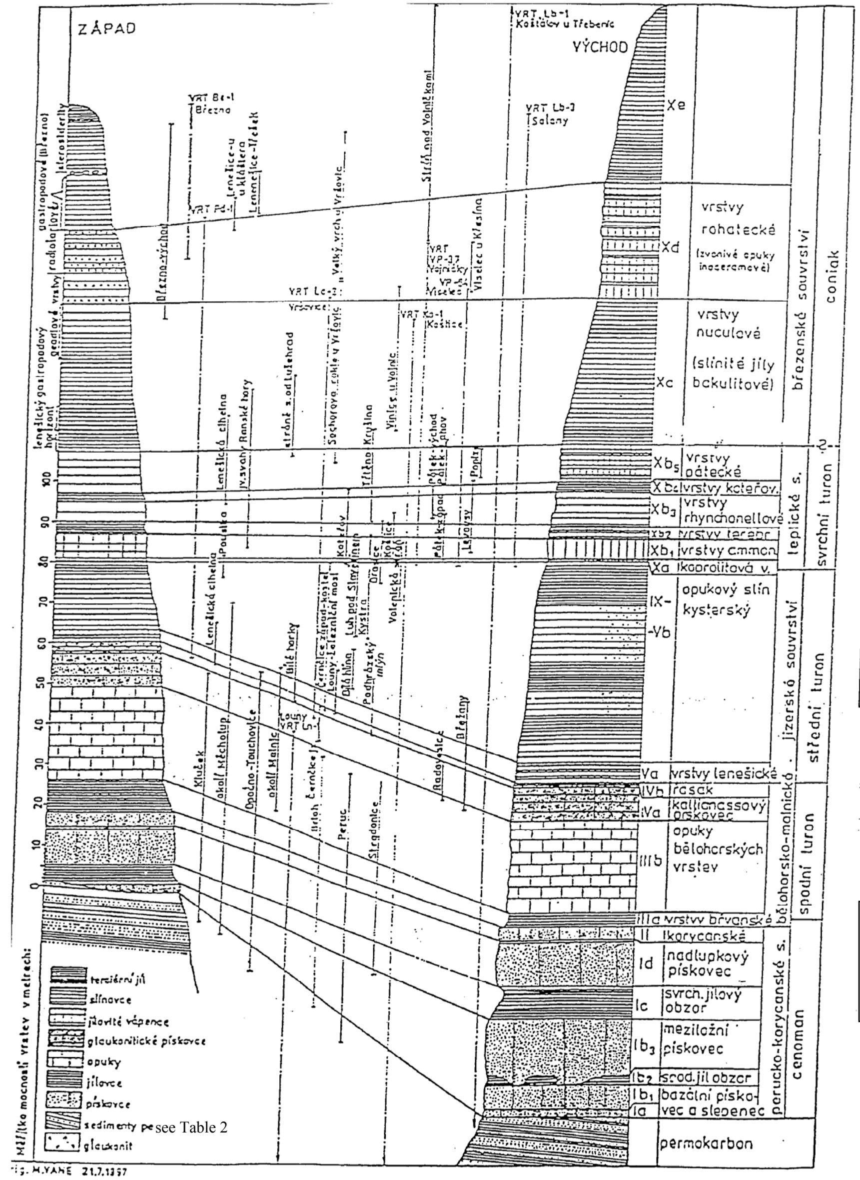
However, from the borehole profiles representing the eastern part of Poohří stratigraphy table, it is clearly visible that under the coprolitic stratum a typical development of the curve of carbonate content for the zone VIII-VII in other places in the basin continues. In the zone VII-VII calcite content there is a substantial drop of its quality by several tenths of percent comparing to the upper part chalkstone position on the basis of the zone IXab (in Poohří Xb – "body"). The outstanding, very limited by its thickness (1 m), "acicilar" calcite content maxima on the curve are typoval for the zone VIII-VII. Lithologically they are often represented by a concrecional sediment calcification of this zone. In the borehole profiles of the Poohří eastern part there is a continuous passage to the sediments of the zones VI and V, creating an ending to the Jizera formation towards the zone VIII-VII.

In the western Poohří region, but also elsewhere in the basin, frequent sedimentation disorders and fast thickness changes of this section of the formation can be traced. In the Louny region these zones are missing in the profiles of many boreholes and the Jizera formation sits on the bed of the Bílá Hora formation by means of the misshaped zones VIII and VII.

After the Pd-1 borehole evaluation it is clear that also in its profile the zones V and VI (probably also VII and VIII) of the Jizera formation are missing. This way the western Poohří region profile, showed in the table, is neither stratigraphic nor material equivalent of the eastern profile of this table.

Chalkstone complex in the uppermost parts of the boreholes, representing the eastern Poohří region and stratigraphically considered to be the zone Xd, does not correspond to the same zone, earmarked in the western Poohří region profile. In the Pd-1 borehole it is real zone Xd, represented by low contents of carbonates of opal matter (CT opal) that is easily comparable with its position in the stratigraphy of the whole Bohemian Cretaceous Basin. The presence of the zone Xd in the upper part of the profile of the Pd-1 borehole can be explained by its location in one of the biggest Ohře aulacogene bodies of the fracture zone between Březno, Dobroměřice, Chožov, Vojničky and Lkáň in the width of 0.5 – 3 km. Its area and its decline against the neighborhood in the scope of 15 – 40 m was outlined by Krutský (1975), who correctly warns of presence of a conserved Coniacian in the middle part of the trough. This prerequisite was validated by the Pd-1 borehole profile with conserved zone Xd (the Rohatce formation) in its uppermost part. The typical chalkstone complex, representing the upper part of the Jizera formation in the basin (zone IX), is located in this borehole in the depth of approximately 57 – 100 m, not taking into consideration the zone Xa that from the mineral and chemical point of view belongs to the Teplice formation in its upper part.

The basic problem of the Ohře region stratigraphy, described by M. Váně, is the fact that the western and eastern Poohří region are mutually compared, where in consequence of an erroneous interpretation the zone Xd in the West of the region and the zone IXcd of the carbonate complex (considered to be zone Xd) in the East are mutually shifted. This way the eastern part is stratigraphically shifted up approximately by 30 – 40 m to the upper part and the chalkstone complex of the uppermost part of the Jizera formation is correlated with younger Rohatce formation (the Březno formation, Coniacian) in the profile of the western Poohří region, represented by the Pd-1 borehole. The real equivalent of this carbonate complex, mistakenly considered to be the zone Xd in the eastern Poohří region profile, is the set of sand silty marlites in the depth of 60 - 86 m in the Pd-1 borehole in the western Poohří region. This way an average height leap between the upper part of these chalkstone complexes in the profiles of western and eastern parts of the Poohří region is 60 m. This way the chalkstone complex in the Pd-1 borehole that is a mineral and chemical equivalent to the uppermost part of the Jizera formation in the basin, the eastern part of



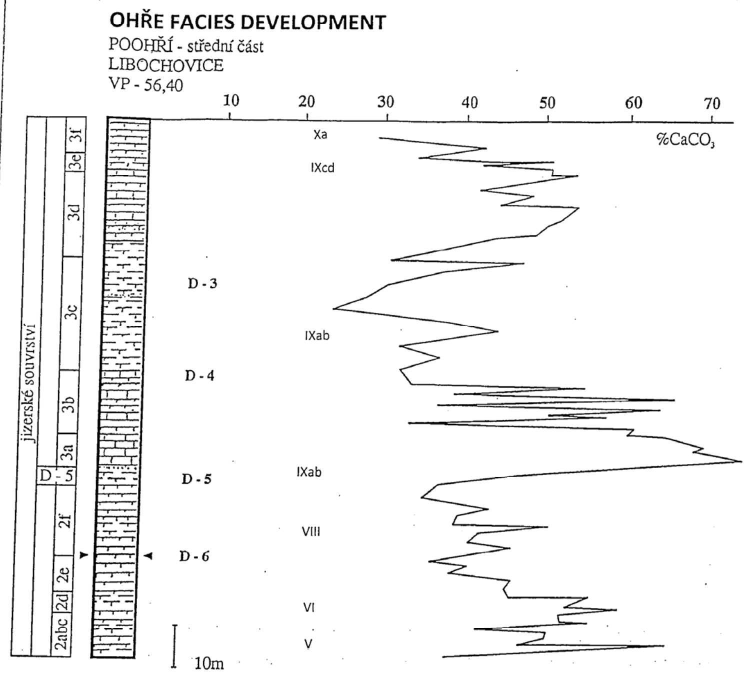
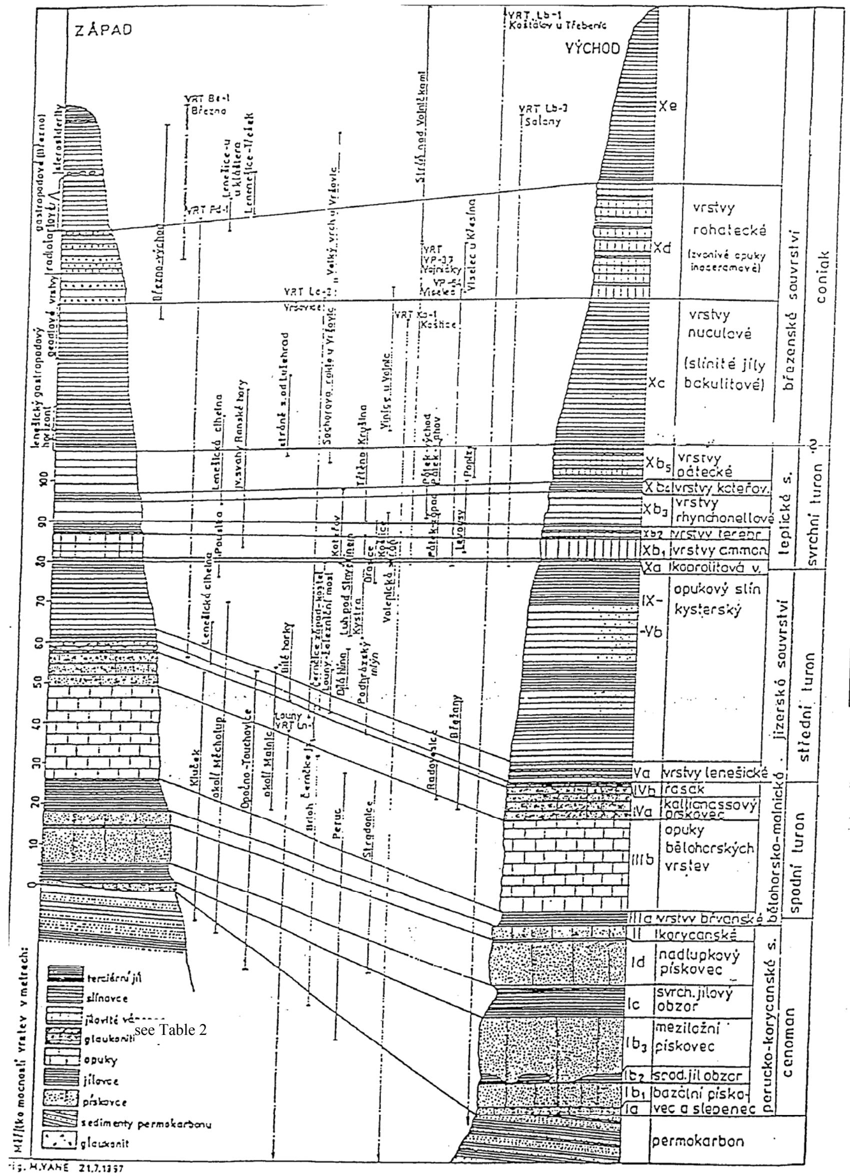


Fig. 11 to **Fig. 20** are published in their original form since it is the old original hand-drawn images by Dr. Váně.
Is accompanied by a glossary of special terms (Table 3).

Fig. 15 *Development of content carbonates in the eastern part of the Ohře facial development (drawing: Ohře facial development – east, Březany over Ohře).



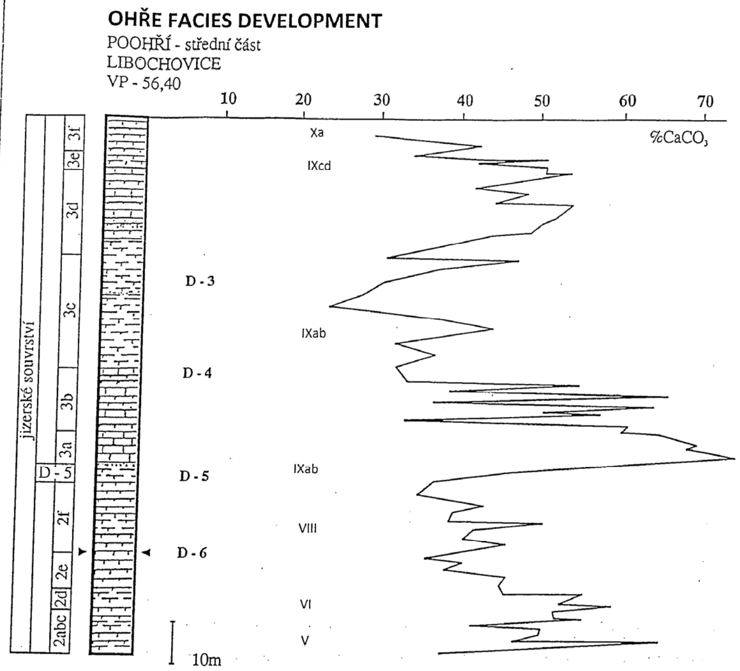


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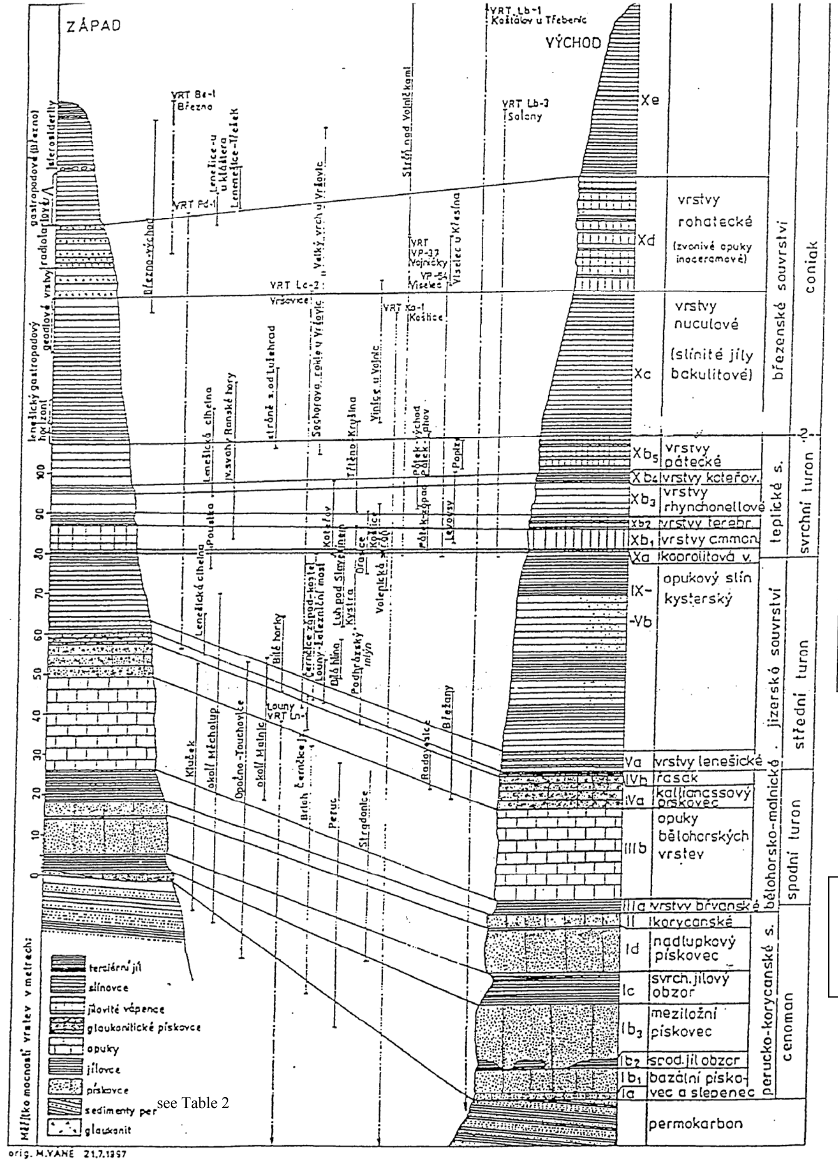
Fig. 16 *Development of content carbonates in the eastern part of the Ohře facial development (drawing: Ohře facial development – east, Libochovice over Ohře).



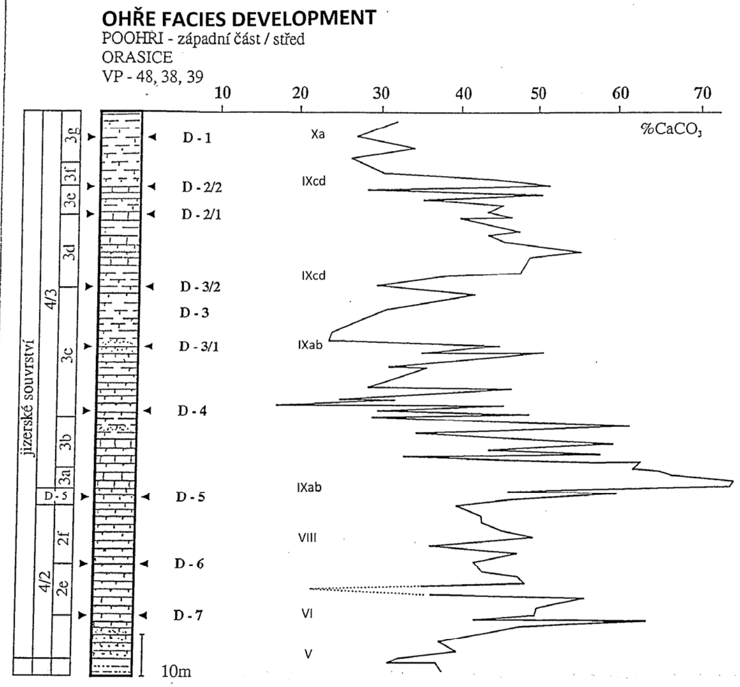


Fig. 11 to **Fig. 20** are published in their original form since it is the old original hand-drawn images by Dr. Váně.
Is accompanied by a glossary of special terms (Table 3).

Fig. 17 *Development of content carbonates in the eastern part of the Ohře facial development (drawing: Ohře facial development – east, Orasice).

the Poohří region is confronted by the litologically similar, hence easily confused, set of strongly calcificated sediments of the zone VIII and VII. In the East in the bed of these zones a continuous passage in zone VI and V sediments can be traced, likewise in other parts in the basin.

Owing to more than 100-year research of the Rohatce platform by Roudnice nad Labem we can come to the assumption that the paleontologic material from the upper part of this morphological formation really produces evidence for sediment belonging to the zone Xd. The only explanation consists in comparison with analogical development in the East of Bohemia, where the reduction of the zones Xbc of the Teplice formation often reaches such a scope that the zone Xd draws near to the glauconitic contact strata (Xa) that is here represented by the uppermost part of the Jizera formation. The morphology of the curve of carbonate content, representing here Soukup's zone IXcd, is identical with the course of the same curve of the chalkstone complex, creating the uppermost part of the Rohatce platform (Figs. 18, 19, 20, 22). A similar chalkstone set, represented by calcite maxima in the uppermost parts of the borehole profiles of the VP series, can be traced in most areas of the Poohří region. The exception to the rule is the Červený Újezd Pd-1 and SH-9 boreholes (Fig. 21), where over the chalkstone complex of the zone IXcd there are easily crumbling marlites of the Teplice formation (Xbc) with the zone Xd the uppermost part of the conserved profile of the upper cretaceous sediments. The difference in thicknesses of particular variations of the curve of carbonate, insoluble residue minerals content between these described boreholes rests in the fact that towards the northwest edge of the Bohemian Central Highlands there are disorders (increase) of thicknesses inside the zones Xbc of the Teplice formation and deferring of the Rohatce formation (zone Xd) from the uppermost part of the Jizera formation.

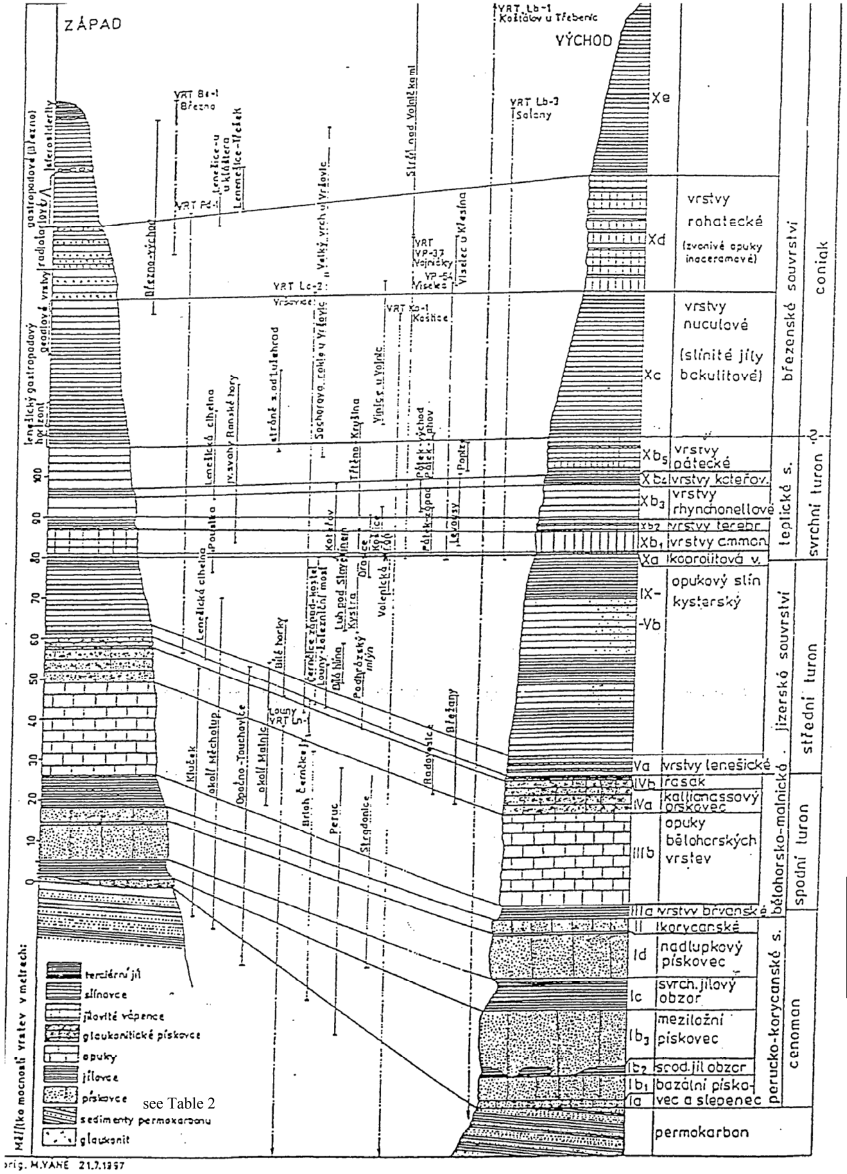
By means of the evaluation of carbonate contents in the boreholes of the VP series in the Poohří region it was possible to correlate them. This correlation shows that most of the boreholes in their beginning part went through the chalkstone complex that is in this area mistakenly considered to be (with the exception of the Pd-1 borehole) the zone Xd. Elsewhere in the basin it corresponds to the uppermost propagation cycle of the Jizera formation ((Soukup's IXcd) and its immediate bed that is part of the upper part of the Soukup's formation IXab). Some authors (Čech, 1994) consider this chalkstone complex to be an equivalent to the lower part of the Teplice formation from the Roudnice and Poohří regions (Zahálka's zone Xb), where these chalkstones are again an equivalent to the base part of the zone IXab in the basin and in the Poohří region they are called "body" (Fig. 19).

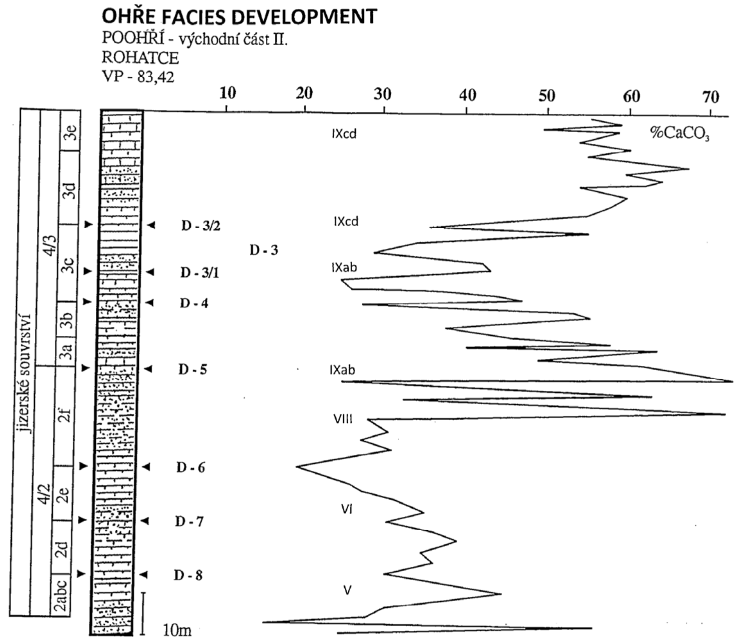
However, it results from the summary of the research of the Poohří region (Krutský et al., 1975) that the zone Xb is here considered to be a set of differently thick and differently calcified marlites up to chalkstones. Over the coprolite lamina that is not an equivalent of the glauconitic contact stratum (of the zone Xa) elsewhere in the basin, but it is one of the mineral and chemical boundary inside the Jizera formation, dividing its upper and lower part. This border, situated here in the upper part of the zone VIII, was in the basin operationally marked as D-5.

The base chalkstone position Xb in the Poohří region reaches the thickness of 5 – 8 m and it is a typical chalkstone position in the whole Bohemian Cretaceous Basin also outside the Poohří region. Contents of $CaCO_3$ here reach to 60 – 70 %; Váně (1997) designated this zone as Xb_1. In the Poohří region this position of chalkstones is also known as "body". On the chalkstone there is 8 and even more-meter thick position of calcificated marlites that differs from the base chalkstones by a lower strength that is given on the curve of carbonate content by a traceable drop of their content. In the Poohří region they create the zone Xb_2 (Váně, 1997). A stratigraphic equivalent to them is Krutský's (1975) Xb_β. In the uppermost position of this set there are marlites, whose strength and calcification continually drop towards the upper part. Their thickness is approximately 4 m (Xb_3, Xb_γ). Succeedingly there is 6 and more-meter thick position of light calcified marlites ($Xb_{4,5}$, Xb_δ). In the whole basin over this position there is another mineral and chemical border (discontinuity), operationally marked as D-4, that creates a boundary in the Poohří region between local bed zone Xb and upper part oscillation character set Xc. The total thickness of this oscillation character chalkstone set in the region moves around 25 m. This part of the Jizera formation reaches a similar thickness also in the basin.

There is a mineral and chemical border D-4 over the base chalkstone position of the Soukup's zone IXab (in Poohří region Xb). The border is highlighted by an accumulation of domatic laminas of macrofauna shells, classical quartz and glauconite. However, it is not at all an equivalent of the "coprolite lamina" from the Poohří region. The real coprolite lamina is located 25 m lower on the boundary of the zone VIII and above mentioned chalkstones of the zone IXab.

Here it is necessary to emphasize that already Krutský (1975) draws the attention to a high lithological similarity of chalkstones of the zone Xb in the Poohří region with "similar chalkstone banks of a younger formation Xd" in the same region. He claims that "by means of their confusion many mistakes came into origin". It is obvious that even after thirty years from this conclusion the authors studying this area follow the same route. This way, influenced by the Ohře region stratigraphy, Čech (1994) rates the chalkstone set in the bed of kalianas sandstones (Soukup's IXcd) in the Orlice-Žďár and Elbe facies region among the base of the Teplice formation in the Poohří region, i.e. among the above





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Is accompanied by a glossary of special terms (Table 3).

Fig. 18 *Development of content carbonates in the eastern part of the Ohře facial development (drawing: Ohře facial development – east, Rohatce).

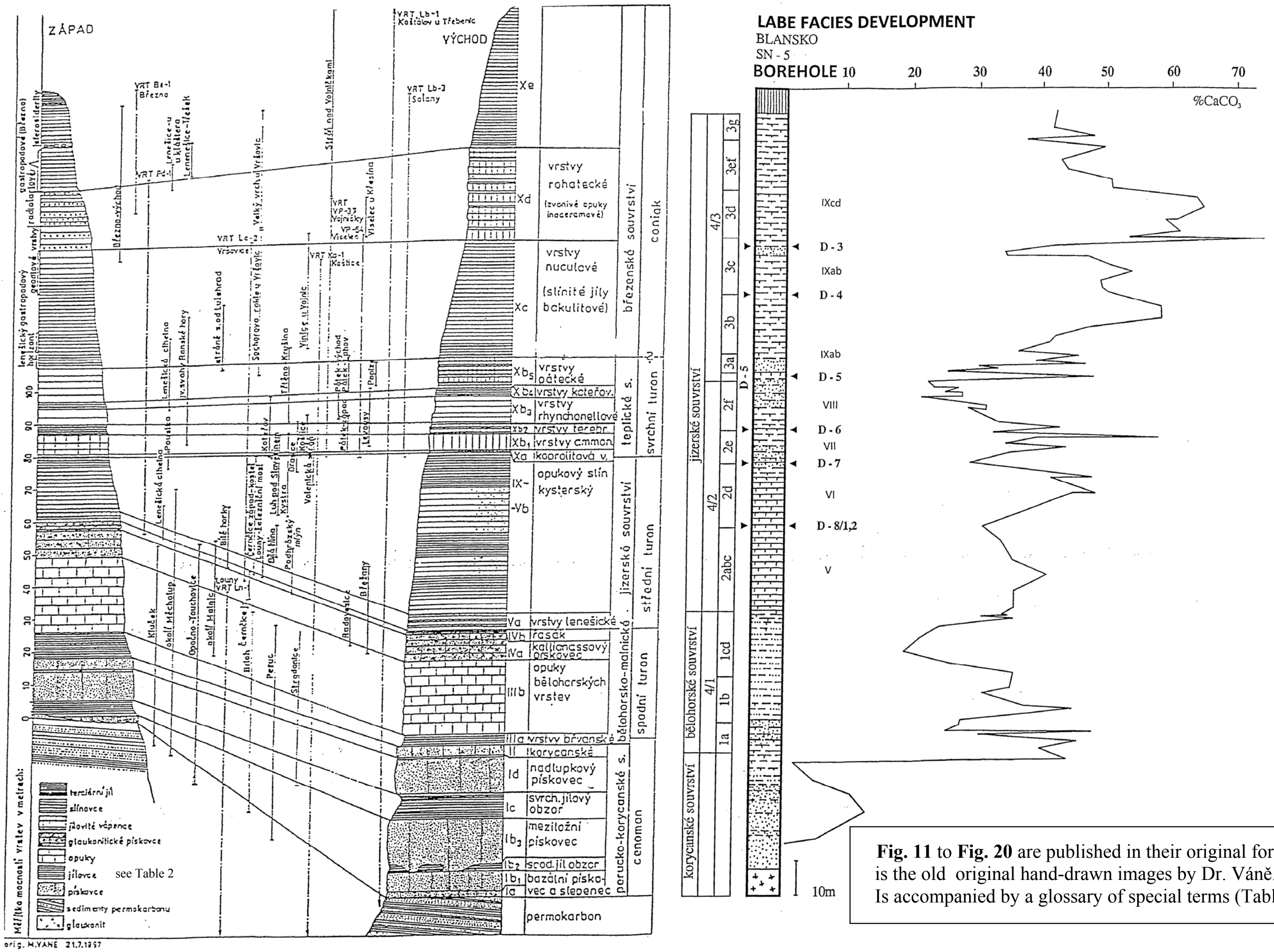

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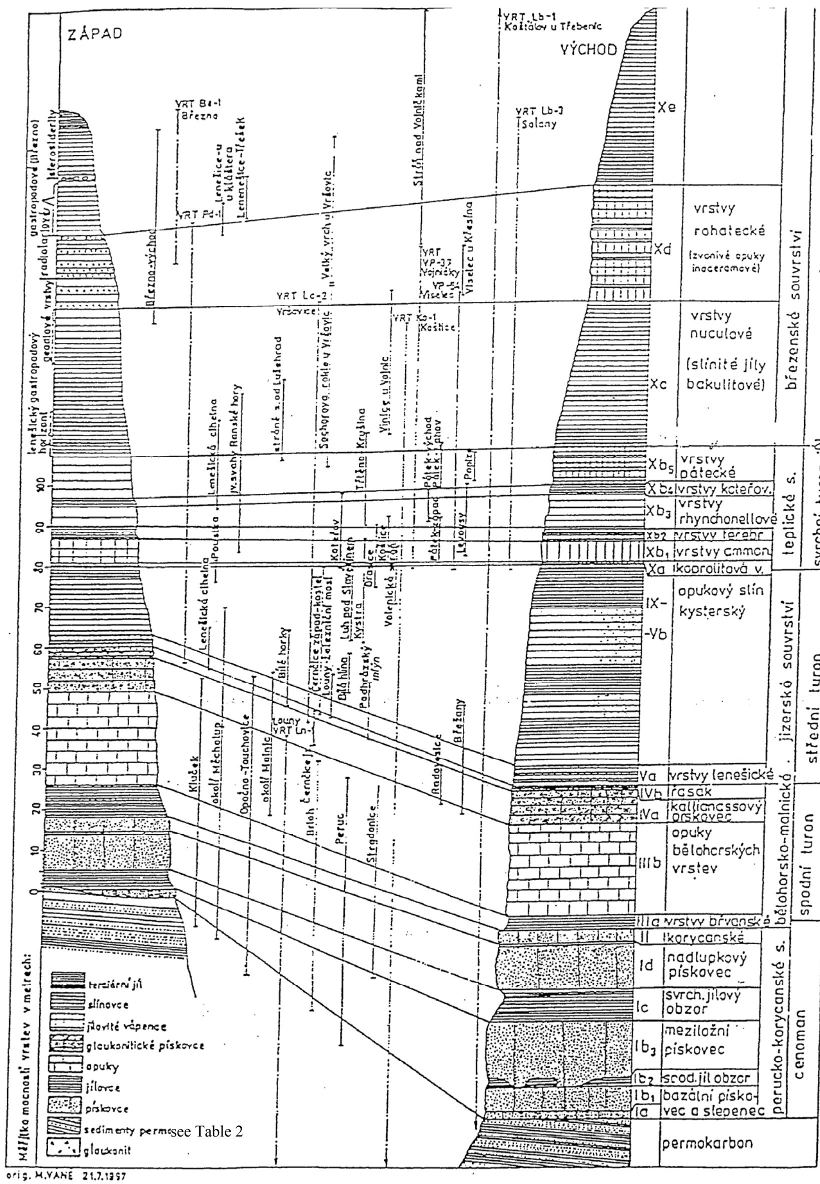
Fig. 19 Correlation with the eastern part of the Poohří region and Elbe facial development.



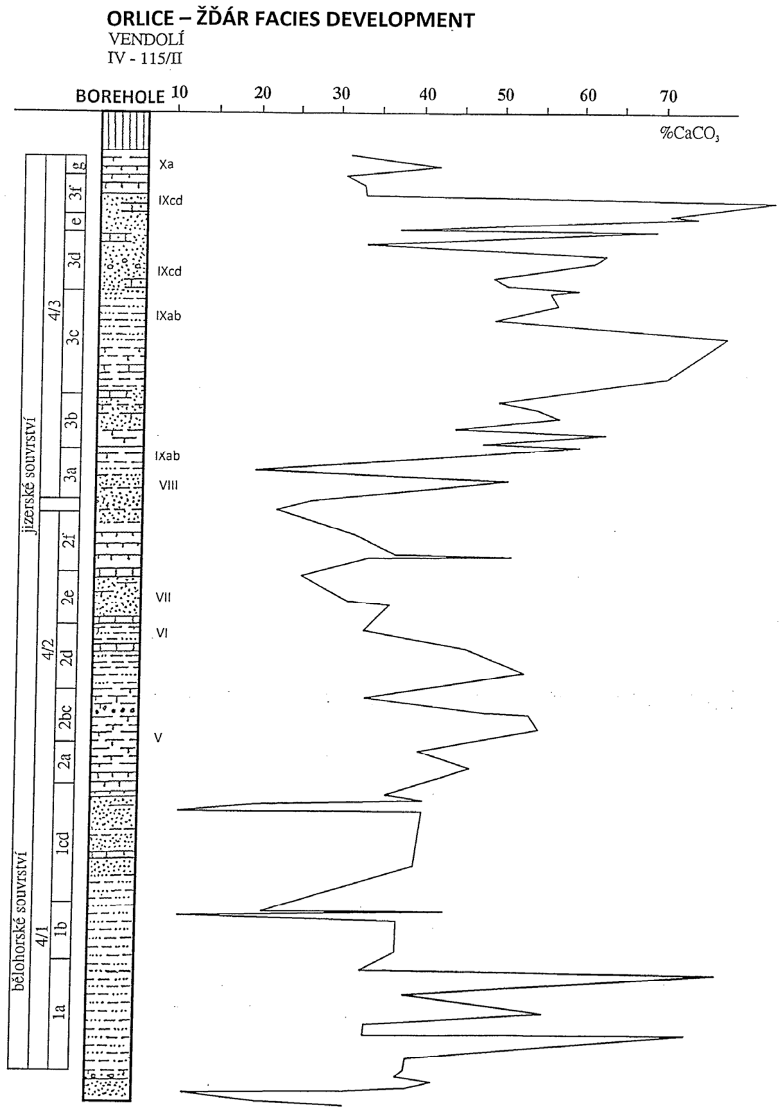


Fig. 20 Correlation of east Poohří and Orlice-Žďár facial development.

Fig. 11 to **Fig. 20** are published in their original form since it is the old original hand-drawn images by Dr. Váně.
Is accompanied by a glossary of special terms (Table 3).

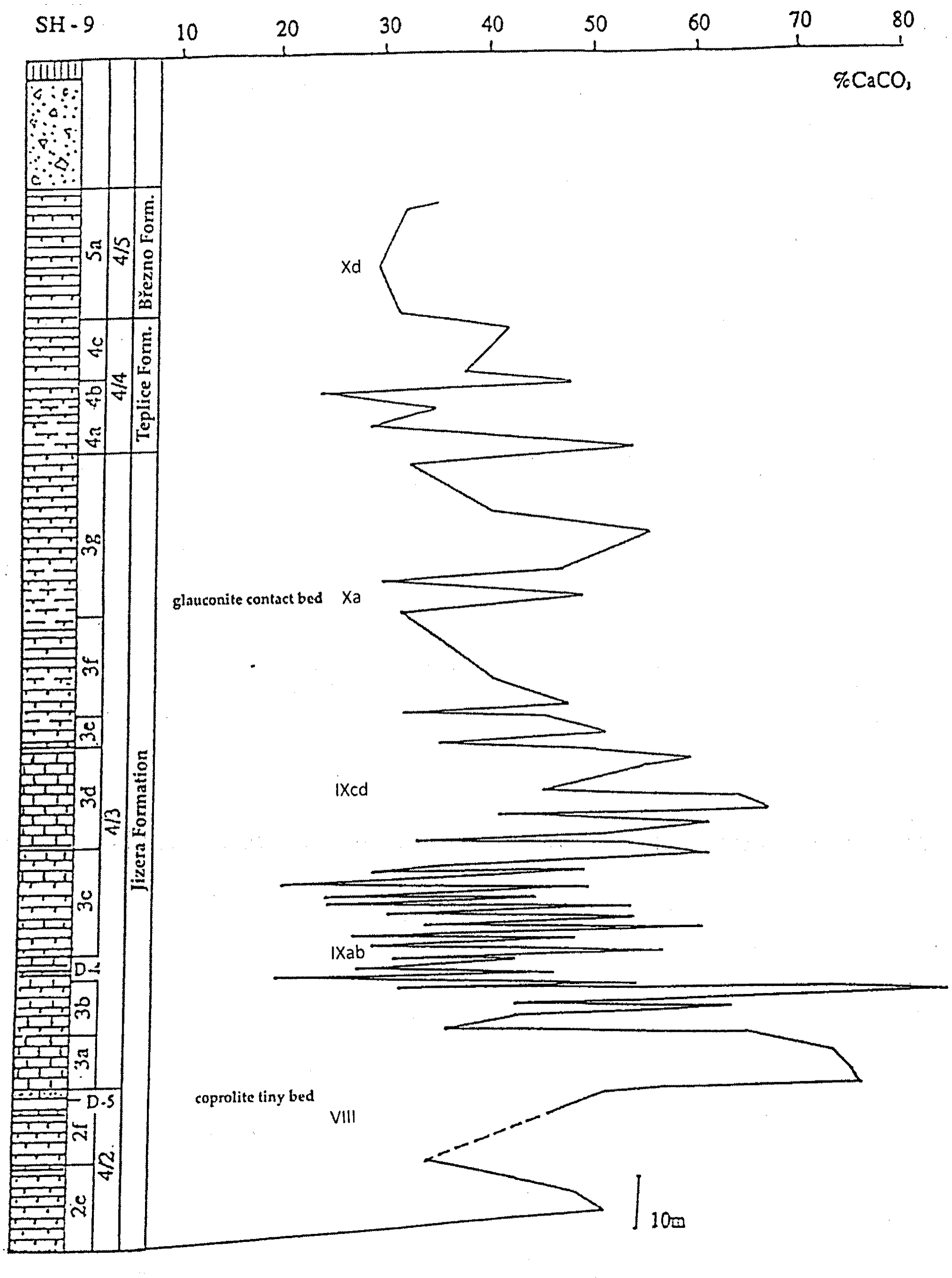


Fig. 21 Stratigraphy of borehole SH-9 Červený Újezd, Ohře facies.

mentioned zone Xb. However, in these facies regions of the Eastern Bohemia over the base chalkstone set of Soukup's IXab a strongly oscillated sedimentation zone follows, where a meter to a decimeter position of soft and compact (calcificated) marlites interchange, reaching a thickness of 20 - 30 m in the basin. The thickness of the oscillation zones dramatically fluctuates.

In the stratigraphic profile of the eastern part of the Poohří region (Váně, 1997) this marlite oscillation set is marked as Xc and its thickness is also 30 m. In this region the zone Xc is represented by a nucule formation (baculite marlite clay). From a stratigraphic point of view the autor rates this formation among the Březno formation – Coniacian. In other places of the basin this oscillation set of marlites is a representative of the Jizera formation (Middle Turonian, zone IXab). Its uppermost part is again ended by an outstanding mineral and chemical diskontinuity (operationally marked as D-3) that is

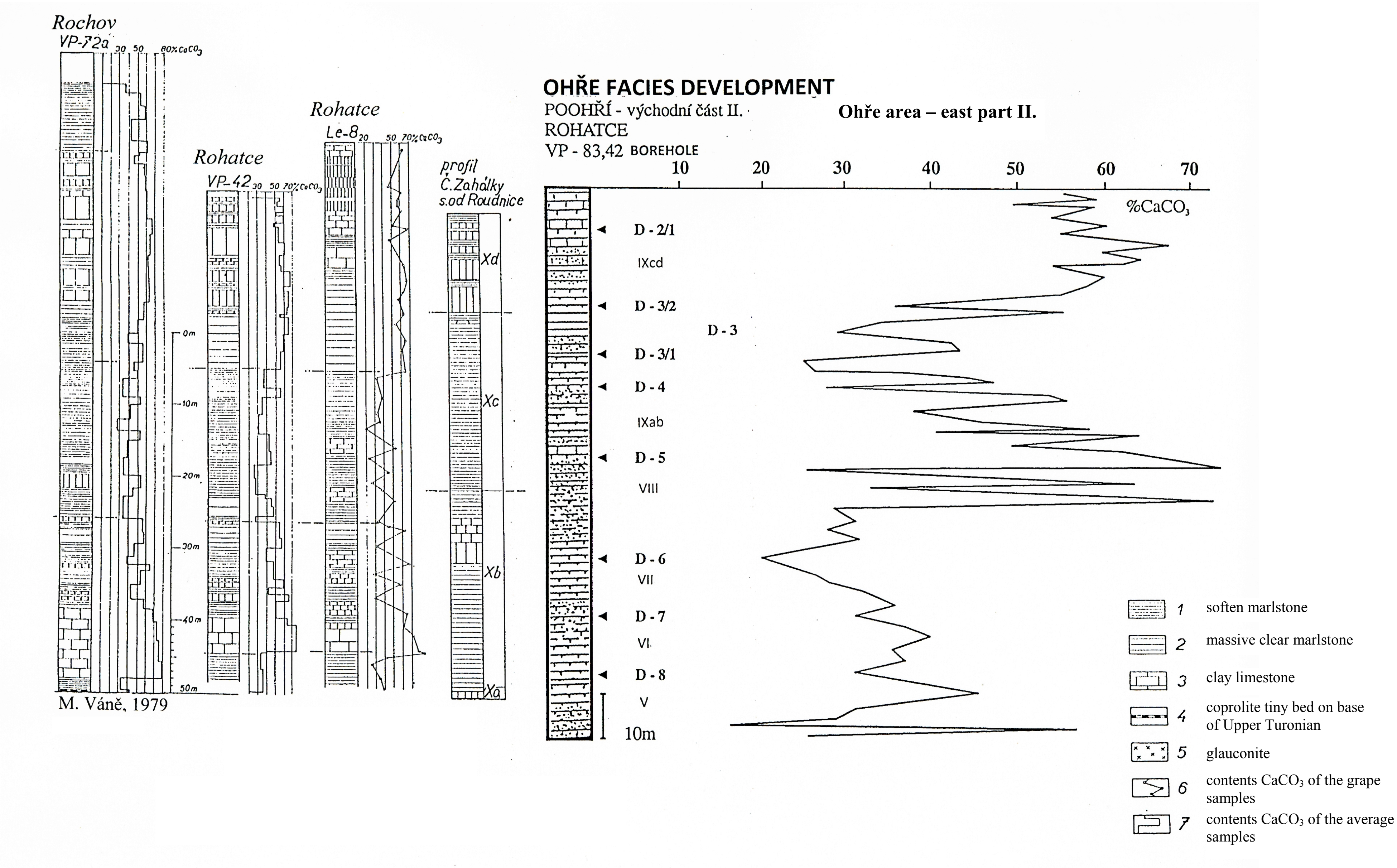


Fig. 22 Development of content carbonates on Rohatské height - Roudnice area.

a part of this complex and is correlated in the whole Bohemian Cretaceous Basin as an important minimum of carbonate content in the bed of chalkstone set that follows in its upper part. This boundary is obvious not only by the carbonate content, but it is also highlighted by a fluctuations in contents of classical sediment phase and other minerals (clay minerals, glauconite, siderite, etc.). It is also an important boundary in the values of specific weight (see mineral composition of Pd-1 borehole).

In the upper part of this boundary (D-3) there is a 20 – 25-m thick set of strongly calcificated sediments. Their carbonate content (first of all calcite) fluctuates from 50 to 75 %. Their facies alterability is high. In the East of the Orlice-Žďár facies region this carbonate maximum is represented by strongly sand chalkstones to calcificated sandstones, known as kalianas sandstones (Soukup's IXcd). Čech (1994) in his amended stratigraphic conception of the region considers them to be sediments of the Teplice formation in the upper part of the zone Xb in the Poohří region. However, in the upper part of these sandstones in the Orlice-Žďár region over the well-known "glauconitic contact stratum" (Soukup's zone Xa), created by differently thick set of dark easily crumbling and light gray solid (calcificated) marlites, there is a set of foliatedly crumbling, grey-black marlites belonging again to the Teplice formation (zones Xbc) in the East Bohemian stratigraphy. If the uppermost part of the Jizera formation really belongs to this area of the Teplice formation, as stated by Čech (1994), its thickness grows to nearly 160 – 170 m. From this point of view the idea of reduction of this thickness in well-known East Bohemian profiles is problematic as the zone Xd ("resounding inoceramus calcareous sandstones") is drawn near to the position of chalkstone complex (Soukup's zone IXcd, kalianas sandstones) to several meters.

The above mentioned chalkstone complex (Soukup's zone IXcd), easily correlated in the whole Cretaceous Basin, is in the eastern profile of the Poohří region mistakenly considered to be the zone Xd. It is demonstrated by the courses of curves of carbonate content and mineralogical composition of boreholes drilled and evaluated in the Poohří region. A justification of this statement is demonstrated by the correlation profiles (Figs. 19, 20). This mistake is intensified by a forcible correlation of this zone with western Poohří region, where the zone Xd on the Rohatce height is compared to the real zone Xd, as demonstrated by evaluated profile of the Pd-1 borehole in Březno u Loun (Figs. 11, 12, 13). Unfortunately, the borehole was finished in the level that does not enable to establish whether the sandstones on its base belong to the zone VIII or to the Bílá Hora formation. This way the chalkstone set, documented by the curve of carbonate content in the Pd-1 borehole in the section of 68 – 98 m, exactly states its stratigraphic belonging to the zone Xd of the Ohře stratigraphy in the eastern part of this region. In other places of the basin this chalkstone complex is typical for the upper part of the Jizera formation (Zahálka's zone IX).

5. CONCLUSION

The evaluation of archive samples from the Březno u Loun Pd-1 borehole enabled establishment of their exact mineralogic composition and its correlation to similarly prepared boreholes in other facies areas of the Bohemian Cretaceous Basin. It enabled the elimination of the mistaken interpretation of the curve of carbonate content (Štaffen, 1999) that was compiled for this borehole by means of joining the results of neighboring examined VP-39 Solany and VP-90B Raná boreholes. The new evaluation demonstrated that in consequence of a tectonic situation of the Pd-1 borehole location it was submerged in the central part of the Ohře trough and this way the youngest (Coniacian) sediments were conserved in its profile before an erosion. A unique opportunity of the correlation of almost total stratigraphy profile of the western Poohří region with the other facies areas of the Bohemian Cretaceous Basin arose.

The correlation of the Pd-1 borehole profile with the basin areas definitely shows that its stratigraphical position is identical with these areas. By its development of the curves of content of particular partaking minerals in the basin it corresponds to the areas located to the South of its axial part. There are outstanding thickness reductions of single zones and in marginal areas they are missing. This development corresponds to the Pd-1 borehole profile, whose analogy can be found in the SN-5 Blansko borehole in the Elbe facies region.

The determination of the stratigraphic identity of the Pd-1 borehole profile comparing to the Bohemian Cretaceous Basin shows the problem of an erroneous prerequisite that the chalkstone formation, covering substantial part of the Poohří region surface, is the zone Xd (resounding inoceramus calcareous sandstones, the Rohatce formation). The identification of the real zone Xd in the uppermost part of the Pd-1 borehole profile eliminates this equivalency. This way the determined profile through the eastern Poohří region (Váně, 1979) does not correspond to the western Poohří region profile. The reason of the stratigraphic jump and a mistaken interpretation is an absence of the zones V-VIII in this part of the Poohří region. Similar absences can be also traced in other places of the basin.

The above interpretation of the Pd-1 borehole profile does not exclude a possibility that there was a stratigraphic approximation of the zones Xd and Xcd in the Rohatce height. This possibility is a paleontologic question. However, the profiles of the examined Hrobce VP-83 and Rohatce VP-42 boreholes demonstrate that in their uppermost part there is again a chalkstone complex as in the prevailing part of the Poohří region. In the basin this

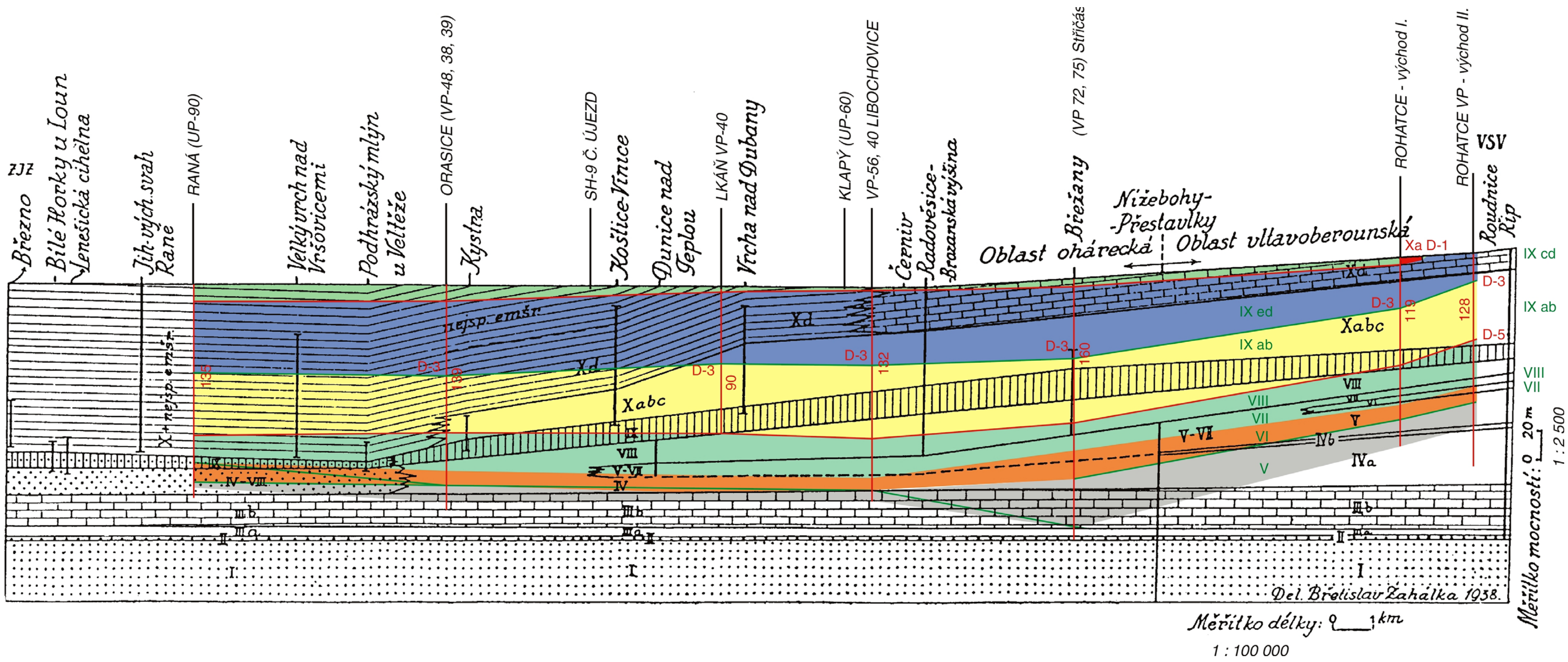


Fig. 23 The startigraphic scheme of creaceous sediments between Březno near Louny and Říp.

Bílé Horky u Loun	Bílé Horky near Louny
Lenešická cihelna	Lenešice brickworks
Jih. vých. svah	South-east slope
Velký vrch nad Vršovicemi	Velký vrch over Vršovice
Podhrázský mlýn u Veltěz	Mill Podhráz near Veltěz
Dunice nad Teplou	Dunice over Teplá
Vrcha nad Dubany	Vrcha over Dubany
Brazanská výšina	Brazany height
Oblast ohárecká	Ohře region
Oblast vltavoberounská	Vltava-Beroun region
Měřítko délky	Line scale
Měřítko mocnosti	Thickness

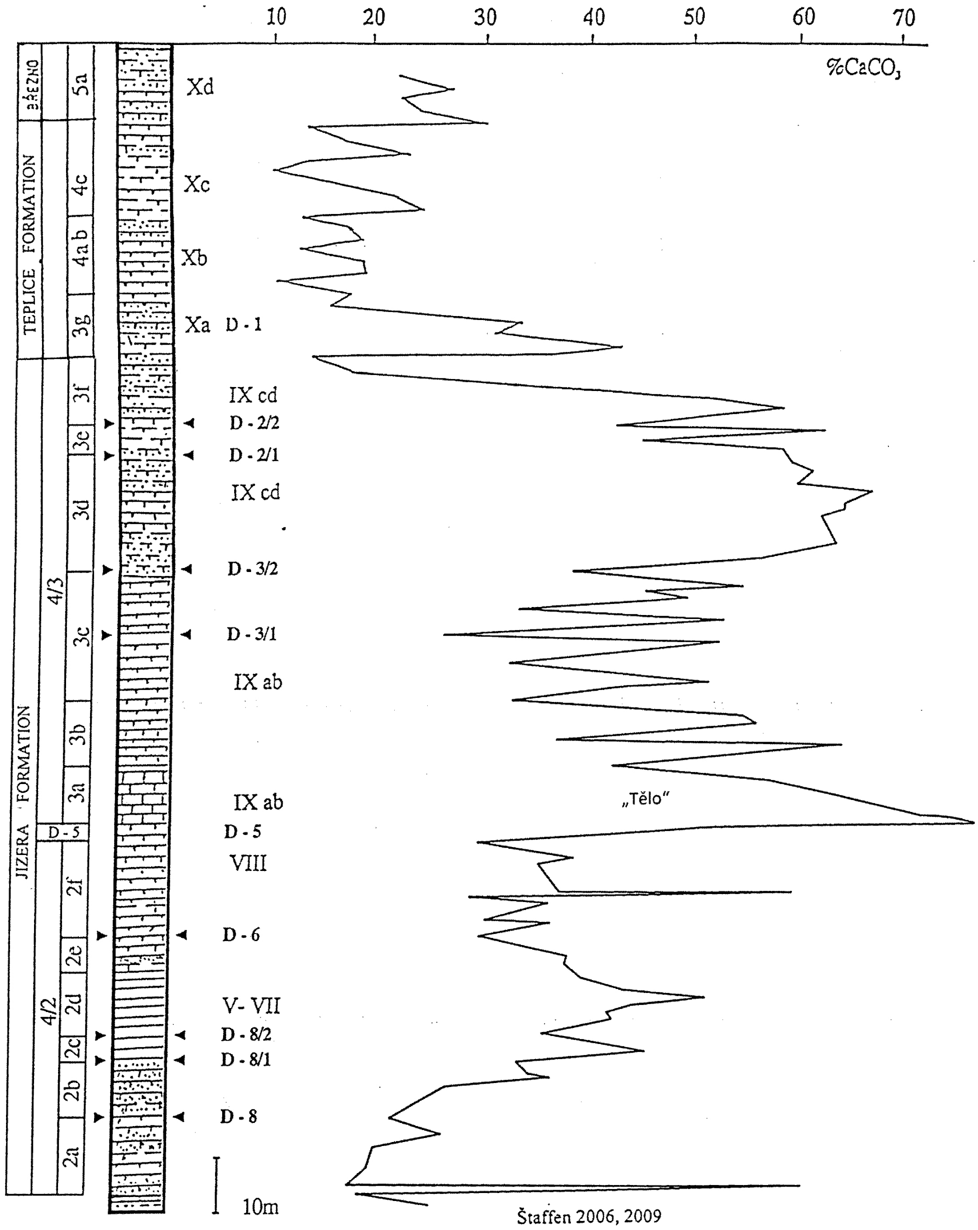


Fig. 24 The chemostratigraphic correlation of the Ohře, Orlice-Žďár and Elba facies development.

formation is an equivalent to the uppermost part of the Jizera formation. The profiles of these boreholes and their stratigraphy were verified at the opposite bank of the Elbe in the Kokořín region. Although there is a strong facies change from lutaceous in the Poohří region to sand, the chemostratigraphic profiles of this region are identical both with the Poohří region and with the other places in the basin. The classical basin development in this area was overtaken by the profile in Bosyně ("right hillside of the Kokořín pit"), where over the zone IXcd of the Jizera formation there are marlites of the zone Xbc and in the uppermost part there is the real zone Xd ("křidlák").

The above problem of the Poohří region stratigraphy and its correlation with other parts of the basin could not have to be solved in case the conclusion of Zahálka (1899), who, by means of the choice of an improper name for his zone IX in the Poohří region, caused that this zone is for more that one hundred years mistakenly considered to be zone X of the Teplice and Březno formation. In the original Č. Zahálka's work there are no doubts that in case of his "Březno formation" in the Poohří region he mentions the Jizera formation in the Kokořín region. As an equivalent to the "Březno formation" he quotes local profile that is an indisputable representative of the

Jizera region. This prerequisite was confirmed by the mineral and chemical examination in the Poohří region. Also the idea of the continuity of gradual petrographic (facies) and paleontologic changes of both regions held by this author and confirmed by chemostratigraphic evaluation of Cretaceous sediments should not be left unannotated.

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