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ROCKY COAST FACIES OF THE UNHOŠŤ-TURSKO HIGH (LATE CENOMANIAN-EARLY TURONIAN, BOHEMIAN CRETACEOUS BASIN)

JIŘÍ ŽÍTT
Institute of Geology, Academy of Sciences of the Czech Republic, Rozvojová 135, 165 00 Praha 6

OLGA NEKVASILOVÁ
Ružinovská 6/1160, 142 00 Praha 4

LENKA HRADECKÁ
Czech Geological Survey, Klárov 131/3, 118 21 Praha 1

MARCELA SVOBODOVÁ
Institute of Geology, Academy of Sciences of the Czech Republic, Rozvojová 135, 165 00 Praha 6

BOŘIVOJ ZÁRUBA
National Museum, Václavské náměstí 68, 115 79 Praha 1

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Abstract: A study of the Late Cretaceous rocky coast deposits of the Unhošť-Tursko High lying west-northeast of Prague is undertaken here. Based on the record of the rocky bottom characters, overlying sediments, phosphates, distribution of foraminifers, palynomorphs and macrofaunal taphocoenoses, two sedimentary settings each with its own phosphogenesis have been distinguished. The phosphogenic products are in part reworked and redeposited into younger beds. The older phosphatic remains are reported from the conglomerate in which the taphocoenose with *Gisilina*? *rudolphi and Goniopygus* cf. *menardi* occurs. Parts of the two sections (Předboj and Černovičky) characterized by this taphocoenose belong to the upper part of *Metoicoceras geslinianum* Zone and are discussed here in more detail. The younger phosphogenic episode is probably of the early Turonian age. Both the proper phosphogenic episodes and subsequent development of strata are correlated with the updip succession of the Pecínov Member and the Bílá Hora Formation in the Pecínov quarry. The palaeoenvironments of principal intervals are briefly discussed to elucidate problems of phosphogenesis and distribution of faunal remains.

■ Rocky coast facies, taphocoenoses, macrofauna, foraminifera, palynomorphs, phosphogenesis, palaeoenvironments, stratigraphy, late Cenomanian-early Turonian, Bohemia

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Introduction

The record of the late Cenomanian - early Turonian near-shore sedimentary environments highly varied along southern margins of the Bohemian Cretaceous Basin (BCB). These settings have been described in several sections of the areas of the Kolín and Vltava-Beroun lithofacial developments (in the sense of Čech and Valečka 1994), e.g. by Žítt and Nekvasilová (1990, 1991c) and Žítt et al. (1997a, b), but our notion is still unsatisfactory.

The first steps of the Late Cretaceous marine sedimentation between Kladno, Neratovice and Prague in central Bohemia highly reflected the morphology of gradually flooded land. While in the lowered relief parts the marine influences are apparent since the late middle Cenomanian, the top parts of the so called Unhošť-Tursko High (UTH) are considered to be first transgressed as long as the early late Cenomanian. In this paper the attention is focused predominantly on the coarse clastic rocky coast facies. The localities of this development are situated on exhumed parts of the UTH, but they are very few and their present-day preservational state is mostly very unsatisfactory. Several of them have already been described in detail (Žítt and Nekvasilová 1990, 1991a, 1992a, 1997, etc.) and for purposes of this paper only the micropaleontology and some details have been supplemented. A more detailed information is confined here only to most important but yet not adequately described localities (Předboj and Černovičky).

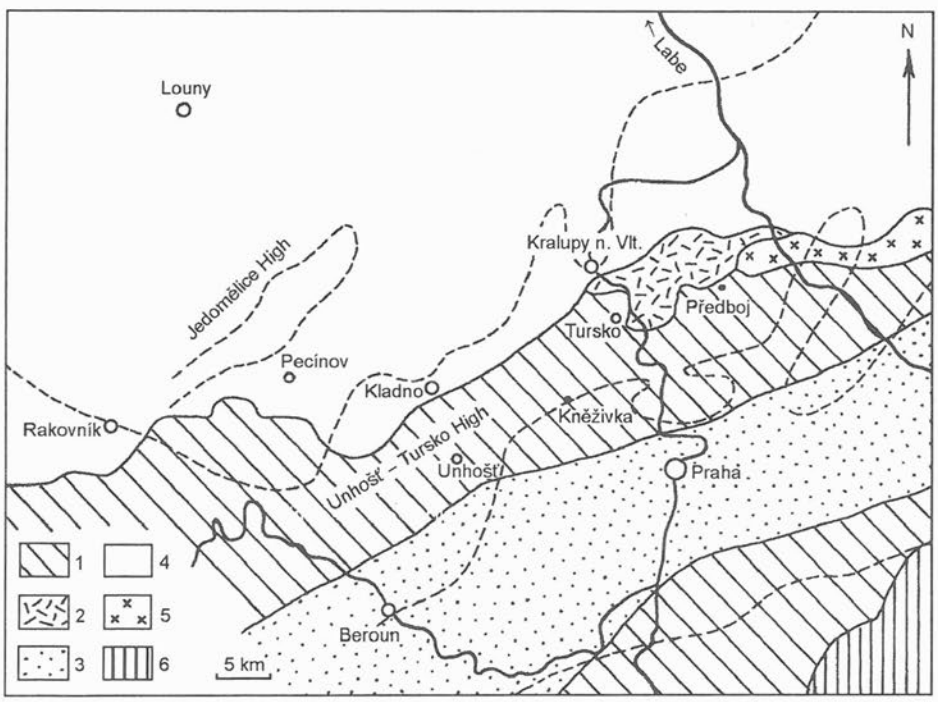
Although the great majority of Předboj sections does not exist today, the large rock samples taken in 1972 from the most important subsequently infilled classical quarry (see below) are presently at our disposal. This material together with the older geological documentation of the locality, some other materials gathered in 1960s, a collection of fossils in the National Museum in Prague, and the study of existing sections in the "Na Kocourku" quarry, enabled the evaluation of the whole Předboj area.

The preservation of sections in the area of the Černovičky locality is not fully satisfactory because the best uncovered conglomerate body (see below) lacks its topmost horizon (destroyed by weathering and sliding), and other important quarries are infilled. The problem was in part eliminated by study of the older samples and documentation.

For practical purposes the full names of some localities are shortened in the following way: Číčovice-Černovičky = Černovičky; Tuchoměřice-Kněžívka = Kněžívka; Tuchoměřice-Pazderna = Pazderna.

Palaeogeographic frame, geographical and geological settings.

The pre-transgression relief of the Bohemian Massif west of Prague was remarkable by generally higher altitudes of southwestern areas and several extensions (highs) protruding into the northern lowered relief parts (text-fig. 17). The westerly lying highs were lower and built mostly of the Late Paleozoic rocks (the Zbrašín and Jedomělice Highs; see Jelen and Malecha 1987, 1988) (text-fig. 1). The most easterly lying Unhošť-Tursko High (UTH), formed mostly of the Late Proterozoic rocks (Kralupy-Zbraslav Group; see Mašek and Zoubek 1980), was higher. All the highs extended approx. in the southwest-northeast direction, the UTH being the most extensive. The shape of this pre-Cretaceous structure was given by Malkovský et al. (1974) and in part by Zelenka (1987) and Straka et al. (1994) (text-figs. 17, 18). The Proterozoic rocks of the UTH are represented mainly by slightly metamorphosed graywackes, siltstones, shales, lydites and basalts (spilites). A post-Cretaceous denudation of sedimentary cover which in part exhumed the transgressed surface of the UTH, uncovered a rather well expressed system of internal chains of elevations and depressions reflecting different resistance of the bedrock (Matějka 1936, Zelenka and Valečka in Straka et al. 1988). The bodies of rigide lydites and silicified shales form the elevated relief parts on which only the basal parts of local Cretaceous deposits survived the complete removal. Basal clastics and limestones of these sections are generally assigned to the Korycany Member of the Peruc-Korycany Formation (Čech et al. 1980) (the Kaňk Member of Houša 1991) and overlying rocks to the Bílá Hora Formation.



Text- fig. 1 - Sketch map showing the Jedomělice and Unhošť - Tursko Highs (dashed line) and geology of the area. Outlines of highs are constructed on the basis of distribution and thickness of the Cenomanian Peruc Member deposits (text-fig. 17). 1 - Upper Proterozoic, 2 - Upper Proterozoic - Lower Paleozoic, 3 - Lower Paleozoic, 4 - Upper Paleozoic, 5 - granodiorite, diorite, 6 - other units.

History of investigations

The Unhošť-Tursko High (UTH) as a significant geomorphological unit of the early Late Cretaceous relief was first distinguished by Zahálka (1911) though he named it only after its northern part as the Tursko High. Matějka (1936) was the first who used the term Unhošť-Tursko Ridge. Later on, this elevated structure played an important part in the Cretaceous bedrock reconstructions and studies of the late Cenomanian-early Turonian transgression phases (Jelen and Malecha 1987, 1988, Malkovský 1974, Straka et al. 1994, Uličný, Hladíková and Hradecká 1993, Uličný and Laurin 1996, Uličný and Špičáková 1996, Uličný et al. 1997a).

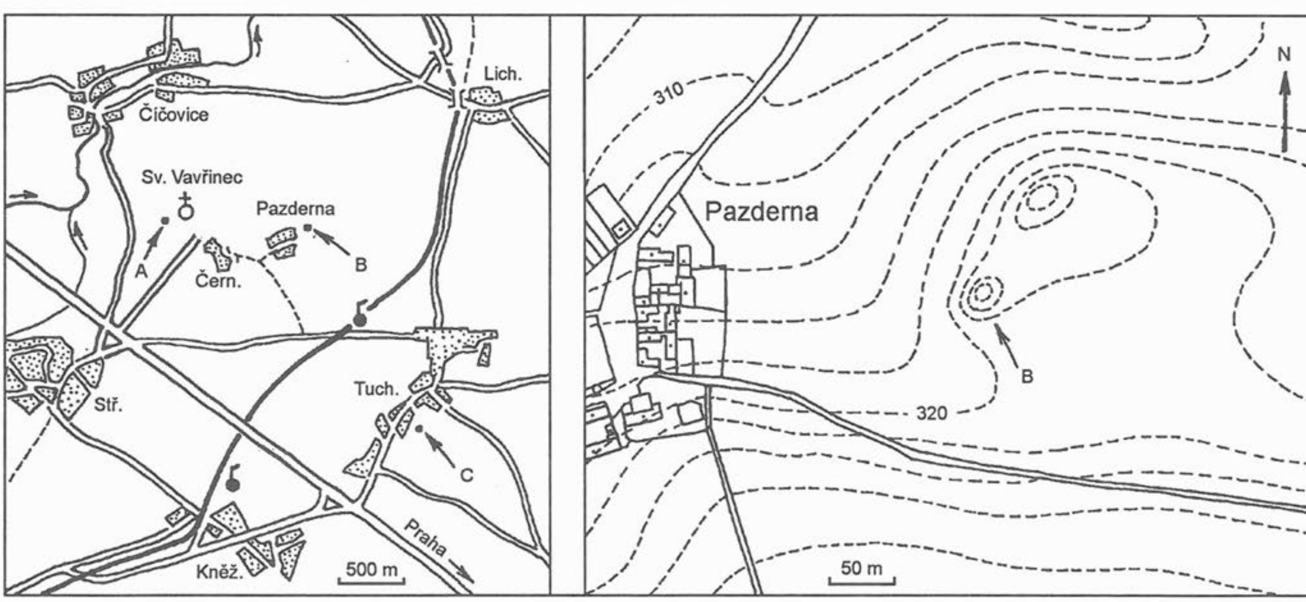
In the area of the high, several localities of the rocky-coast facies were described and now they do not exist or are in a very bad condition (Běloky - Zahálka 1911, Zázvorka 1930a; Bášť - Zázvorka 1930b; Předboj - Zázvorka 1939; Netřeba near Hřebeč and Černý Vůl - Zázvorka 1944a; Velké Přílepy - Zázvorka 1944b; Jeneč - Klein 1952; Vrapice - Žebera 1937, Augusta and Žebera 1939, etc.). Still existing localities were described in detail by Žítt and Nekvasilová.(1990 - Kněžívka, 1991a - Kojetice, 1997 - Pazderna) and Hradecká, Nekvasilová and Žítt (1994 - Odolena Voda). An extraordinary section was described at the temporary outcrops (warm-water pipeline) near Líbeznice (Žítt and Nekvasilová 1992a). Some localities of phosphates were briefly mentioned by Žítt and Nekvasilová (1991b, 1992b; Velká Dobrá, Středokluky, Vrapice, Předboj) and Žítt (1993a; Žákova skála, Černovičky, Pazderna, Svrkyně, Odolena Voda). Important localities of the area have been mentioned by Svoboda (1986, 1987, 1997a, b).

The Předboj fauna was for many years collected by Vl. Zázvorka (National Museum, Prague) but it was first reported by Prantl (1929, 1938). Zázvorka (1939) subsequently published important but too brief information on geology and a part of macrofauna of the classical section east of the road to Horňátky (see more below). Up to now a lot of papers appeared in which various groups of macrofauna were treated or mentioned (Backhaus 1959, Eliášová 1992, Hradecká 1984, Kollmann, Peza and Čech 1998, Nekvasilová 1964, 1967, 1973, 1983, 1986a, 1989, 1993, Nekvasilová and Prokop 1963, Svoboda 1986, Voigt 1979, 1983, 1989, Voigt and Flor 1970, Záruba 1965a, b, Zázvorka 1944c, Ziegler 1978, 1984, Žítt 1993b, 1996b). The phosphates were reported by Žítt and Nekvasilová (1991b, 1992b). Geological investigations of the Předboj area were carried out by Kodym and Matějka (1927), Klein (1952), Holásek et al. (1988), and Straka et al. (1994). Pražák in Straka et al. (op. cit.) gave also a list of macrofauna of the area.

As regards the Černovičky section, it was first mentioned by Zahálka (1911, 1912) under the name Zvonice, but during the following decades this locus nearly fell into oblivion in the literature. Nevertheless, since 1982, the revival of attention has led to the publication of several papers showing in more detail the geology and palaeontology of this interesting locality (Svoboda 1982, 1985, Zelenka 1987, 1990, Hercogová 1988, Nekvasilová 1989, 1993, Mašek et al. 1990, Žítt 1993a, Eliášová 1995, 1997, Žítt and Nekvasilová 1996). Some part of the palaeontological data remained, however, unpublished (Nekvasilová 1986b, 1988). Brief overall information was published in connection with the status of the locality as the Nature Monument protected by the Law on Nature and Landscape Protection (Knížetová, Pecina and Pivničková 1987, Pivničková 1992, Němec, Ložek et al. 1996).

Key localities of the Unhošť-Turško High

The geographic dispersal of the most important Cretaceous localities relative to the UTH shore position in the beginning of the Korycany Member deposition (Malkovský et al. 1974) is illustrated by text-fig. 18. For more detailed comparative studies of the rocky coast facies the sections at the localities Kněžívka, Pazderna, Černovičky (text-fig. 2), Předboj, Líbeznice, and Kojetice have been selected. These key sections are either the best preserved or important for some special featu-



Text- fig. 2 - Left - a map showing the localities Černovičky (A), Pazderna (B) and Kněžívka (C). Right - detailed map with the Pazderna locality (B). Abbreviated names of villages: Čern. - Černovičky, Kněž. - Kněževes, Lich. - Lichoceves, Stř. - Středokluky, Tuch. - Tuchoměřice.

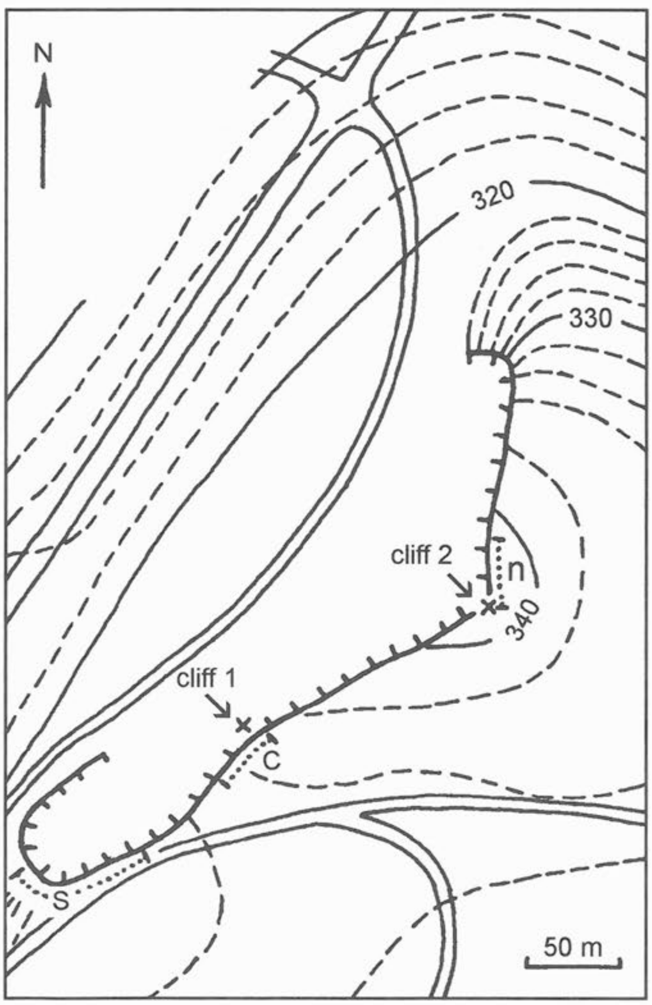
res. In addition to these key localities some additional supporting localities are considered mainly regarding the phosphatic horizons (Odolena Voda, Středokluky, Žákova skála, etc.). As the Kněžívka, Kojetice, Líbeznice and Pazderna localities have already been described, only new findings are reported here in detail. On the other hand, the still little known localities Předboj and Černovičky are described in more detail throughout the whole text.

The Kněžívka locality is situated in an abandoned quarry opened in the western top part of a narrow lydite elevation (343 m a. s. l.) forming the southeastern part of the UTH (text-fig. 3). The locality Pazderna lies in more central parts of the UTH, on two low lydite elevations (c. 326 m a. s. l.) and in closely adjacent areas (text-fig. 2). The Kojetice locality is situated in a quarry opened in the northern slope of the Kojetice elevation (easternmost extension of the UTH). The abraded Proterozoic surfaces lie here at c. 187-193 metres a. s. l. The Líbeznice locality was situated in the excavations for the pipeline on the foot of a lydite elevation at c. 210 m a. s. l. This elevation forms the southern margin of the Kojetice elevation.

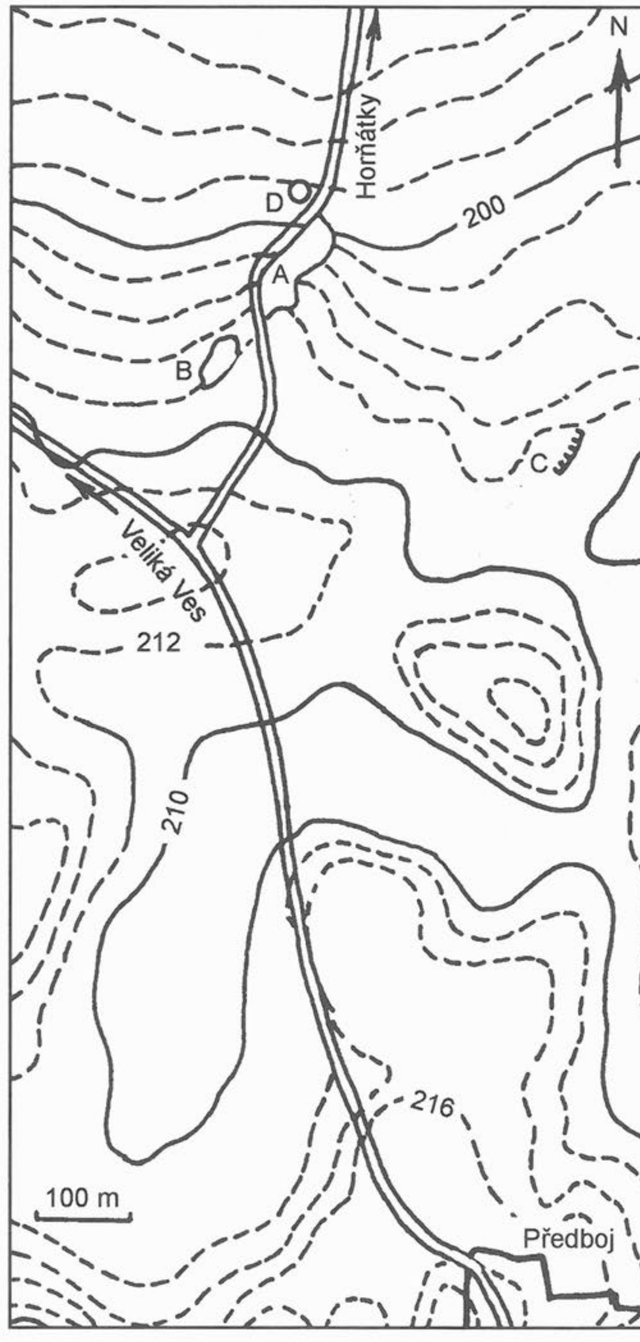
For more detailed data on all these localities we refer to the papers of Žítt and Nekvasilová (1990, 1991a, 1992a, 1997).

In the Předboj area situated on the northern slope of the UTH, several small quarries operated in the past (see text-fig. 4 and Svoboda 1986), but at present only the "Na Kocourku" quarry is preserved. The old classical locality reported by Prantl (1929, 1938), Zázvorka (1939) and, e.g. Nekvasilová and Prokop (1963), is here marked as A (c. 200-204 m a. s. l.) and the "Na Kocourku" quarry as C (c. 208-209 m a. s. l.). One of the micropaleontological samples came from a small natural exposure (D in text-fig. 4).

The locality Černovičky (text-fig. 5) lies on the south-southeastern foot of the low lydite hill (345 m a. s. l.) and on the UTH it is situated still a little more "landwards" if compared with the Kněžívka locality (text-fig. 2). In the past, four quarries operated in this area (see A - D in text-fig. 5), but only two are preserved. In addition, two important samples were taken outside from these quarries (sites "krmelec", and "okraj lesa", samples 4 and 5; text-fig. 5). The lydite bedrock overlain by the Cretaceous sediments is situated about 323 m a. s. l. in the most important quarry A.



Text- fig. 3 - A map of the Kněžívka quarry. Dotted lines near the quarry margin - parts of exposures serving for construction of geological sections (text-fig. 7); s - Kněžívka-south, c - K.-centre, n - K.-north



Text- fig. 4 - A map of northern neighbourhood of the Předboj village with quarries A, B, C and sampling site D. Quarries A and B are infilled.

Significant features of the key localities

The rocky bottom

The bedrock overlain by the Cretaceous sediments is mostly formed of the lydite and subordinately of other Proterozoic rocks, such as the more or less silicified shales, and greywackes. At all localities, the sea abrasion and erosion highly influenced the shapes and surfaces of the rocky bottom both as a whole and in detail.

Extraordinary traces of the sea activity are preserved at Kněžívka where two approximated levels of erosion are recorded as notches in a small remainder of the rocky-shore cliff (text-fig. 6; see also Žítt and Nekvasilová 1990). This unique occurrence is the only in the Bohemian Cretaceous Basin, which directly shows the temporal positions of the sea-level.

Interesting shaping of the rocky bottom was found at Líbeznice where lydite streaks and lense-like bodies in shaly bedrock were formed into the bottom ridges with incised bay-like structures inbetween (Žítt and Nekvasilová 1992a).

The channel-like erosional structures exemplified below do not reach the depth and size of those occurring in the easterly lying diabase or gneiss rocky shore areas of the basin (Žítt and Nekvasilová 1991c, Žítt et al. 1997a, b). At Kněžívka, a rocky bottom depression of unknown depth adjoins the cliff with notches (see above) and another one in the northern part of the locality is about 5 metres deep (it is filled with conglomerate); some other less expressed depressions or channels 2-3 metres deep as a maximum are cut by the wall in the other quarry parts (Žítt and Nekvasilová 1990). Not too pronounced channels are recorded also on the northern slope of the Kojetice elevation in the Kojetice quarry (Žítt and Nekvasilová 1991a). The lydite bedrock in quarries A and B at Černovičky is steeply inclined in accordance with the overall dip of elevation surface. In the quarry B up to 2 metres deep erosional grooves occur in the lydite surface, dropping steeply the southwestern elevation slope. Their walls are more or less smooth. In the infilled quarry D, the northern lydite wall (facing approx. southwards) cut across about 3 m deep depression, which might well be a channel-like structure sinking down the southwestern elevation slope (observation by O. Nekvasilová, 1974). The bedrock surface in the quarry A dipps in c. 20° to the south-east but is uncovered in only about 3 metres long section.

At the Předboj-quarry A, three small exposures of Cretaceous sediments, two of them adjoined to the lydite bedrock, were preserved after the end of quarrying. These exposures probably represented infills of mutually separated several metres deep rocky bottom depressions. The bottom erosional shapes at the Předboj-quarry C are not so pronounced. The locality lies on the northwestern slope of a low lydite ridge.

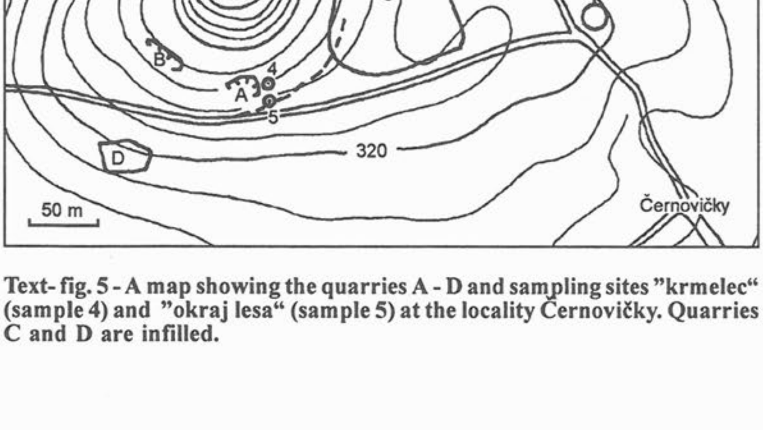
All mentioned lydite surfaces are abraded, uneven but basically smooth with rounded irregularities. However, these abraded surfaces were in addition locally affected by younger processes of corrosion and possibly even the selective abrasion (see below). This is most pronounced in the Předboj-quarry C, Líbeznice, and some parts of Kněžívka, where surfaces of both lydite rock and large clasts (cobbles to boulders) used to be locally deeply (several centimeters) dissected.

Lithology of sediments

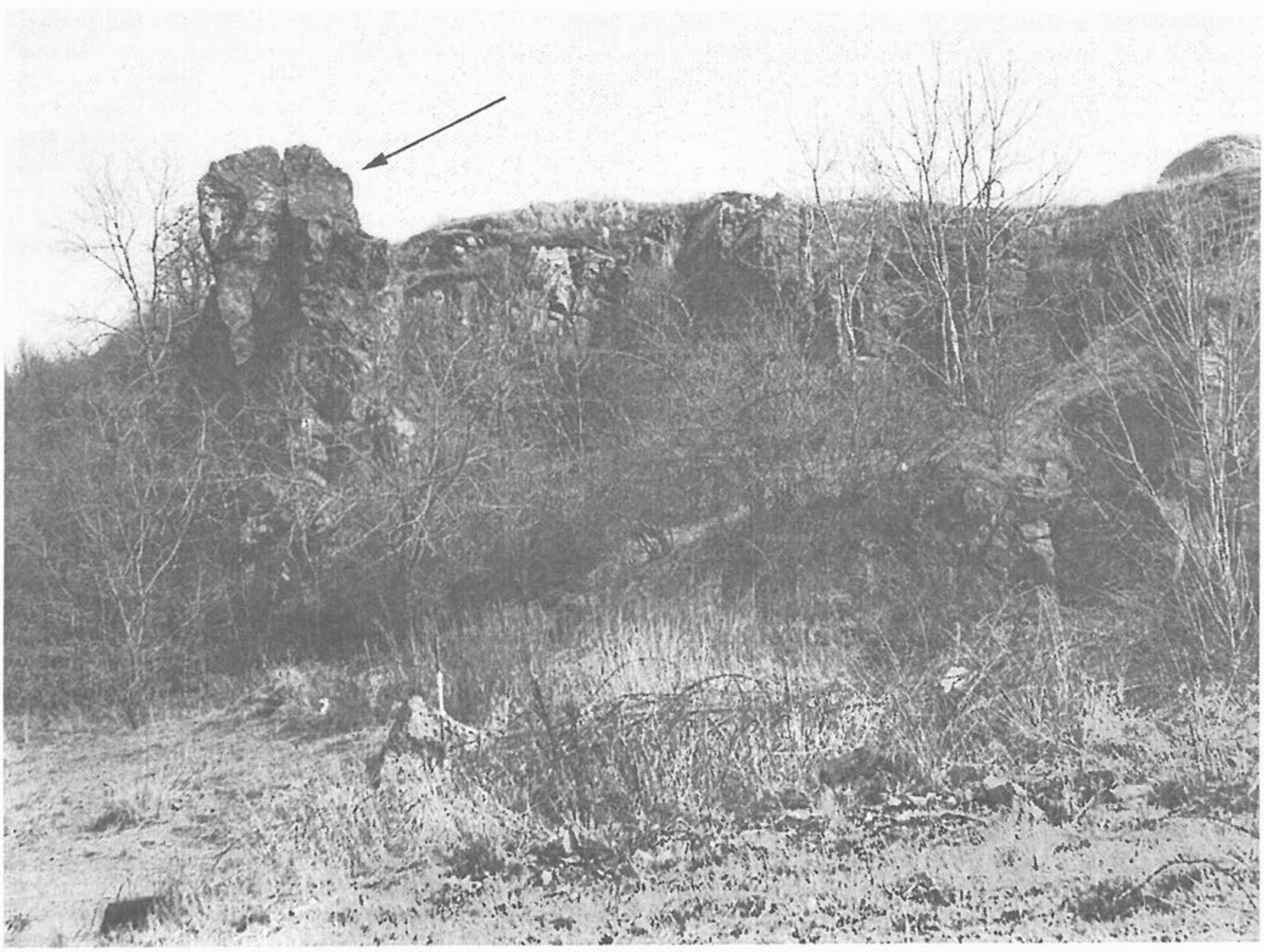
Two lithostratigraphic units may be distinguished at all studied sections (text-figs 7, 9, 10,11). The basal clastics belong to the Korycany Member of the Peruc-Korycany Formation (Kaňk Member of Houša 1991) and overlying marlstones and spongolite - spiculite rocks to the Bílá Hora Formation. The lithologic variation is, however, very pronounced at the majority of localities and individual sections of a given locality may markedly differ.

For instance, in the 300 m long, approx. southwest-northeast oriented section through the rocky bottom at Kněžívka, the basal clastics form several superimposed bodies differring in character of matrix, clasts and faunal content and, consequently, in the age. In the northerly lying conglomerate body of section Kněžívka-north (text-fig.7C, basal part) the bioclasts are very rare and are corroded and large calcite crystals and caolinisation indicate dissolution and chemical alterations. This filling of a large depression may represent a local basalmost part of the Korycany Member. On the other hand, the basal clastics in southern part of the quarry (Kněžívka-south, text-fig. 7A, conglomerate on the left side) are rich in bioclasts of macrofauna and no chemical alterations of the above mentioned type are present. Number of clasts may be locally suppressed here so that carbonate matrix prevails (text-fig. 8). This clastic accumulation is overlain by another one (Kněžívka-centre, text-fig. 7B, sample B) distinctive by a mixture of uncorroded and corroded clasts and reddish sandy matrix with rare sponge spicules and lack of larger bioclasts. The further clastics (text-figs. 7B, C, topmost parts) cap locally the older ones and have mostly the marly matrix and rich macrofauna. They are post-phosphogenic, as the clasts (mostly the boulders) bear relics of phosphates (see section on phosphates). The youngest rocks are conglomerates and marls in the section Kněžívka-south (text-fig. 7A, right part of section) and marls in section Kněžívka-centre (text-fig. 7B) which are basally rich in macrofauna. However, the mentioned sections differ in age (see the part on microfauna). For details we refer to Žítt and Nekvasilová (1990).

The character of lydite clasts in different levels of conglomerate accumulations of the Kojetice section (text-fig. 10B) (Žítt and Nekvasilová 1991a) also highly differs. While they are smooth and black through almost total conglomerate thickness, in the top part they are distinctly altered, with light and irregularly modelled surfaces. The lithology of sediments at Líbeznice-section 1 is distinctive by suppression of basal clastics in studied exposures

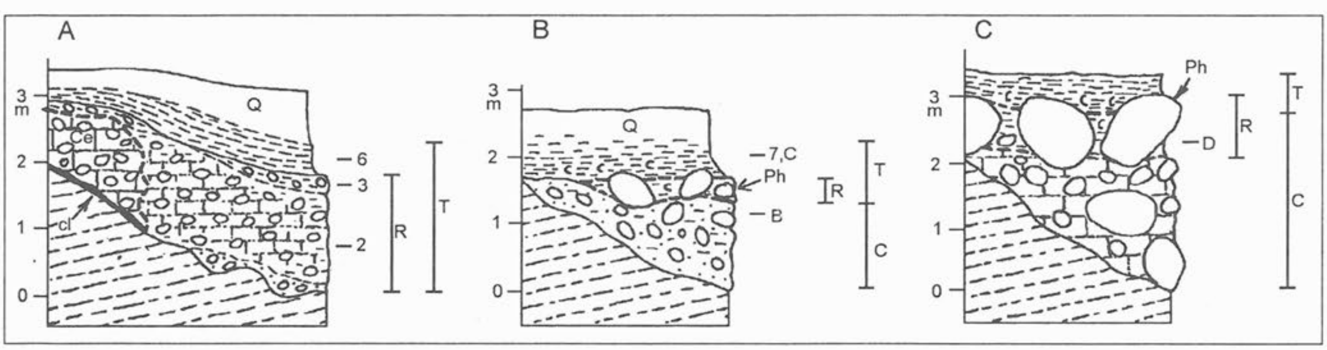


Text-fig. 5 - A map showing the quarries A - D and sampling sites "krmelec" (sample 4) and "okraj lesa" (sample 5) at the locality Černovičky. Quarries C and D are infilled.

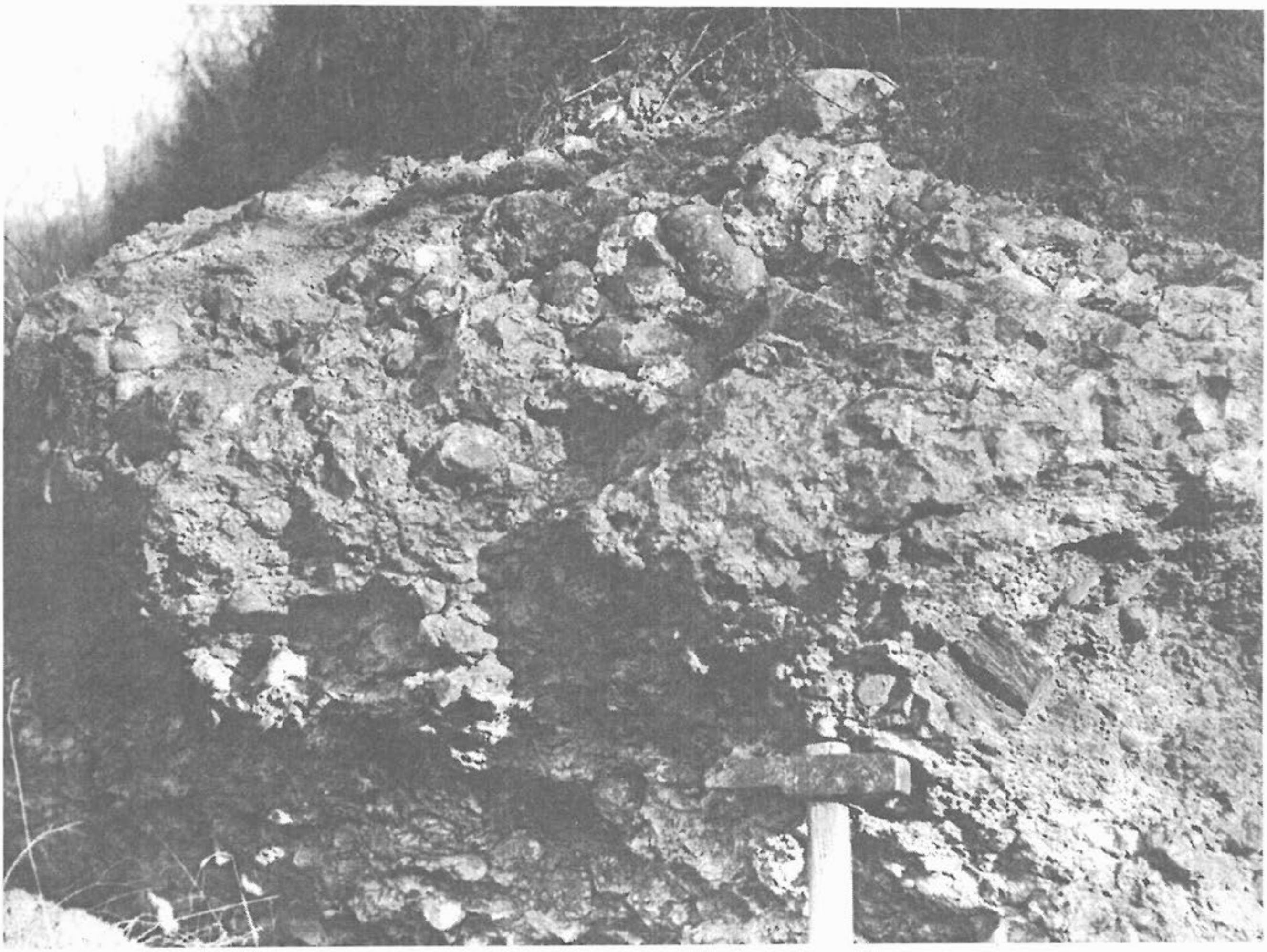


Text- fig. 6 - Kněžívka, central part of the quarry viewed from the west. The cliff 1 with eroded notches is marked by an arrow. Cretaceous sediments are exposed in top parts of quarry walls. Photograph J. Žítt, 1990.

(text-fig. 9). Those present consist also of the two mentioned types of clasts. The most pronounced are large boulders approx. 1 - 2 m in size, only slightly abraded but with deep superficial relief, colour alterations, corrosion and cemented epibionts (e.g. Pl. 3, fig. 6). The conglomerate matrix and the overlying beds are marly and the rich accumulations of invertebrate coprolites and ichthyolites occur here (Žítt and Nekvasilová 1992a). In the top parts of section there are the spiculite siltstones and hard spongolites in two to three irregularly developed horizons. In the relatively thin Líbeznice-section 2 the basal sorted medium grained conglomerate with marly matrix is capped by grey to locally grey-greenish marl (text-fig. 9B). The lithology of sediments encircling the lydite elevations at the Pazderna locality is different (text-fig. 10A). The conglo-



Text- fig. 7 - Studied geological sections at Kněžívka. A - Kněžívka-south, B - K.-centre, C - K.- north. 2-7, B-D - samples (see Appendices 1, 2), Ce - Cenomanian conglomerate from which the sample A was derived. R - reworked deposit, C - Cenomanian, T - Turonian, Ph - phosphatic crusts, c - occurrence od invertebrate coprolites, cl (with arrow) - claystone. Other explanations - see text-fig. 9.

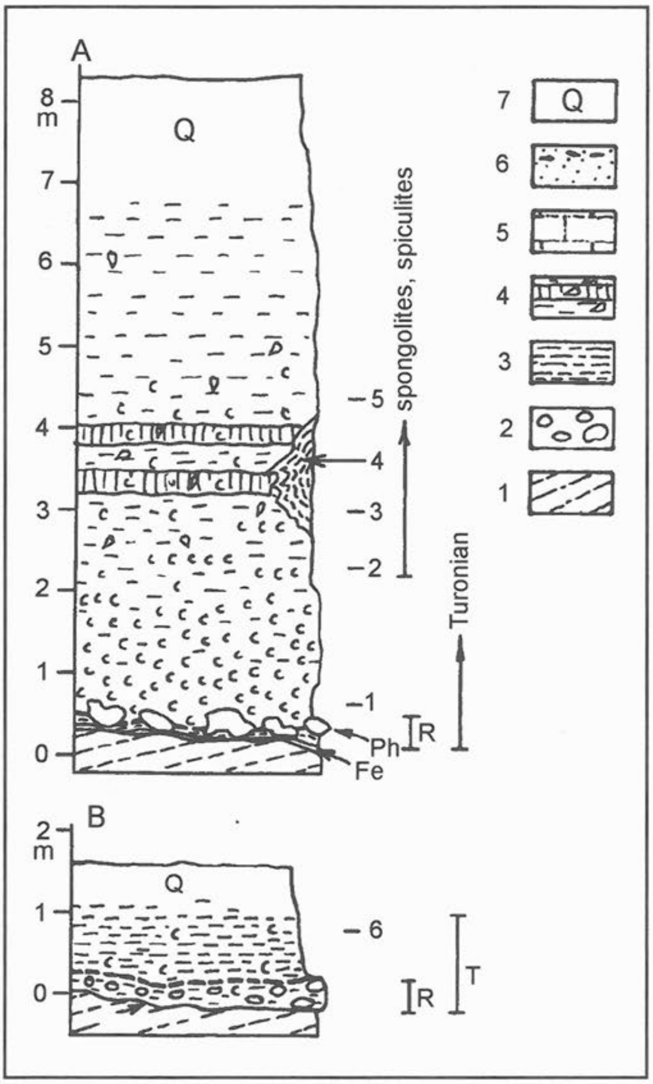


Text- fig. 8 - Northern part of the section Kněžívka-south. Late Cenomanian conglomerate with carbonate matrix (in text-fig. 7A marked as Ce; in text-fig. 19 drawn as basalmost conglomerate of the column). Hammer head is 14 cm long. Photograph J. Žítt, 1988.

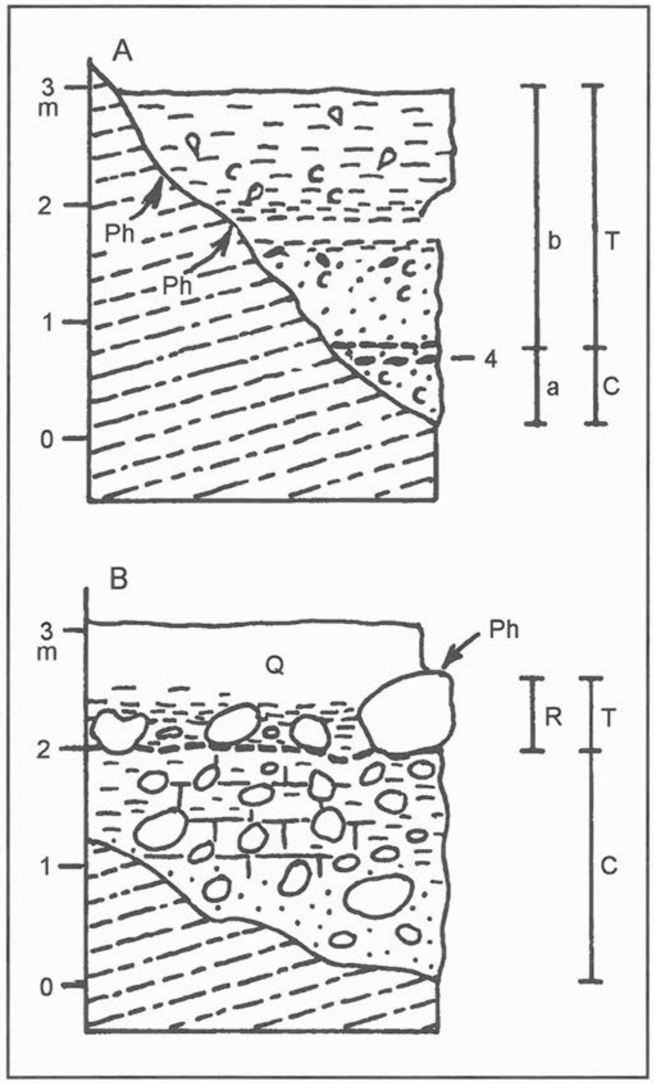
merates are suppressed in available exposures and calcareous sandstones overlap the lydite bedrock. The sandstone is covered by a spiculite siltstone to spongolite ("opuka") of the Bílá Hora Formation. This boundary is locally enriched with a marly component (Žítt and Nekvasilová 1997).

At the Předboj-quarry A, the character of basal clastics of the Korycany Member indicates they arose in several steps (text-fig. 11B). The basalmost conglomerate was well sorted with matrix formed of the hard greyish limestones. This rock was overlain by the coarse unsorted conglomerate with boulders up to 1metre large and a variable, yellowish carbonate to marly matrix with rich macrofauna (text-fig. 12). The clasts were oval to subangular with more or less smooth surfaces. Svoboda (1986) reported two faunistically different horizons in this coarse conglomerate (see section on macrofauna). The conglomerate accumulation was capped by the yellowish marlstone preserved in small relics, rapidly passing both laterally and upwards into the Quaternary loess-loams. The lower boundary of marlstone was sharp as observed by Svoboda (1986). This succession strikingly varied in the individual sections (depression fillings) of the locality as regards the presence and thickness of mentioned deposits and the record of fauna. On the other hand, the deposits in the Předboj-quarry C (text-fig. 11C) are more uniform. The abraded lydite rocky bottom of northern quarry part is covered by badly preserved (possibly because of quarrying) variably thick unsorted lydite conglomerate with suboval to angular clasts up to 30 cm large and with sandy matrix. Some subangular boulders up to 2 metres in diameter were also present protruding highly into the overlying sediments. In more central quarry part the thin basal conglomerate is overlain by marly conglomerate to marlstone with clasts and sand admixture. A part of the clasts is deeply corroded and frequently bears extraordinarily well preserved phosphatic crusts. With upwards decreasing number of clasts the rock turns to marlstones. They are, however, preserved only in small relics passing rapidly to the Quaternary loess-loams (analogically to the Kojetice and some other sections). In the Předboj-quarry B and on the small natural exposure of site D (text-fig. 4) only the marlstones cropped out similarly to those of quarry C.

At the Černovičky section, conglomerates are the most distinctive lithology (text-figs. 11A, 13). They were, however, largely influenced by the post-Cretaceous (most probably Quaternary) destructive processes (sample 6). We suppose that not only the dissolution of calcareous matrix, but also a small-scale redeposition (possibly local sliding) is responsi-



Text- fig. 9 - Líbeznice, sections 1 (fig. A) and 2 (fig. B). 1-6 - samples, Fe - Fe-clay. Lithology (in all figured sections): 1 - Proterozoic bedrock, 2 - conglomerate, 3 - marl, marlstone, 4 - spongolite, spiculite, 5 - limestone, 6 - sandstone with phosphatic concretions, 7 - Quaternary deposits. Other explanations - see text-fig. 7.



Text- fig. 10 - Geological sections at Pazderna (fig. A) and Kojetice (fig. B). a - sandstones with phosphatic concretions on the foot of southern lydite elevation, b - rocks found only in relics on the lydite surface. For other explanations see text-figs 7, 9.

ble for the present state of the conglomerate preservation and position. In washings of matrix the great amount of small sharp lydite fragments occur, originated from total crushing of the clasts. Only a part of the conglomerate accumulation remained unaltered (here denoted as intact conglomerate of the quarry A). In the irregular, subvertical to subparallel contact of both conglomerate types (text-fig.11A) the hard carbonate matrix was found sharply separated from the soft reddish one. In detail, some hard-limestone surfaces bear weathered out and strongly corroded bioclasts being in direct contact with the altered soil-like reddish matrix without fossil remains. Except for very rare corroded bivalve fragments only the siliceous agglutinated foraminifer *Acruliammina longa* colonizing the clast surfaces, was preserved in the red conglomerates. In the quarry B (text-fig. 5) only these altered conglomerates were found. The matrix of conglomerate in the quarry D was, on the other hand, light yellowish, so that the accumulation appeared, at least in basal parts, as lying in situ. The fauna was, however, absent. As mentioned above, a small relic of intact conglomerate is preserved only in the quarry A (samples 1-3) (text-figs. 11A, 13). This lydite conglomerate is unsorted, clast-supported, composed of pebbles to boulders. The great majority of clasts is abraded, at least on edges, and there are many clasts very well rounded and perfectly smooth. Some reworked fragments of larger rounded clasts are also present. No surface corrosion (in the sense of Žítt and Nekvasilová 1990) and secondary modelling of lydite clasts was observed. Nevertheless, their surfaces are sometimes matting due to fine pitting (see section on bioerosion). Several large lydite boulders found separated but coming from the profile show rounded edges and effects of selective abrasion (text-fig. 13). Many clasts of the top conglomerate parts are in situ fractured into several parts, which are only partly joined by the original matrix or later formed (Quaternary) sinter. The crushing of clasts is, however, only slight if compared with the above mentioned reddish conglomerate. The conglomerate matrix is yellowish, prevailingly hard carbonate, but locally enriched by the clay substance. It locally contains rich bioclasts derived of macrofauna (see below). In the upper parts of the accumulation the lydite clasts decrease in amount and size. Between the clasts of the conglomerate top part (sample 3) prevailingly silty to clayey matrix is present, enriched with phosphatized invertebrate coprolites. About 5 metres to the east of the quarry, c. 0.5 m thick relic of a conglomerate with lydite pebbles to small cobbles and marly matrix has been recently found (site "krmelec", sample 4, see text-fig. 11A). This rock was yellowish basally and upwards became reddish, and contained rich macrofauna and fragments of phosphatic crusts.

In the quarry C of Černovičky there occurred greyish and yellowish spongolitic calcareous-clayey sandstones and silstones of the early Turonian age (Zelenka 1990). Similar rock has been recently found in close south-eastern vicinity (sample 5, the site called here as "okraj lesa", see text-fig. 5) of the quarry A. They altitudinaly correspond with the mid-level of the exposed part of the intact conglomerate body of the quarry.

Phosphates

The phosphates are locally abundant at the key localities of the UTH and occur in the following types: 1/ Phosphatic crusts, 2/Phospatized domains of conglomerate matrix, 3/ phosphatized bioclasts, 4/ phosphatized invertebrate and vertebrate coprolites, 5/ phosphatized internal moulds of macrofauna, 6/ phosphatized fillings of burrows and borings, 7/ phosphatic concretions, and 8/ the other types. Distribution of some of these phosphates at the key localities of the UTH is included in text-figs. 7, 9, 10, 11, 19).

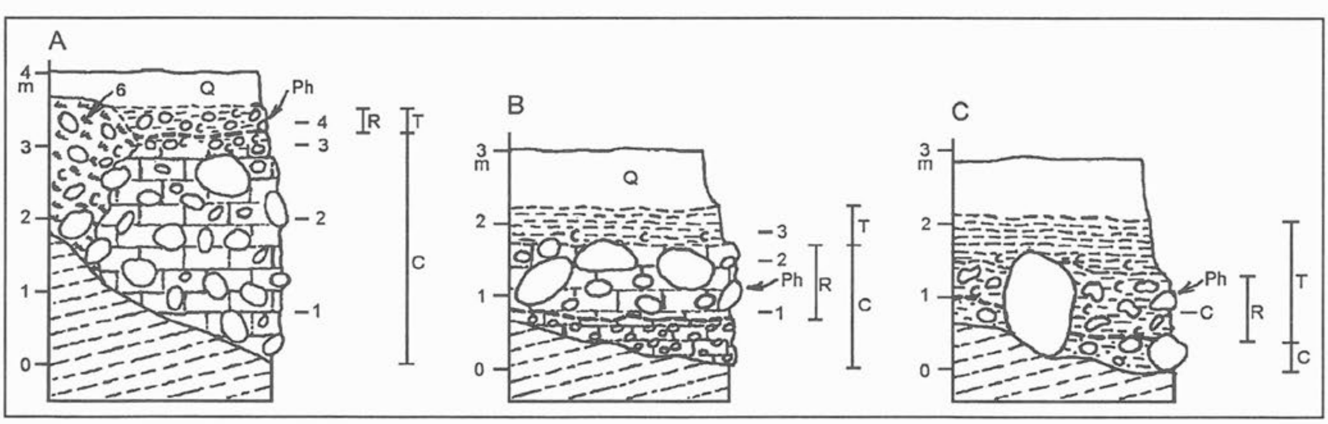
1/ Phosphatic crusts

In the area of the Unhošť-Tursko High (UTH) they were first found at the Kněžívka, Kojetice and Líbeznice localities (Žítt and Nekvasilová 1990, 1991a, 1992a, respectively). However, they abundantly occur also in more eastern rocky coast areas of the Bohemian Cretaceous Basin, e.g. at Chrtníky and Nákle (Žítt and Nekvasilová 1991c), Velim (Žítt and Nekvasilová 1993, 1996, Žítt et al. 1997a, b), etc. The phosphatic crusts are often intimately joined with the occurrences of a special type of cementing epifaunas (see section on epibionts).

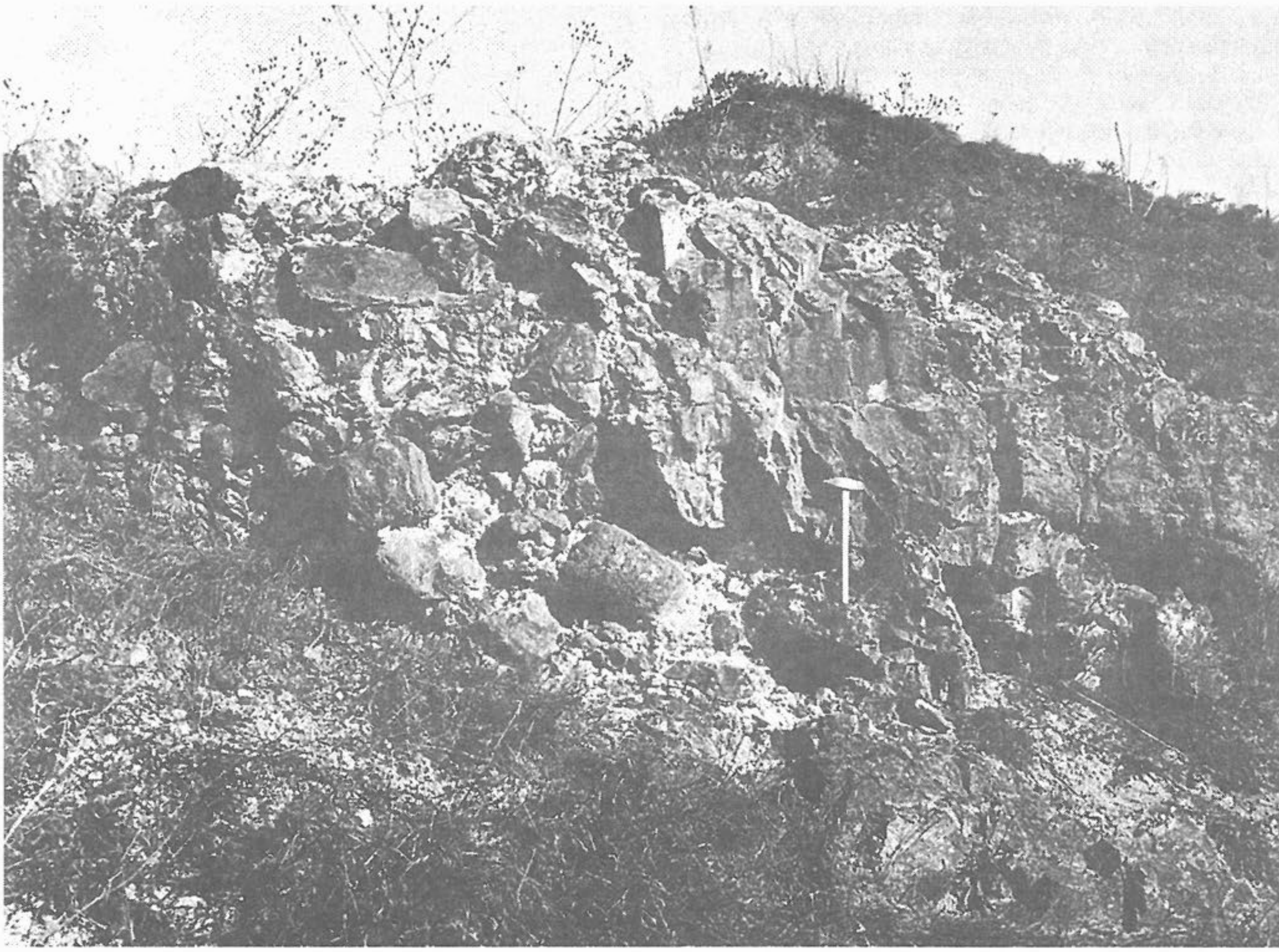
The location of phosphatic crusts in geological sections is illustrated in text-figs. 7, 9, 10, 11, 19. They are found mostly as coatings of clast and bedrock surfaces or as interstice fillings of the topmost conglomerate horizon. The coatings may be very thin, film-like, but most frequently they are 1-2 mm thick. If well preserved, the crusts cover the substrates continuously on both elevated and depressed parts (e.g. the Předboj-quarry C). The crusts are mostly laminated but massive types were also observed. At Kněžívka (cliff 2 in Žítt and Nekvasilová 1990 and here in text-fig. 3) they locally cement the pebble fill in the mouth of a rock joint and in relics occur on the nearby elevated rock surface. At the Středokluky locality, a marlstone with lydite clasts and bioclasts about 15 cm thick on the base of a shallow lydite rocky bottom depression was interwoven with a series of phosphatic crusts. Relic crust coatings were also found on lydite boulders lying in secondary position in the now infilled quarry. At Líbeznice, the crusts coated elevated rocky bottom part with some lydite pebbles stuck with phosphate in shallow (several centimeters) substrate depressions. Another coated clasts were found separated in sediment on the foot of the elevation. The rapid local transitions of several milimetres thick phosphatic crusts into the bluish films were also observed. The crusts but mainly the films penetrated the thin and more than 15 cm deep rock joints. This phenomenon was also found at the Pazderna locality (Žítt and Mikuláš 1994).

Due to the reworking, the great majority of crusts is of a relic nature. Brownish to greyish phosphorite islets show they are the rests of originally extensive and mechanically destroyed clast or rock coverings and coatings. Crusts of individual parts of a substrate often show different type and intensity of destruction. For instance, the top of about 3 metres high lydite elevation at Líbeznice has relatively best preserved crusts, while they were strongly destructed on the steeply sloping rock side. However, the shaping of phosphatic relics indicates here a complicated way of destruction, in which a bioerosion could significantly participate. Unlike this rocky bottom surface, the crusts of clasts were removed mostly by abrasion. This is well documented at Kojetice, Kněžívka and Středokluky. Fragments of phosphatic crusts sometimes occur in the topmost horizon of the Korycany Member (Černovičky-quarry A, sample 4, text-fig. 11A).

Thin crusts and films may also, mostly in a relic state, cover the bioclasts (Pazderna, Líbeznice), which could be loosen by reworking of phosphatized deposits of the Středokluky type



Text- fig. 11 - Geological section in the Černovičky-quarry A (fig. A), Předboj-quarry A (fig. B) and Předboj-quarry C (fig. C). 1-4, 6, C - samples. Other explanations - see text-figs 7, 9.



Text- fig. 12 - Předboj-quarry A, exposure of lydite conglomerate in which the majority of studied fauna of this locality was collected. The hammer is 33 cm long. Photograph L. Záporožcová, 1963.

(see above). On the other hand, the laminae coating the invertebrate coprolites (Pazderna locality) arose in situ as a final product of phosphogenesis.

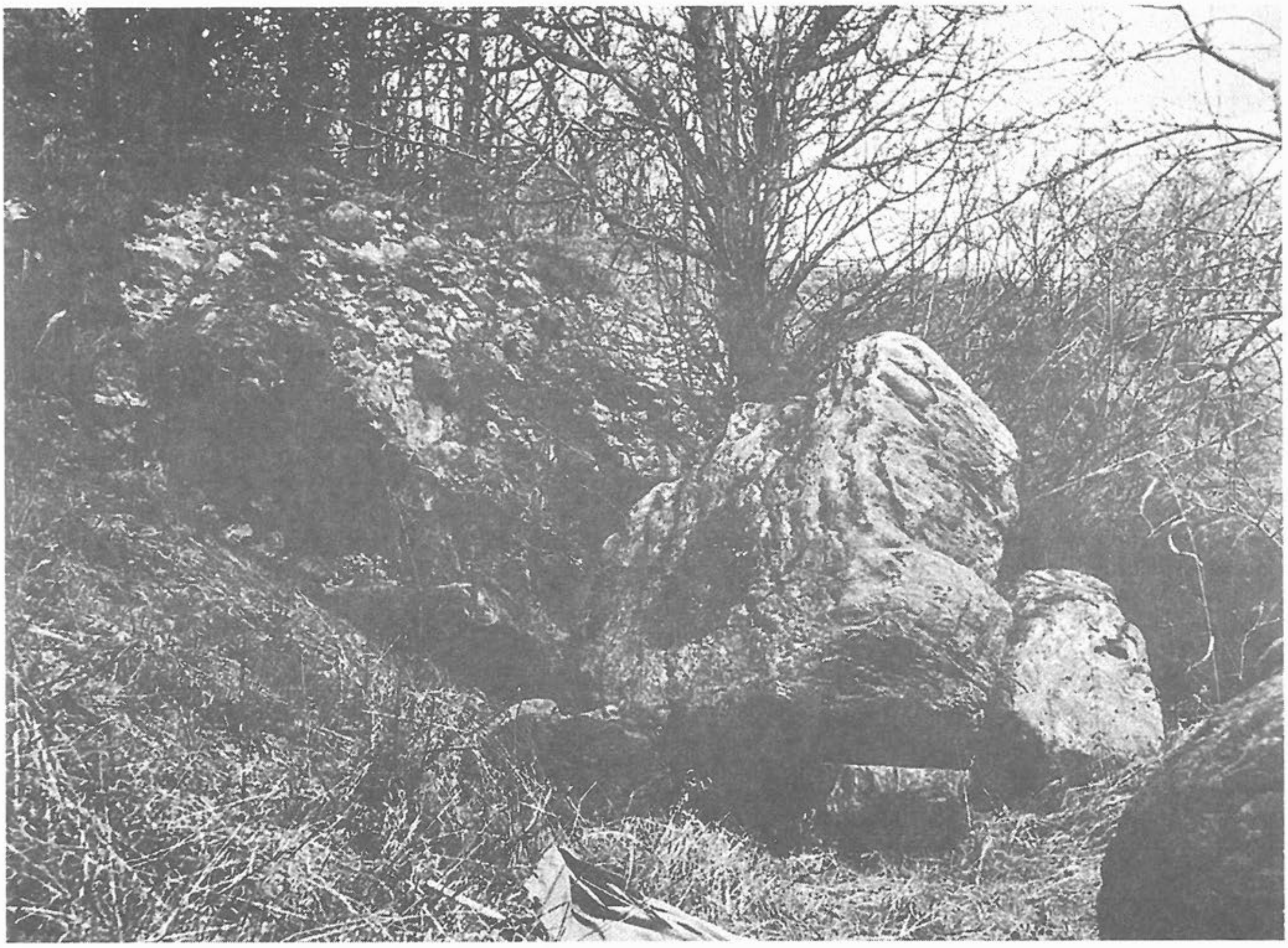
2/ Phosphatized domains of conglomerate matrix

While the phosphatic crusts are restricted mostly to the top conglomerate horizon and adjacent rocky bottom surfaces, the inner parts of conglomerate bodies may also be locally phosphatized but in a little different way. This phosphate is mostly accompanied by the glauconite and is soft and never laminated. At the Předboj-quarry A it forms irregularly shaped greenish parts of the carbonate to marly matrix which fills the spaces between bioclasts and lydite clasts. These mineralized parts may be sharply defined in the surrounding rock and sometimes may contain irregular non-phosphatized inner islets. Marginal parts of phosphatized and glauconitized domains used to be more intensively green than their internals. Mineralized matrix parts may sometimes have a form of thin irregular streaks, disseminated in the rock. The just described type of mineralization is identical with that of mollusc moulds of the same locality and horizon (see below). Similar mineralization products were described in the conglomerate bodies at Velim near Kolín (Žítt et al. 1997a, b).

Small yellowish non-laminated phosphatized parts of matrix were rarely found in the intact conglomerate accumulation (samples 1, 2) of the Černovičky-quarry A (see also Žítt 1993a). They were formed in situ and do not show effects of reworking.

3/ Phosphatized bioclasts and epibiont remains

In the Korycany Member, the carbonate bioclasts are (with only few exceptions) unaffected by phosphatization. Only those found immediately within the phosphatic crusts may be slightly mineralized by phosphorus and iron. However, in basal parts of the Bílá Hora Formation frequently occur small phosphatized and in part glauconitized sponge bioclasts rarely showing the post-phosphogenic encrustation (mostly by agglutinated foraminifers) and so in fact belonging to the intraclast category. The vertebrate remains (fish and shark teeth and vertebrae), which are typical for the just mentioned horizon are frequently fragmented, mostly before their phosphatization. The epibionts colonizing hard substrates on which the phosphatic crusts deposited were often phosphatized. The best examples are the bivalves *Atreta* sp. and *Spondylus* sp., and agglutinated foraminifer *Bdelloidina cribrosa* from the Líbeznice locality (Žítt and Nekvasilová 1992a). Phosphatized tests of the last species were found at the Kněžívka (Pl. 3, fig. 1) and Pazderna localities. At Kojetice, slight phosphatization of *Atreta* sp.1 (classified in the sense of Nekvasilová and Žítt 1988) on a boulder surface was ascertained. The so far un-



Text- fig. 13 - Černovičky-quarry A. Conglomerate and large boulders (locally colonized by *Acruliammina longa*). Photograph O. Nekvasilová, 1974.

described stromatoporoid-like growths rarely found on the rock and clast surfaces of Líbeznice were always strongly phosphatized (dark brown to black colours).

4/ Phosphatized invertebrate and vertebrate coprolites

Invertebrate coprolites (faecal pellets) occur only in the top parts of conglomerate bodies and in the basal parts of the Bílá Hora Formation, mostly together with phosphatized ichthyolites and sponges (see above). The coprolitic accumulations are most pronounced in the Líbeznice-section 1 (text-fig. 9A) where they encircle the rocky bottom elevation with phosphatic crusts and epibionts (Žítt and Nekvasilová 1992a). The invertebrate coprolites are superficially glossy, brown to grey, in perfect condition or in part destructed, frequently encrusted by agglutinated foraminifers. Several morphological types may be distinguished, the elongated ovoid and cylindrical shapes being most frequent (Žítt et al. 1997a, text-fig. 15). Invertebrate coprolites at Pazderna occur abundantly in calcareous sandstones around the lydite rocky bottom elevation, but they are frequent also in basal parts of phosphatic crusts on the rocky bottom and in the overlying marls and spongolitic siltstones of the Bílá Hora Formation (text-fig. 10A). In similar stratigraphic position they occur also in the Předboj-quarry C (text-fig. 11C), Černovičky-quarry A (samples 3 and 4; text-fig. 11A) and, more rarely, at Kněžívka (central and northern sections, samples C, D; text-figs. 7B, C). Because of the strong destruction of coprolites, the small (around 1 mm) irregularly shaped corpuscles may be generated which locally form a part of the coprolite associations, e.g. at Černovičky-quarry A (sample 5).

Vertebrate coprolites frequently occur associated with invertebrate ones but may be found anywhere in the Korycany Member and in the basal Bílá Hora Formation. Good examples were reported by Žítt and Nekvasilová (1992a) from Líbeznice. Recently they have been found also at the Předboj quarries A and C. The vertebrate coprolites are mostly ovoid or roundedly cylindrical in shape, rarely with a spiral structure. Their colour is light, white to ochreous. Untill now only variously damaged (compressed, fragmented) specimens have been collected. Complete coprolites are relatively rare. Some coprolites are bored by microborers (Líbeznice).

5/ Phosphatized internal moulds of macrofauna

In the conglomerate matrix of the Předboj-quarry A there occurred the slightly phosphatized and glauconitized gastropod and subordinately bivalve moulds. The shells were completely diagenetically dissolved and surfaces of the moulds are smooth and well preserved. Gastropod moulds belong to several species but only those of *Neritopsis nodosus* could be tentatively determined (Pl. 2, fig. 13). For this species at least partial preservation of shell is typical (Pl. 2, figs.10-12).

Bivalve moulds are rather fragile and so often fragmented (in part possibly by washing) in our collection and hardly determinable. Phosphatized gastropod moulds resemble those from the abandoned locality Plaňany near Kouřim, the deposits of which may in part be isochronous with samples 1 and 2 of the Předboj-quarry A.

6/ Phosphatized fillings of borings and burrows

a. Fillings preserved only together with the bored substrate

The borings *Gastrochaenolites* isp. in the lydite and hard shale rocky bottom at Líbeznice were in part filled with phosphatic crusts occurring also in relic state on neighbouring unbored surfaces. These fillings record the overall course of phosphogenesis in the area but may possess some special features given by microenvironments of small but often deeply depressed niches. In comparison with the neighbouring flat surfaces, we suppose here mainly more successful trapping of soft sediment forming a substrate of subsequent phosphatization. The fillings of borings in such hard and relatively insoluble substrates could hardly be loosen otherwise than by strong impacts destructive for the fragile fillings themselves. In case of complete preservation of some borings, their mouthward narrowing also prevented the loosing of fills. Another boring type described from the Líbeznice and Pazderna locality as *Meandropolydora sulcata* (see Žítt and Mikuláš 1994) posseses some specific preservational features. These borings occurring in phosphatic fillings of crevices and joints of lydite rocky bottom were only in part filled with younger massive phosphate. The boring fills are mostly formed of concentric very soft centripetally accreting phosphatic laminae identical with those of the above mentioned phosphatic crusts. The central parts of tunnels remained often free of any filling. Loosing of these fragile fillings from substrate and their separate deposition is also impossible.

Phosphatic and glauconitic fillings of the sponge borings in carbonate substrates such as massive oyster shells are rarely found at the Předboj-quarry A and Kněžívka-south (text-figs. 11B, 7A) though the bored bioclasts themselves are here common. The borings are mostly filled with non-mineralized sediment.

b. - Fillings preserved separately

They were derived mostly from the carbonate substrates. Boring fills from Předboj-quarry A may be divided into two groups. The first group is represented by fillings of the bivalve boring trace *Gastrochaenolites* isp. They are of typical wide sac-like mouthwards narrowing shape (Pl. 2, fig. 16) but their great majority is not preserved completely. This may be caused both by the fragmentation and the incomplete filling of bored cavity. Some fillings of truncated borings may be hidden in this group. The maximum diameter of fillings is 2.0-7.0 milimetres, length of the most complete specimen equals to 9.0 milimetres. In one case a mould of the bivalve producer was found within the filling (Pl. 2, fig. 15). This borer may be tentatively conspecified with *Lithodomus pistilliformis* (REUSS), described in this locality by Zázvorka (1944c) without any data on eventual mineralization.

The surfaces of boring fills rarely bear the "foreign sculptures" (Fremdskulpturen by Voigt 1971; Pl. 2, fig. 8) sometimes indicating the type of bored substrates. According to Voigt (op. cit.), some Fremdskulpturen represent imprints of the coral skeleton structures but some other types are difficult to explain. All these specimens come from old washings and detailed sedimentologic aspects of their occurrence are not known. Nevertheless, the redeposition of loosen specimens does not seem not to be probable.

In the second group of phosphatized fills there are the elongated, direct to slightly curved burrow fills of roughly circular or elliptical cross-sections with a diameter c. 2.0-4.0 milimetres. They have been found in washings of sandstones from Pazderna (sample 4) and are mostly fragmentary with maximum length equaling 20.0 milimetres.

7/ Phosphatic concretions

Concretionary phosphate was abundantly found only in the sandstone of Pazderna (sample 4, text-fig. 10A; see also Žítt and Nekvasilová 1997). The irregularly shaped and up to 2 cm large concretions occur together with the above mentioned phosphatized burrow fills. They are mostly brownish to greyish and contain a large proportion of sand and glauconite grains, identical with sourrounding sandstone. They are doubtless in situ as shown by their diffusive boundaries in the rock. A portion of these concretions was, however, later reworked and deposited in the overlying marlstones.

8/ Other phosphate types

In the association of various phosphatic particles accumulated in the topmost Korycany Member and on the base of the Bílá Hora Formation (see above), interesting hard, dark and massive phosphatic fragments rarely occur. They in part belong to sponges as shown by teeny mesh remains but some of them are completely structureless. Phosphates of such a type form the oldest generation of phosphatic crusts rarely found on small gneiss fragments in basal horizons of the Bílá Hora Formation at the Velim locality (Žítt et al. 1997a). This massive nearly black phosphatic generation is here often capped by light laminated phosphate. However, this relation of the dark phosphate to the laminated crusts may not be confirmed for the occurrences in the area of the UTH. Though some parts of rich crusts at Líbeznice are relatively dark and massive, their inner structure is different.

Macrofaunal taphocoenoses

All the macrofaunal species we found at Černovičky, Předboj and Kněžívka are listed in Appendix 1; included are also some data by other authors. For macrofauna of Kojetice, Líbeznice and Pazderna we refer to our previous papers (Žítt and Nekvasilová 1991a, 1992a, and 1997). A lot of data was published by Svoboda (1986, 1997a), Klein (1952), Pražák in Straka et al. (1994), Pražák and Valečka in Volšan et al. (1990). The nomenclature of oysters used in this paper follows that by Záruba (1996). (Note: In the following text the authors of species are not quated as they are included in the faunal lists (Appendix 1 and 2).

The studied taphocoenoses may be subdivided into the following groups related to the lithology and age of respective strata.

Taphocoenoses of the Korycany Member

1. Conglomerate accumulations except for their topmost marly parts

a/ Taphocoenoses with *Gisilina*? *rudolphi* and *Goniopygus* cf. *menardi*

The brachiopod species *Gisilina*? *rudolphi* (GEINITZ, 1872) (syn. *Terebratulina*) (Pl. 1, fig. 3) was originally descri-

Table 1

Distribution over the BCB of the most important brachiopod and echinoderm species indicating presence of taphocoenose with *Gisilina*? *rudolphi* and *Goniopygus* cf. *menardi*. [1]see Nekvasilová (1983); [2]found also in the surroundings of Chvatěruby and in the Veliká Ves Hills (= a part of the UTH approx. between Chvatěruby near Kralupy n. Vltavou and Předboj) as documented by the collection of P. Svoboda in Kralupy n.Vltavou (vidi Nekvasilová); [3]probably synonymous with *L. perneri* PRANTL, 1929; [4]probably synonymous with *R. carinatus* PROKOP et NEKVASILOVÁ, 1964 (see Schneider 1988); [5]Žítt (1993b); [6]the locality was situated in now infilled quarry situated about 700 m NW of Předboj quarry A (Svoboda 1986); [7]Svoboda (1997b); [8]topmost conglomerate part of quarry A, sample 3; [9]unidentified level of conglomerate of quarry A (Zelenka 1990; determined by P. Svoboda); [10]base of a depression filling, western part of the locality (Ziegler 1982, Žítt 1992); [11]unpublished data of O. Nekvasilová; [12]for data on the locality see Soukup (1966); studied specimens come from the samples of glauconitic sandy limestones taken in 1960′ by O. Nekvasilová; [13]Nekvasilová (1986a), Žítt et al. (1997a); [14]untere Pläner von Plauen (Geinitz 1872); [15]Dresden-Plauen (Backhaus 1959); [16]Plauen and Coschütz (Tröger 1956); [17]Geinitz (1872); [18]Hoher Stein bei Dresden (Schneider 1988); [19]untere Pläner von Plauen (Geinitz 1871), Meissner Schichten (Prescher and Tröger 1989).

	Localities in the Bohemian Cretaceous Basin and in Saxonia							
Species	Předboj - quarry A	Předboj - quarry II[6]	Chvatěruby-Zlončice[7]	Černovičky	Radim[10]	Plaňany[12]	Velim[13]	Saxonia
Gisilina? *rudolphi*	+	+	+	-	+[11]	-	-	+[14]
Thecidiopsis bohemica	+	+	-	-	+[11]	-	+	+[15]
Argyrotheca sp. A[1]	+	-	-	-	-	-	-	-
Magas geinitzi[2]	+	+	-	-	-	-	-	+[16]
Lichenopora multiradiata[3]	+	+	-	-	+[11]	-	-	+[17]
Roveacrinus alatus[4]	+	-	-	-	-	-	-	+[18]
Pseudarbacia?[5]	+	-	-	+[8]	+	+	-	-
Salenia? sp.[5]	+	-	-	-	+	+	-	-
S. liliputana[5]	+	-	-	+[9]	-	-	-	+[19]
Goniopygus cf. *menardi*[5]	+	-	-	-	+	+	-	-

bed from "unteren Pläner von Plauen" (upper Cenomanian) of Saxonia. The echinoid species *Goniopygus* cf. *menardi* (DESMAREST, 1825) (Pl. 1, fig. 4) occurs in the Cenomanian of France, Belgium, Germany, Portugal, North Africa and the Middle East (see Geys 1985). Distribution of these two and some other species in taphocoenoses of the Bohemian Cretaceous Basin is illustrated by table 1. This distributional pattern indicates that the source communities of this taphocoenose type occurred prevailingly in the area of the Vltava-Beroun lithofacial development (in the sense of Čech and Valečka 1994) and in Saxonia (Germany).

According to Svoboda (1986), the species *G.*? *rudolphi* was at Předboj-quarry A confined to the lower part of the coarse conglomerate accumulation and did not occur in the upper part typical by the crinoid species *Roveacrinus alatus*. However, our materials and documentation do not indicate here the existence of two separated faunal horizons. *R. alatus* was found to form thin to massive streaks and fillings in central and top conglomerate interstices (text-fig. 12). In irregular nests there occurred also *G.*? *rudolphi*, *G.* cf. *menardi* and many other species.

Up to now over 132 species were determined in the *G.*? *rudolphi* - *G.* cf. *menardi* taphocoenose of the Předboj-quarry A. The roveacrinid species *Roveacrinus alatus* DOUGLAS (probably synonymous with *R. carinatus* NEKVASILOVÁ et PROKOP) is most conspicuous here because it has not been found at any other locality of the Bohemian Cretaceous Basin. Bryozoans, regular echinoids, brachiopods, bivalves and other groups are diverse (Appendix 1). In the top conglomerate parts the guards of *Praeactinocamax plenus* (BLAINV.) were found by Svoboda (1986). However, this species was reported from unprecised lithology of the quarry already by Zázvorka (1939). Scleractinians have been studied by Eliášová (1997) on the base of specimens of P. Svoboda from Kralupy n. Vltavou. The hexacoral species are listed in our Appendix 1, similarly as worms (according to personal communication of V. Ziegler and Ziegler 1984).

Principal features of the *G.*? *rudolphi* - *G.* cf. *menardi* taphocoenose at Předboj-quarry A may be summarized as follows: Variously fragmented and abraded remains are mixed with very well preserved ones. The fragments belong mostly to the indeterminable bivalves. Large massive oyster fragments have at least rounded edges and are frequently strongly bioeroded (mostly by sponges - Pl. 2, fig. 19) or corraded. Epibiont encrustation of these fragments as well as of other abraded bioclasts is mostly weak. All preserved bivalve shells are disarticulated. Slightly abraded non fragmented right (i.e. upper) valves of the oyster *Amphidonte* (*A.*) *haliotoideum* are relatively rare but c. 5 - 15% of these shells are encrusted. Juvenile oysters, minute worms, cyclostome bryozoans, and agglutinated foraminifers (*Acruliammina* sp.) are the most abundant colonizers. Left valves of oysters are rare (e.g. *Hyotissa semiplana* - see Pl. 2, fig. 1) except *Gryphaeostrea canaliculata*. This species also frequently settled on bioclasts (Pl. 1, fig. 1).

Another oyster, *Pycnodonte (Phygraea) vesiculare* is relatively numerous, represented by its left valves. Most recently the oyster species *Cubitostrea sarumensis* (WOODS), new for the Late Cretaceous of Bohemia (Záruba in print a, b) was found. The shells are always disarticulated and strongly bored from the outside (Pl. 2, fig. 3). Right valves of some other oyster species subordinately occurred in the taphocoenose (*Rastellum diluvianum* - Pl. 2, figs. 17, 18; *Arctostrea colubrina* (syn. *Rastellum carinatum*) - Pl. 2, fig. 2). Rudists were found mostly as moulds but fragmented or nearly complete specimens also occurred rarely (Pl. 2, figs. 6, 7). Young specimens were preserved better. Pectenids and spondylids are represented by subangular fragments. Shells of brachiopods (*Cyclothyris*, *Gisilina*?, *Magas*, *Monticlarella*, *Sellithyris*) are preserved mostly completely (Pl. 1, figs. 2, 3, 5, 6, 8, 9) and are abundantly encrusted by bryozoans, juvenile oysters and worms. Tests of *Sellithyris phaseolina* show especially rich encrustation (Pl. 1, figs. 5, 8, 9, 17). A postmortal overgrowing of the comissure is very rare in all the species. About 20-30% of brachiopod shells were not infilled with a sediment. Shells of *Argyrotheca* and *Thecidiopsis* are mostly disarticulated and slightly abraded. The inarticulate species *Ancistrocrania* cf. *gracilis* is represented only by isolated brachial valves richly colonized by cheilostome and cyclostome bryozoans, rarely even on the internal shell surfaces.

Univalve skeletons (shells of gastropods) were mostly diagenetically dissolved. The mineralized moulds are often well preserved (see section on phosphates). The only species which may preserve the shell is *Neritopsis nodosus* (Pl. 2, figs. 10-12).

Bryozoans are highly diverse with the predominance of cyclostomes. Individuals are not, however, very abundant. Prantl (1938) mentioned a strong predominance of arborescent and erected forms over the encrusting and coating ones. Morphological details of zoaria are badly preserved both because of the soft abrasion and possibly a dissolution. This feature makes the determination of taxa very difficult. Sometimes a strong abrasion and fragmentation of branches occur. Close relationship of the Předboj and Saxonian bryozoans has been recently reported by Voigt (1983, 1989).

Anthozoans are not too frequent. Octocorals are represented by isolated variously abraded internodes of *Moltkia foveolata* and, possibly, of other indetermined species. As regards the scleractinians, only some slightly abraded fragments were found in our washings. Worms are often fragmentary with subangular broken margins of the tubes. Some specimens of the species with unattached anterior parts of tubes were, however, found complete (*Mucroserpula* sp., Pl. 1, fig. 10). Encrusting species such as *Pomatoceros triangularis* and *Glomerula solitaria* are generally well preserved if found attached to their substrates (Pl. 1, figs. 8, 12).

Echinoderms are very characteristic taphocoenose components. The above mentioned roveacrinids locally build the matrix and form the yellow crinoid limestone (Nekvasilová and Prokop 1963). The disarticulated skeletal elements show only slight sorting and are very well preserved, slightly destructed only by the diagenetic recrystalisation. Thin sharp edges, spines of cups and brachials and globose dorsal capsulae of cups are often complete. The roveacrinid remains also form fillings of burrows (found isolated in washings) and deep concavities of some oyster valves (*G. canaliculata*, Pl. 2, fig. 4). Isocrinid stems are always disarticulated into the individual columnals and, rarely, short pluricolumnals. A slightly abraded massive cup of cyrtocrinid *Cyathidium* aff. *depressum* was found detached from a substrate (Žítt 1996b). Disarticulated brachials of this species are extremely rare. Echinoid remains highly differ in their preservation. The cidarid tests are always disintegrated into plates and spines, while other groups may rarely manifest well preserved coronas (Žítt 1993b). In *Pseudarbacia*?, *Phymosoma* and *Cottaldia* they always lack apical systems but in *Codiopsis*, *Orthopsis*, *Goniopygus* (Pl. 1, fig. 4) and in saleniids they are preserved. Tests of the last mentioned taxa are in part free of sedimentary fillings (see the brachiopods), though their peristomes are open and lanterns postmortally removed. Disarticulated lantern ossicles dispersed in sediment are mostly well preserved. Asterozoan skeletons are always disarticulated and their isolated elements are intact or slightly abraded.

The *Gisilina*? *rudolphi* - *Goniopygus* cf. *menardi* taphocoenose which is best defined at the Předboj-quarry A seems to be also represented in the Černovičky-quarry A (see table 1), though only two characteristic species have been identified here so far. General characters of macrofauna are, however, similar. In the sample 3 (topmost part of conglomerate, text-fig. 11A), rich alcyonarian (Octocorallia) spicules and mesh fragments were found. Bryozoans are here relatively most diverse over the whole locality. All the species are, however, represented by small, mostly slightly abraded fragments. Relatively rich are the upper valves of very small, probably juvenile oysters. Echinoderms are represented mostly by echinoids. In addition to the isolated elements (spines, rotulae, coronal plates), several ambulacral and interambulacral plate columns of 2-3 species have been picked up from the washing. These all belong to the very young specimens of *Pseudarbacia*? sp. and some other indetermined species. All of these echinoid remains are well preserved unlike many isolated plates, mainly of the heavy cidaroid type, which are often fragmented and highly abraded. The occurrence of phosphatized small invertebrate coprolites and fragments of corrallinacean algae is conspicuous. The underlying conglomerate with hard sandy-carbonate matrix (samples 1, 2) contains a diverse but not too frequent macrofauna, in which the gastropods and bivalves are relatively abundant (see Appendix 1). However, the poor preservation did not, in many cases, allow precise determinations (Pl. 2, fig. 14). Some macrofaunal species included in the Appendix 1 were listed by Zelenka (1990), Mašek et al. (1990) and Eliášová (1995). Macrofauna of samples 1 and 2 shows a relative stability in taphonomic features through the section. Macrofaunal remains are mostly fragmented and partly abraded. Gastropods are preserved mostly as internal moulds (dissolution of aragonite tests; Pl. 2, fig. 14). Bivalves are mostly disarticulated and fragmented. However, several non-oyster species (including the rudists) were determined by Zelenka (1990) and Zelenka in Mašek et al. (1990). The amount of oyster fragments increases up the section. Echinoderms are rare, but several echinoid species mentioned by Zelenka (1990) probably come from this lithology (e.g. *Salenia liliputana*). The same holds for coral species listed by this author and by Eliášová (1995). Brachiopod tests are rare and mostly disarticulated, *Sellithyris phaseolina* being most common. In some parts of the conglomerate accumulations where the matrix is decalcified (clayey reddish)(e.g. quarry A, sample 6; text-fig. 11A), very small fragments of indeterminable bivalves (probably oysters) are rarely observed. All conglomerate occurrences of Černovičky-quarry A are well known by rich epibiont encrusters of clasts (see section on epibionts).

b/ Other taphocoenoses

The other taphocoenoses of conglomerates of the UTH vary both taxonomically and taphonomically but are relatively poorly preserved. In the conglomerate accumulations of Kněžívka only the calcareous conglomerate of southern quarry part (sample A of Appendix 1; text-figs. 7A, 8) contains a rich macrofauna (Svoboda 1982, Zelenka 1982). The species spectrum is more or less identical with that of the so called first-phase conglomerate distinguished at the Velim locality (Žítt et al. 1997a). Taphonomic features show the taphocoenose as a mixture of mostly fragmented unabraded and abraded remains. All bivalve shells are disarticulated, the most massive ones being bored by boring sponges. Encrusting epibionts have not been observed. However, the hardness of carbonate matrix and the presence of sand grains must be noticed as it makes difficult the gathering of fossils and their study. Sample B of Kněžívka (Appendix 1; text-fig. 7B) comes from a conglomerate with reddish matrix similar to the sample 6 of Černovičky-quarry A. The faunal content of both these bodies is not representative as it was definitely dissolved during the post-Cretaceous times (see section on lithology).

Very rare fauna consisting mainly from badly preserved right valves of small oysters is known from the Kojetice locality (Žítt and Nekvasilová 1991a).

2. Taphocoenoses of the topmost marly conglomerate parts

This taphocoenose is presently preserved at Černovičky, Kněžívka and Předboj-quarry C.

The macrofaunal species spectrum of marly conglomerate in the Černovičky-quarry A (sample 4) is similar to those occcurring at many other localities of this facies (e.g. Velim and Kněžívka, see Žítt et al. 1997a and Žítt and Nekvasilová 1990, respectively). Most conspicuous are the brachiopods, corals (mainly *Synhelia gibbosa*) and bivalves (Appendix 1). Small oysters of the genera *Amphidonte*, *Gryphaeostrea* and young *Hyotissa* are very frequent. Their shells are always disarticulated and only slightly abraded if at all. A find of so far indetermined oyster species with softly wrinkled relatively thin-walled shell, described for the first time in the Velim locality (Žítt et al. 1997a, Pl. I, figs. 13-15) was also recorded. One fragmentary, originally cemented valve of *Atreta* sp. 1 (in the sense of Nekvasilová and Žítt 1988) was found in the sediment. Pectenids and spondylids are abundantly present in small fragments. However, the rudists are completely missing. Echinoderms are rare, but one fragmentary cup of *Roveacrinus* sp. and one fragment of *Pseudarbacia*? sp. was found. The majority of other echinoderm remains is represented by disarticulated skeletal elements (spines of echinoids, small brachials and cirrals of isocrinids and comatulids, columnals of isocrinids, asteroid and ophiuroid ossicles; see also Žítt 1996a). The cidaroid spines (*Stereocidaris sorigneti*) are the most conspicuous. Abrasion of echinoderm elements is absent or low, fragmentation was found mainly in a part of long spines *Stereocidaris vesiculosa*). Remains of shark teeth and small invertebrate coprolites are also typical though infrequent. Encrustation of macrofaunal remains by epibiont species is relatively rare. Bivalve shells may be colonized both on the outer and inner surfaces.

The list of fauna known from Kněžívka-north (sample D, text-fig.7C) is included in the Appendix 1. In this sample small abraded or sharpe-edged fragments of small oysters predominate. Larger determinable bioclasts belong mostly to the right valves of *Amphidonte* (*Amphidonte*) *sigmoideum* and *A. (A.) reticulatum* (for general data on the latter species see Záruba 1965c, 1966) and left fragmentary valves of pycnodonteine oysters and *Gryphaeostrea* cf. *canaliculata*. Corals *Synhelia gibbosa* and *Moltkia foveolata*, brachiopod *Terebratulina "chrysalis"* and thecideans are rare components of this taphocoenose.

The fauna of marly conglomerate in Předboj-quarry C is basically identical. Rare finds of abraded (reworked) specimens of some species originally belonging to the *Gisilina*? *rudolphi* - *Goniopygus* cf. *menardi* taphocoenose must be noted here.

3. Taphocoenoses of sandstones

The Korycany Member of the Pazderna locality is formed by calcareous sandstones. The taphocoenose is composed prevailingly of disarticulated oyster shells (mostly right valves) among which the species *Rastellum diluvianum*, *Amphidonte (Amphidonte) sigmoideum* and *A. (A.) reticulatum*) are the most frequent. The other fauna is rare (e.g. hexacoral *Synhelia gibbosa*, cyclostome bryozoans, rhynchonellid brachiopods) (see Žítt and Nekvasilová 1997). All the remains are variably abraded and fragmented and only slightly encrusted by epifaunas. The invertebrate coprolites, ichthyolites, phosphatized sponge intraclasts and in situ formed phosphatic concretions are numerous and have been discussed in the section on phosphates (see above). The fauna of Pazderna sandstones was also collected by Svoboda (1997a). From his finds the brachiopod *Cyclothyris* aff. *difformis* is the most important.

Taphocoenoses of the Bílá Hora Formation

1. Basal deposits

The marly deposits occur not only as matrix of the topmost conglomerate horizons of the Korycany Member (see above) but they are also frequent on the very base of the overlying Bílá Hora Formation. The best examples of taphocoenoses in the latter horizon have been studied at the Předboj, Kněžívka, Líbeznice, and Kojetice localities.

The taphocoenose from Předboj-quarry A (sample 3; text-fig. 11B), was characterized by predominance of isolated cidarid spines *Stereocidaris vesiculosa* and *S. sorigneti*, small oysters *Amphidonte (A.) sigmoideum* and *A. (A.). reticulatum* (Pl. 2, fig. 5), hexacoral *Synhelia gibbosa*, brachiopod *Cyclothyris* cf. *zahalkai* and several species of shark teeth (Svoboda 1986). In our collection there are very poor fossils from this horizon (sample 3). Field documentation evidences that only small irregularly preserved relics with fauna survived in places a strong Quaternary destruction of the horizon modified into the loess-loam. The marlstone overlying the marly conglomerate in the nearby Předboj-quarry C is of the same character.

In the sample 7 from Kněžívka-centre (C in Appendix 1 and text-fig. 7B) relatively rich fauna occurs, which is nearly iden-

Table 2

Distribution of epibionts encrusting the rock substrates relative to the younger phosphogenic episode.

Locality: lithostratigraphy	Deposit containing or /and covering encrusted rock substrates	A-association of encrusters	*Atreta - Bdelloidina* community		Notes to samples and substrates
		pre-phosphogenic	phosphogenic	post-phosphogenic	
Sediments with the *Gisilina*? *rudolphi* - *Goniopygus* cf. *menardi* taphocoenose					
Černovičky: Korycany Member	intact calcareous conglomerate	+	-	-	samples 1-3 clasts
Předboj, quarry A: Korycany Member	calcareous conglomerate	+	-	-	samples 1, 2 clasts
Sediments with younger taphocoenoses					
Černovičky: Korycany Member	marly conglomerate	-	-	+	sample 4 clasts
Kněžívka: Korycany Member	calcareous conglomerate	+	-	-	sample A clasts
Kněžívka: Korycany Member	decalcified reddish conglomerate	?	-	-	s. B - clasts and r. bottom they cover
Kojetice: Korycany Member	basal conglomerate	+	-	-	clasts
Kněžívka: Korycany Member	marly conglomerate	+	-	-	s. D - clasts and r. bottom they cover
Kojetice: Korycany Member	marly conglomerate	-	+	-	clasts
Líbeznice 1: Korycany Member	marly conglomerate	-	+	+	clasts and rocky bottom
Odolena Voda: Korycany Member	marly conglomerate	-	-	+	clasts
Předboj, quarry C: Korycany Member	marly conglomerate	-	-	+	sample 2 - clasts
Středokluky: Korycany Member	marly conglomerate	-	+	-	clasts
Líbeznice 1: Bílá Hora Formation	marlstone	-	+	+	rocky bottom below marlstone
Pazderna: Bílá Hora Formation	sandy marlstone with clasts; spongolite	-	+	+	clasts; underlying rocky bottom

tical with that of the topmost conglomerate of Kněžívka-north (sample D). However, the disarticulated columnals of *Isocrinus* ? aff. *lanceolatus* are very numerous and crinoid brachials and cirrals as well in the sample C.

At Líbeznice there are developed relatively thick (c. 2 metres) marly sediments surrounding the submarine rocky elevation with phosphates and epibionts (Žítt and Nekvasilová 1992a). Basally they are extremely enriched with invertebrate coprolites and ichthyolites. The macrofauna is relatively rich (mainly the small oysters - *Amphidonte (A.) reticulatum*, *Gryphaeostrea* cf. *canaliculata*, spines of *Stereocidaris vesiculosa*, brachiopod *Terebratulina "chrysalis"*, etc.) but the species diversity is low. Through the whole thickness of the deposit various ichthyolite species (mainly shark and fish teeth) similar to the Předboj-quarry C or Kněžívka-centre and north (samples C, D) occur abundantly. Preservation of the bivalve shells is good, their abrasion is very slight or missing, disarticulation is complete. Ichthyolites used to be fragmented, shark teeth appear frequently with broken bases. Marly beds at Kojetice are of the loess-loam nature and lack the macrofauna.

2. Spongolitic siltstones to spiculites

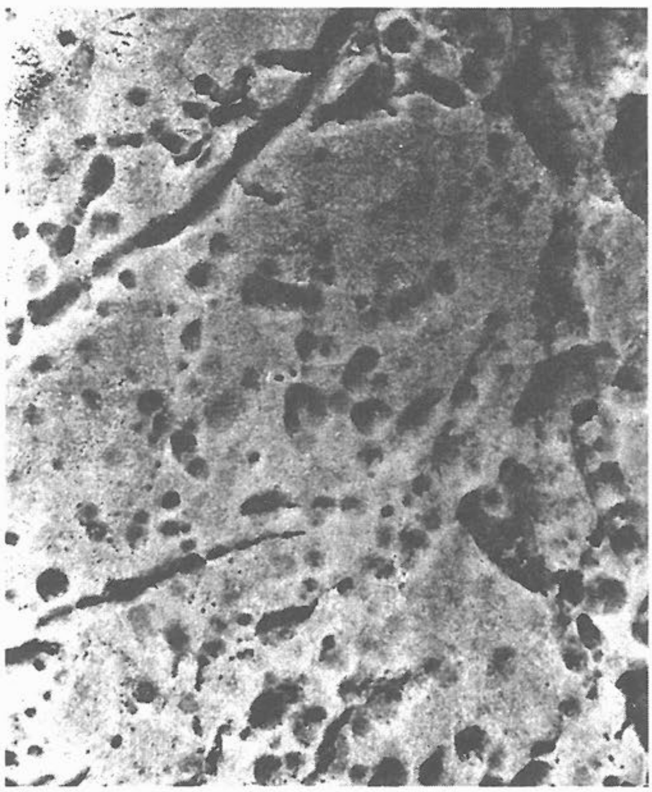
These rocks overlying the marly sediments above conglomerates are only subordinately represented at the key localities.

In the sample 5 (text-fig. 5) of Černovičky very poor fauna was found. Most common are isolated spicules and fragments of sponge meshes. Some ostracods were also separated from the micropaleontological washing.

The relatively thick siltstones in the Líbeznice-section 1 and Pazderna (text-figs. 9A, 10A). are of the same nature. Their macrofauna is very poor, consisting mainly of small oysters, irregularly dispersed invertebrate coprolites and ichthyolites and rarely found sponge skeletons of the type described by Žítt et al (1997a, b) from the Velim locality. At Pazderna the streaks of fragmentary, completely dissolved and indeterminable bivalves occur locally (Žítt and Nekvasilová 1997).

Epibionts of the rock substrates

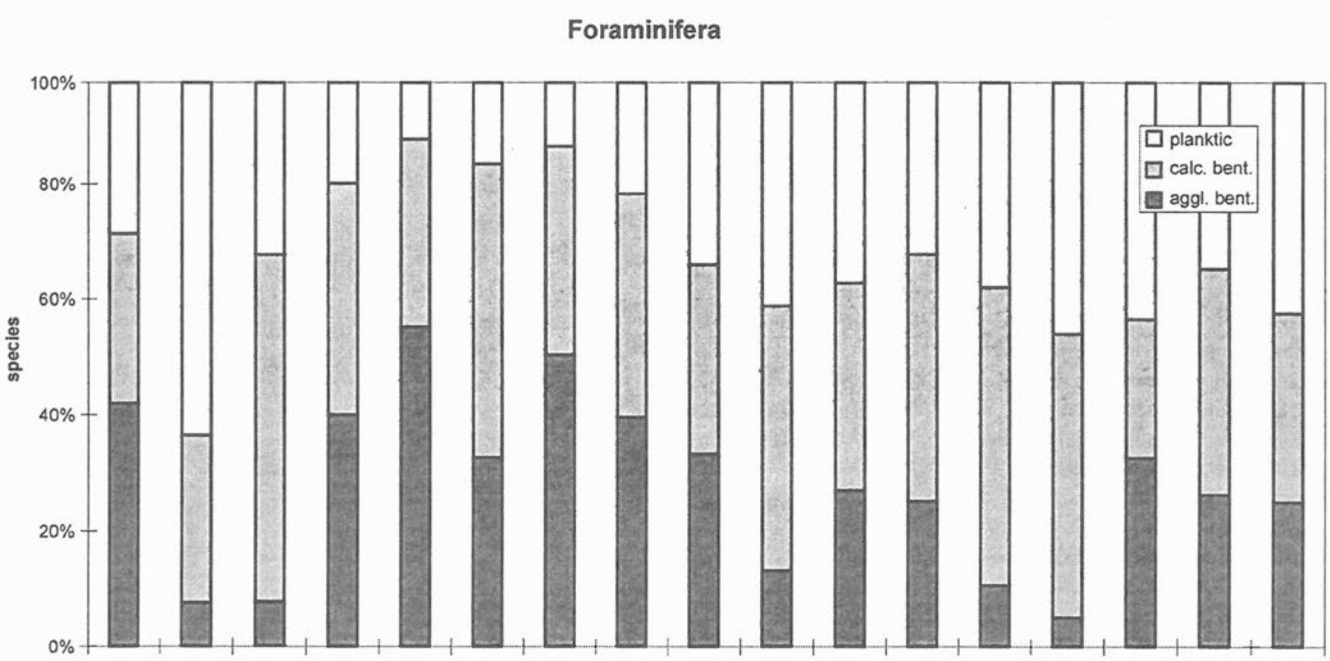
The results of studies of the rock substrates (i.e. the rocky bottom and the rock clasts) and their faunal encrusters in the rocky coast facies of the BCB were summarized by Žítt and



Text- fig. 14 - Černovičky-quarry A (sample 2). Surface of lydite clast with borings and later affection by etching (dissolution). x c. 2.0.

Nekvasilová (1996). Within the range of the UTH they were described from Kněžívka (Žítt and Nekvasilová 1990), Kojetice (Žítt and Nekvasilová 1991a), Líbeznice (Žítt and Nekvasilová 1992a), Odolena Voda (Hradecká, Nekvasilová and Žítt 1994), Pazderna (Žítt and Nekvasilová 1997), Černovičky-quarry A and, in a lesser extent, from some other localities (Žítt and Nekvasilová 1996). In table 2 all relevant data on the epibiont communities relative to the local records of phosphogenesis and faunal taphocoenoses in sediments are summarized.

Two principal encrusting assemblages were distinguished in the BCB (Žítt and Nekvasilová 1996). The first one, named as A-association of encrusters is composed mainly of oysters (*Amphidonte (A.) haliotoideum, A.(A.) reticulatum, A. (A.) sigmoideum* etc.). The second one, named as *Atreta-Bdelloidina* community includes among other taxa the bivalves (false oysters) *Atreta* spp. 1 (Pl. 3, fig. 4) and 2 (determination sensu Nekvasilová and Žítt 1988) and the large agglutinated foraminifera *Bdelloidina cribrosa* (Pl. 3, fig. 1). The A-association is very rarely found or preserved in the area of UTH and represents locally older, mostly the pre-phosphogenic remains of encrusting communities (Kněžívka-south, sample A, Ce in text-fig. 7A). A clast from the Předboj quarry A (samples 1+2) covered by phosphate relics was, however, also colonized by this community. The *Atreta-Bdelloidina* community was more frequently recorded on the UTH and belongs to locally younger colonization episodes, which may be both phosphogenic and post-phosphogenic in age. Mentioned time relationships between epibiont communities seem to be valid for individual localities or smaller areas. Their regional correlations may be questionable and must be supported by other data. For full species lists we refer to Žítt and Nekvasilová (1996).



Text- fig. 15 - A chart showing percentages of planktic and benthic (calcareous and agglutinated) foraminiferal taxa in the majority of studied samples.

Ichnofossils

Several types of ichnofossils are known from the rocky coast areas of the UTH. The rocks (lydites, shales) forming parts of the sea bottom bear frequent borings of the *Trypanites* ichnofacies, described as *Gastrochaenolites* sp. They occur at Líbeznice and Pazderna and mostly show varying degree of truncation (see Žítt and Nekvasilová 1992a, 1997, respectively). In both localities they are pre-phosphogenic in age, because they contain phosphatic fillings and coatings. However, in some places of the rock substrate at Líbeznice, the boring is post-phosphogenic as the borers participated in destruction of phosphatic crusts. Bored surfaces are buried by basal deposits of the Bílá Hora Formation.

Interesting bioerosion was found on the lydite cobbles to boulders in the intact conglomerate of the Černovičky-quarry A. They are represented by small circular pits about 1.5 mm in maximum diameter which are mostly irregularly dispersed over the clast surfaces (text-fig. 14). The depth of pits only rarely exceeds their diameter. On the clast surfaces they may be both solitary and, rarely, in groups. The pits in these groupings were situated so closely to each other that the rock between them was more or less consumed by bioerosion. In this way two to three-part borings originated, the three partial pits being arranged in a line. Only the minority of clasts was, however, bored and those affected are irregularly admixtured in the accumulation. The bored clasts were also affected by a dissolution. Their surfaces (but also surfaces of several other non bored clasts) are not smooth but matting because of the very fine pitting. The inside surfaces of borings and their edges are of the same appearance. The edges of borings are not sharp but often strongly rounded. The boring and dissolution of bored surfaces preceded the colonization by foraminifera *A. longa*, abundantly occurring in the pits and overgrowing all the etched surfaces.

The internal moulds belonging to *Gastrochaenolites* sp. were found in conglomerate of the Předboj-quarry A, sometimes with still preserved bivalve borer *Lithodomus pistilliformis* (Pl. 2, figs. 15, 16; see also Zázvorka 1944c). The original substrate of respective borings is not known as the fillings were found separated, but most likely it was the carbonate (bivalve? shells). Similar borings but mostly free of sedimentary fillings occur also in fragments of the heavy oyster shells.

Many boring traces occur in oyster valves at Kněžívka-south (Cenomanian conglomerate of sample A, text-fig. 7A), Černovičky-quarry A (conglomerate, sample 4, text-fig. 11A), Pazderna (sandstone, text-fig. 10A), Předboj-quarry A (conglomerate, samples 1, 2, text-fig. 11B), Předboj-quarry C (conglomerate, sample C, text-fig. 11C). As the producers of these borings may be preliminarily considered the clionid demosponges preferring the thick-shelled oysters (Hartman 1958). On the other hand, the smaller bioclasts (including the epibiont remains still attached to their rock substrates, such as the bivalves *Atreta* spp. 1 and 2) frequently bear minute more or less branched borings possibly produced by bryozoans or/ and some other organisms (Žítt and Nekvasilová 1991a).

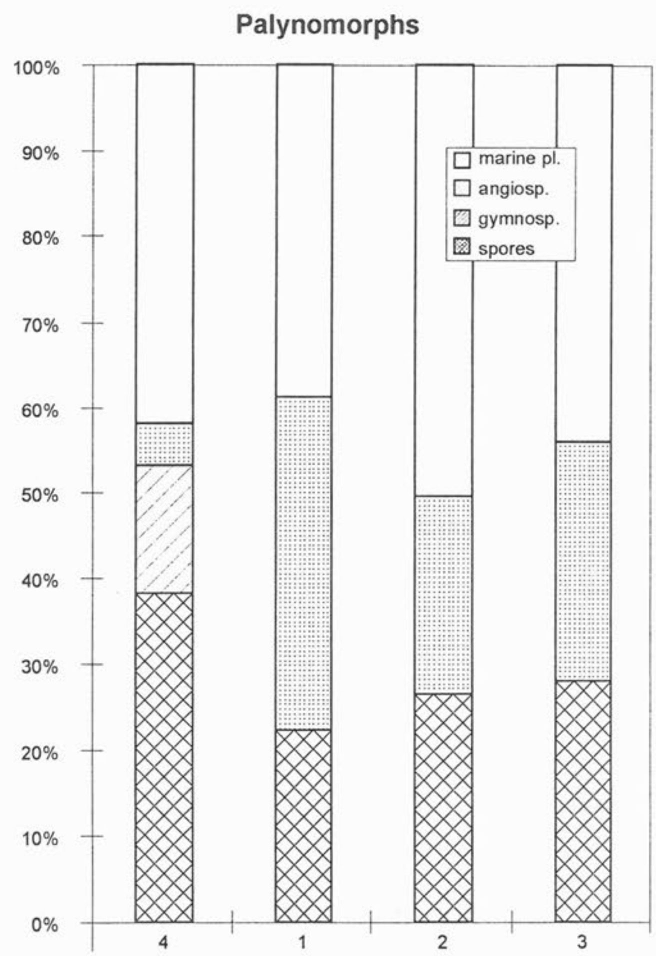
The fillings of burrows have been described by Žítt and Nekvasilová (1997) from the Pazderna locality. In sandstones they are cylindrical, but the real shape is not known, as they come from washings and are fragmentary. Another type of burrow fills occurs also directly on the rocky bottom (lydite) surface. The fills are sinuously curved, non-branched and indicate that respective burrows had originated on the interface with sedimentary cover.

The boring and burrow fills are often phosphatized and glauconitized. One type of borings originated directly in phosphatic crevice fillings. For these types we refer to the section on phosphates in this paper.

Microfauna

All found foraminiferal species are listed in Appendix 2. About 36 species of agglutinated, 43 species of the calcareous benthic and 22 planktic species have been determined in 21 samples (text-figs. 7, 9, 10, 11) encircling all the key rocky-coast sections of the UTH (except the unfossiliferous Kojetice section). The percentages of planktic and benthic (agglutinated and calcareous) species are included in the chart (text-fig. 15). The preservation of calcareous tests is relatively favourable but the assemblage of Pazderna (sample 4) which is probably impoverished due to the abrasion and decalcification.

Foraminiferal diversity is the highest in the Předboj-quarry A, samples 1+2 (i.e. the horizon with *Gisilina*? *rudolphi*-*Goniopygus* cf. *menardi* taphocoenose). Agglutinated benthos



Text- fig. 16 - A chart showing percentages of principal palynomorph groups (marine plankton, angiosperms, gymnosperms and pteridophytes) in four samples of Líbeznice-section 1 (Bílá Hora Formation). Location of samples see text-fig. 9A.

is most pronounced here. The occurrence of calcareous benthic species *Gavelinella cenomanica* (together with *Praeactinocamax plenus*) marks the top parts of *Metoicoceras geslinianum* Zone (more about stratigraphy see sections on biostratigraphy and discussion) of the late Cenomanian. There is a striking drop in foraminiferal diversity in the reworked conglomerate of Předboj- quarry C (early Turonian), most remarkable in agglutinated forms which are more rare even in the overlying Bílá Hora Formation (sampled in the Předboj-quarry B and on site D). The decrease in number of planktic species was gradual.

The oldest assemblage of Černovičky-quarry A (samples 1 and 2 taken from basal conglomerate) is characterized by dominating benthos (text-fig. 15). The assemblage of the overlying horizon (sample 3) has similar composition as that at Předboj-quarry A; the species diversity is not, however, representative (possibly impoverished by dissolution resulting in accentuation of agglutinated species). *W. archaeocretacea* is the most important here. The overlying sample 4 belonging to the same facies as the sample derived of Předboj-quarry C is remarkable by the high diversity of calcareous benthic forms and rich whiteinellids of *W. archaeocretacea* Zone (text-fig. 15). Foraminifers in sample 5 (Bílá Hora Formation) are very rare and may reflex both a sudden natural change in populations and an increase of unfavourable preservational conditions (decrease of $CaCO_3$ content in sediment, diagenetic dissolution of carbonate test).

In the Kněžívka sections, only the sample 7 of Kněžívka-centre shows features of the *W. archaeocretacea* Zone but the impoverishment of foraminiferal assemblage is probable. This

Table 3
Distribution of palynomorphs in four samples of the Líbeznice-section 1 (Bílá Hora Formation). For location of samples see text-fig. 9A. * - rare, ** - common

	samples			
Taxa	1	2	3	4
marine plankton (dinoflagellates and acritarchs)				
Canningia minor COOKSON et HUGHES	*	-	-	-
Cribroperidinium cf. *edwardsii* (COOKS. et EIS.) DAVEY	-	-	-	*
Microdinium veligerum (DEFLANDRE) DAVEY	-	-	*	*
Odontochitina operculata (O. WETZEL) ALBERTI	*	-	-	-
Psaligonyaulax cf. *deflandrei* SARJEANT	-	*	-	-
Subtilisphaera cf. *perlucida* (ALBERTI) JAIN et MILLEPIED	*	*	-	-
Fromea amphora COOKSON et EISENACK	*	-	-	-
Micrhystridium sp.	-	-	-	*
Veryhachium cf. *hyalodermum* (COOKSON) DOWNIE et SARJEANT	-	-	-	*
pteridophyte spores				
Appendicisporites sp.	-	-	-	*
Camarozonosporites insignis NORRIS	-	-	-	*
Cicatricosisporites venustus DEEAK	-	-	-	*
Clavifera triplex (BOLCHOVITINA) BOLCHOVITINA	-	-	-	*
Cyathidites minor COUPER	-	*	-	*
Gleicheniidites senonicus ROSS	*	-	*	*
Pilosisporites cf. *notensis* COOKSON et DETTMANN	-	*	-	-
gymnosperm pollen				
Alisporites bilateralis ROUSE	-	-	-	*
Pinuspollenites sp.	-	-	-	*
Taxodiaceaepollenites hiatus (POTONIE) KREMP	-	-	-	*
angiosperm pollen				
Atlantopollis cf. *microreticulatus* W. KRUTZSCH	-	-	-	-
Atlantopollis sp.	-	*	-	-
Complexiopollis complicatus GOZC. f. minor DIN. KDS. SIM.	-	*	-	-
Complexiopollis spp.	**	**	**	*
Tricolpites sp.	-	-	*	-

is the sample with the lowest species diversity and abundances within the Kněžívka sections and corresponds with shallow-water conditions. The other Kněžívka samples (2, 3, 6) belong to the *H. helvetica* Zone of the late early to early middle Turonian (see discussion). Equal diversities of benthic and planktic forms in sample 2 of Kněžívka-south (clayey carbonate conglomerate matrix) contrast with fluctuating values in samples 3 and 6 (marly conglomerate and overlying marl-stone). Relatively deeper conditions are documented mainly by the keeled planktic species of *Dicarinella* and *Helvetoglobotruncana* in sample 6. Favourable living conditions are indicated by occurrence of *Heterohelix* (samples 2, 3).

Sample 4 from the Líbeznice-section 1 (for the geological character of this sample see section on palynology) belongs to the basal part of the Bílá Hora Formation (*W. archaeocretacea* Zone) and geologicaly corresponds with samples of Předboj-quarry B and site D. This Líbeznice sample together with overlying samples 1 - 3 show gradual increase in plankton and calcareous benthos while the number of agglutinated forms gradually decreases. These trends may correspond with gradual deepenning of the sea during younger parts of the *Helvetoglobotruncana helvetica* Zone of the early Turonian. The horizon of sample 5 may be coeval with that of sample 6 of Kněžívka-south.

The sample 4 of Pazderna, dated into the *W. archaeocretacea* Zone, indicates conditions of the relatively shallow sea. The only specimen doubtfully belonging to *Gavelinella cenomanica* is very badly preserved and may come from older deposits.

Agglutinated foraminifers *Acruliammina longa, A.* sp., *Bdelloidina cribrosa* and *Placopsilina* sp.(see Appendix 2) were important colonizers of hard substrates in studied sections. *A. longa* is ubiquitous encruster of bioclasts and rock substrates (clasts and rocky bottom) and locally forms extraordinarily rich growths (Pl. 3, figs. 2, 5). The occurrence of *Bdelloidina cribrosa* is closely connected with breaks in phosphogeny and following post-phosphogenic conditions (Žítt and Nekvasilová 1996). *Placopsilina* sp. is probably a specialized and rare colonizer of other living organisms (e.g. the sponges). The larger tests of *A. longa* and *B. cribrosa* are found also detached from their substrates and more or less fragmented. The species *Placopsilina* sp. has never been found detached from its substrates yet (but it is very rare). All these three species may be (at least potentially) registered by currently used macropaleontologic and micropaleontologic methods. However, the last species, *Acruliammina* sp.(see Žítt and Nekvasilová 1990) so far observed only on lydite clasts, is so soft that its registration in micropaleontologic washings is quite impossible. No doubt that the character of test obscures possibly much wider species distribution in the rocky coast facies of the UTH.

Palynology

Palynological examinations revealed that in the area of the UTH only the samples from the Bílá Hora Formation of the Líbeznice-section 1 (text-fig. 9A) yielded determinable though generally rare palynomorphs (Pl. 4, figs. 1-16).

The studied associations (four samples) are very rich in dinoflagellate cysts (39-50%; text-fig. 16). The cavate forms are mainly of the *Subtilisphaera* type together with cavate ceratioid form *Odontochitina operculata* (Pl. 4, figs. 12, 13). These species are abundant in the lower part of the section (samples 1 and 2), constituting about 60 % of the total dinoflagellate cyst population. No chorate cysts, indicative of neritic conditions, were recorded from the Líbeznice samples. Small spiny acritarchs of the *Micrhystridium* (Pl. 4, fig. 9) occur scarcely.

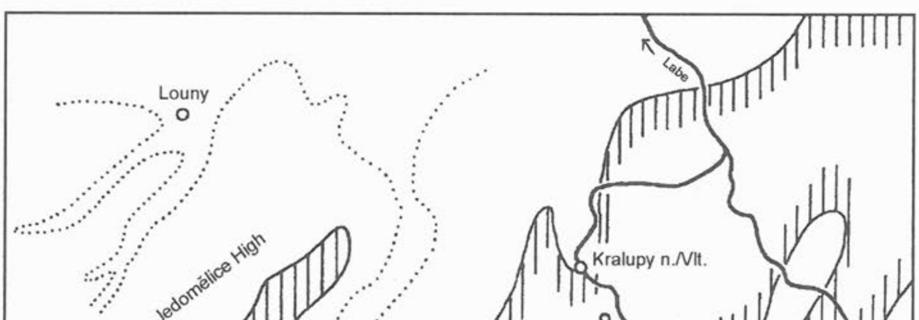
Triporate angiosperm pollen of the Normapolles group (*Complexiopollis* type only) are highly dominant in the terrestrial flora of samples 1-3 (25-40 %) (Pl. 4, figs. 1, 2) in which only some spores of pteridophytes occur.

In the sample 4 the pteridophytes are the most abundant components of terrestrial flora; some gymnosperms are also present. Due to partial Quaternary (neotectonic?) destruction of the profile, this sample in fact represents the basalmost horizon of the whole studied section.

The assemblage of Líbeznice-section 1 is comparable to that found in samples 6 and 7 of Velim (Svobodová 1990) (i.e. sections II and VII in Žítt et al. 1997a,b). The former one differs only in higher percentage of triporate angiosperm pollen of *Complexiopollis* type, but the composition of the terrestrial flora is identical (Svobodová in Žítt et al. 1997b).

Species diversity and distribution in samples are plotted in table 3 and relationships between the percentages of main palynofloral groups are in the chart (text-fig. 16).

Palynofacies is characterized by low amount of amorphous organic matter with some land particles. No scolecodonts and foraminifer linings were recorded. This indicates sedimentation in an environment with normal oxygen content (see Svobodová, Méon and Pacltová 1998).



Text- fig. 17 - A sketch showing former outlines (dotted) of geographical highs, based on 20 m-isopach of the Cenomanian deposits. Full line - extent of land during approx. upper part of the Peruc Member. Modified after Jelen and Malecha (1987, 1988) - area west of the Unhošť-Tursko High, and after Malkovský et al. (1974) - UTH and eastern area.

Notes to the biostratigraphy

In this paper the stratigraphic scheme and foraminiferal zonation of Robaszynski and Caron (1995) are used. Because of the lack of *Rotalipora cushmani* in studied sections we are applying the *Gavelinella cenomanica* Zone of Hradecká (in Hradecká and Švábenická 1995); the extinction levels of this species and of *R. cushmani* are roughly identical (see also Uličný, Hladíková and Hradecká 1993). The deposits of subsequent *Praeactinocamax plenus* Zone are in situ developed in only one key section of the UTH. The updip correlation of these deposits with the siltstones of Pecínov Member (Uličný, Hladíková and Hradecká 1993, Uličný and Špičáková 1996, Uličný et al. 1997a, b) is only tentative (see below) because of the lack of this species in the well known Pecínov section. *P. plenus* was found only in the topmost parts of this series more basinward of Pecínov and the UTH (Pražák 1989). In papers of Uličný et al. (op. cit.) the *M. geslinianum* Zone is used for this interval instead of *R. cushmani* and *P. plenus* Zones. According to Christensen (1992), the stratigraphic range of *P. plenus* is identical with *Metoicoceras geslinianum* Zone in the NW Europe. The proper Plenus Cold Event of Gale and Christensen (1996) was recorded from the lower part of *M. geslinianum* Zone in NW Europe and it was identically located also by Tröger (1996). According to Jarvis et al. (1988), *P. plenus* occurs in the top parts of the range of *M. geslinianum* in the Plenus Marls of Dover. Košťák and Pavliš (in print) consider the substitution of *M. geslinianum* Zone by *P. plenus* Acme Zone would be adequate in the shallow-water facies of the BCB due to the lack of mentioned ammonite species. Pražák (1989) and Košťák and Pavliš (in print) also noticed frequent redepositions of *P. plenus* into the younger beds.

Stratigraphically overlying *Whiteinella archaeocretacea* Zone crossing the Cenomanian-Turonian boundary is well documented in the studied samples of the UTH. Some sections partly belong to the well defined *Helvetoglobotruncana helvetica* Zone.

For the age determinations within the Cenomanian-Turonian boundary deposits the brachiopods *Cyclothyris* aff. *difformis* and *Cyclothyris zahalkai* were used as index species for the late Cenomanian and early Turonian, respectively (Svoboda 1997a). As the stratigraphic value of these species is not yet fully proved, we used their presence only as an additional subsidiary criterion.

Evolution of the area

Sedimentation in depressed zones

The oldest (fresh-water) sediments of the Peruc-Korycany Formation were deposited in the most depressed areas between the highs (text-fig. 17). Into these palaeovalleys (Uličný and Špičáková 1996; "flows" or input depressions of Jelen and Malecha 1987, 1988) the first pulses of marine transgression also invaded. These environments are best documented on the south-western foot of the Unhošť-Tursko High (Pecínov quarry; Uličný and Špičáková op. cit.) by the late middle Cenomanian to late Cenomanian Peruc-Korycany Formation, beginning with four fluvial - marginal marine parasequences (Peruc Member), followed by a shallow marine parasequence (Korycany Member) and subsequently the four offshore parasequences (Pecínov Member). The Pecínov Member is capped by three units of the early Turonian open shelf Bílá Hora Formation; basal unit is, however, composed of two subunits (Uličný and Laurin 1996).

Uličný and Špičáková (op. cit.) and Uličný et al. (1996, 1997a, b) defined the Peruc and Korycany Members, and Pecínov Member of the Peruc-Korycany Formation as belonging to two successive sequences. In Pecínov, the base of Korycany Member represents a maximum flooding surface and subsequent deposits of the member probably belong to the highstand systems tract. This sedimentation was progradational, upwards shallowing and at Pecínov area ended by subaerial exposure. Basal surface of the overlying Pecínov Member has in Pecínov the features of a transgressive surface. Practically no or only a slight sea-level fall is indicated in Pecínov at this level, but the fall of about 20-30 m is supposed in Saxonia (Voigt, Pohl and Tröger 1992). Individual parasequences of the Pecínov Member belong to the transgressive systems tract and show features of the stepwise transgression phases separated by distinct omission surfaces. No eustatic sea-level fall is indicated between the individual parasequences. During this deposition, the C_{org} content in sediment and the depletion of oxygen in the bottom waters were increasing. First two parasequences belong to the *Metoicoceras geslinianum* Zone and are of trangressive nature, the upper two parasequences possibly represent the highstand systems tract without index fossils.

Between the Pecínov Member and overlying Bílá Hora Formation there is a gap important because of the sea-level fall and erosion. The lower two units of the Bílá Hora Formation were interpreted as a transgressive systems tract (Uličný et al. 1997a).

The knowledge of sedimentary environments on the opposite (south-eastern) side of the UTH is rather incomplete and the sequence-stratigraphic studies are still lacking there. The Peruc Member arose here prevailingly in the most depressed zones (e.g. the Lower Paleozoic Barrandian region; see Zelenka and Valečka in Straka et al. 1988) and only the overlying Korycany Member and the Bílá Hora Formation covered the area and crossed the Unhošť-Tursko High.

Sedimentation on the UTH

The beginnings of sedimentation in the area of proper Unhošť-Tursko High were briefly discussed by Zahálka (1911), Matějka (1936), Malkovský et al. (1974), Zelenka 1987, Zelenka in Mašek et al. (1990), Žítt and Nekvasilová (1990), Svoboda (1997a, b), etc. According to Uličný and Špičáková (1996), the slopes of the UTH were step by step flooded during the Peruc Member deposition and its top parts were first flooded during the subsequent Korycany Member.

The sea-level-dependent changes of contour of the UTH are difficult to estimate. During the deposition of the upper parts of the Peruc Member in the Pecínov area probably only a part of the Jedomělice High and distinctly narrowed UTH remained unflooded (text-fig. 17). Using data of Malkovský et al. (1974), the northern half of the UTH together with its easternmost part (the Kojetice High by Pražák and Valečka in Volšan et al. 1990) could form an elongated island before the beginning of the Korycany Member deposition (text-fig. 18). For sedimentary record in the just studied key sections of the UTH see above (section on lithology).

Discussion of correlations and paleoenvironments

Reasonable correlations between the Předboj group (i.e. Předboj, Líbeznice and Kojetice, c. 200 m a. s. l.), the updip lying Kněžívka group (i.e. Kněžívka, Černovičky, Pazderna, c. 320-340 m a. s. l.) of rocky-coast sections and the Pecínov section (more than 400 m a. s. l.) are possible only if some postsedimentary relative altitudinal changes are considered. The saxonian radial tectonics was slight in this area, but considering the neotectonic (mostly Pliocene to Quaternary) differential uplift (southwestern part of the UTH - 150-300 m, northeastern part - between Vltava and Labe rivers - 0-150 m) found by Balatka (1989), the pre-tectonic physiography of the UTH and adjacent areas may be approximated. In this view, the highest points of the UTH could form more or less continuous chain with altitudes only slightly descreasing (some tenths of metres) to the northeast.

1. Deposits of the Korycany Member with *Gisilina*? *rudolphi* - *Goniopygus* cf. *menardi* taphocoenose, and preceding sedimentation

Relatively very old Late Cretaceous rocky coast deposit of the UTH is that of the Předboj-quarry A (conglomerate, samples 1, 2). However, the matrix and the clastic frame of the rock seem to be formed in different sedimentary phases (text-fig. 19).

The matrix with *Gisilina*? *rudolphi* - *Goniopygus* cf. *menardi* taphocoenose belongs to the boundary interval of the *Gavelinella cenomanica* (*R. cushmani*) and overlying *Praeactinocamax plenus* Zones (i.e. to the ammonite *Metoicoceras geslinianum* Zone) because both index species are present in samples 1 and 2. Similar community in Hoher Stein (Saxonia) is of roughly identical age (*R. cushmani* - see Rompf 1960, *P. plenus* - see e.g. Schneider 1989). The palaeoecologic factors controlling the distribution of communities with *Gisilina*? *rudolphi* - *Goniopygus* cf. *menardi* over the basin correspond with fully marine conditions of normal salinities and oxygenation. The depletion of oxygen in bottom waters characteristic for the upper part of Peruc-Korycany Formation in the Pecínov area and in the basin did not influenced relatively more shallow-water environments of the UTH.

The depositional setting of Předboj - quarry A (samples 1 and 2) may be downdip tentatively correlated with the top parts of the siltstone sequence (borehole sections NM 1, MV 2 and BŠ 4 situated west of Mělník) within which lies the level of last occurrence of *Gavelinella cenomanica* (Uličný, Hladíková and Hradecká 1993). In some other boreholes the guards of *P. plenus* have been found in the top parts of siltstone facies but the relation to foraminiferal zonation is unknown (Pražák 1989). Updip correlation (text-fig. 19) of strata with *Gisilina*? *rudolphi* - *Goniopygus* cf. *menardi* is rather problematic due to the lack of *G. cenomanica* and *P. plenus* in the whole Pecínov Member exposed in the Pecínov quarry. *M. geslinianum* characterizes only the lower half of this sequence while the upper half lacks any index fossils. Based on this state of knowledge, the Předboj horizon may be tentatively correlated with the top parasequence of really evidenced *M. geslinianum* Zone (parasequence 2) at Pecínov. Future precision of age determination of the Pecínov Member may, however, change this conclusion and shift the level of Předboj-quarry A to younger parasequences of Pecínov Member.

The history of clastic conglomeratic frame of the rock in samples 1 and 2 in the Předboj-quarry A is older (text-fig. 19). The ecological features of macrofauna and microfauna in the above discussed conglomerate matrix indicate deeper sublitoral conditions (probably several tenths of metres). In this environment the coarse rounded lydite clasts could hardly be formed (according to Uličný and Špičáková 1996, the UTH was completely flooded already during the deposition of Korycany Member at Pecínov). Therefore, the clasts have to be formed under conditions of substantially lower sea-level (intertidal to shallow subtidal environments) within some of preceding transgressive steps. The strongly corraded remains of large oysters which are present in the just studied final conglomerate of the Předboj-quarry A could even be inherited from older deposits of this type. The phosphogeny followed the deposition of clastics in anyone but most probably identical transgression step. The problem arises when the

Text- fig. 18 - An approximative sketch of the Unhošť-Tursko High in the very beginning of sedimentation of Unit 5, corresponding with Korycany Member at Pecínov (*C. naviculare* Zone) (modified after Malkovský (1974) and Jelen and Malecha (1987, 1988) and supplemented after Uličný et al. (1997b)). Localities: 1 - Kojetice, 2 - Předboj, 3 - Líbeznice, 4 - Kněžívka, 5 - Černovičky, 6 - Pazderna, 7 - Středokluky.

mechanism and timing of reworking of these conglomerates and phosphatic deposits are considered. Because no sea-level falls are indicated between successive transgression steps of the Pecínov Member (Uličný et al. 1997a), the reworking may be: A/ coincident with regression and transgression episodes at the boundary of the Korycany and Pecínov Members, B/ caused by other than the extreme shallow-water factors (e.g. by an increase or change in current activity and subsequent erosion). This scenario seems to be more probable because frequently found well preserved relics of phosphatic crusts (common at some localities of the BCB) would hardly survive the extreme conditions of intertidal reworking and eventual subaerial exposure. The reworking of Předboj conglomerates may thus well be coincident even with beginnings of deposition of parasequence 2 of the Pecínov Member. The reworking event could therefore only shortly precede the final stage of deposit formation, during which the vacant conglomerate interstices were definitively infilled.

The correlation attempts with the updip lying Pecínov section may be finally summarized as follows: the primary clastic deposits could be formed synchronously with deposition of the Korycany Member (*C. naviculare* Zone) or rather the parasequence 1 of the Pecínov Member (base of *M. geslinianum* Zone) in the Pecínov area. The phosphogenesis followed the drop in mobility of temporary clastics within the respective parasequence; reworking and final Předboj deposits with *Gisilina*? *rudolphi* - *Goniopygus* cf. *menardi* were isochronous with Pecínov Member - parasequence 2, recorded in the Pecínov area. This scheme (text-fig. 19) is only tentative, corresponding with the actual state of age determinations in the key Pecínov area.

The updip correlation of Předboj-quarry A (samples 1 and 2) with the rocky coast sections of the Kněžívka - Pazderna - Černovičky area shows some resemblance only with the conglomerate accumulation of the Černovičky-quarry A, especially its topmost part. The differences of Předboj and Černovičky may be caused by possibly slightly higher altitude of the Černovičky area. This position reflected in shallow, rather extreme high-energy environment unfavourable to existence or/and preservation of some macrofaunal species and resulting in the impoverishment of the community (taphocoenose) with *Gisilina*? *rudolphi* - *Goniopygus* cf. *menardi*.

Another question is the lack of phosphatic crusts in samples 1-3 of Černovičky which might be coeval with those of Předboj-quarry A. The phosphates of the UTH were probably generally formed as a reflexion of rapid deepenning of the area, abrupt transfer of depocentres landwards and subsequent lowering of the rate of sedimentation and slight condensation (Loutit - Hardenbol - Vail 1988). Under these conditions, the phosphatic crusts represent a type of authigenic phosphatic product often accompanying formation of hardgrounds (e.g. Glenn et al. 1994). However, when the above mentioned conditions had prevailed in the area of Předboj-quarry A, and phosphogenesis coeval with a part of parasequence 1 of Pecínov started, the area of Černovičky was most probably still a part of the unflooded land. At most there may exist some emerged deposits of preceding sedimentary phase (coeval with the Korycany Member in Pecínov area). The occurrence of etched (matting) clasts indicating long-term supratidal or subaerial affection supports the idea about their origin from some older deposits.

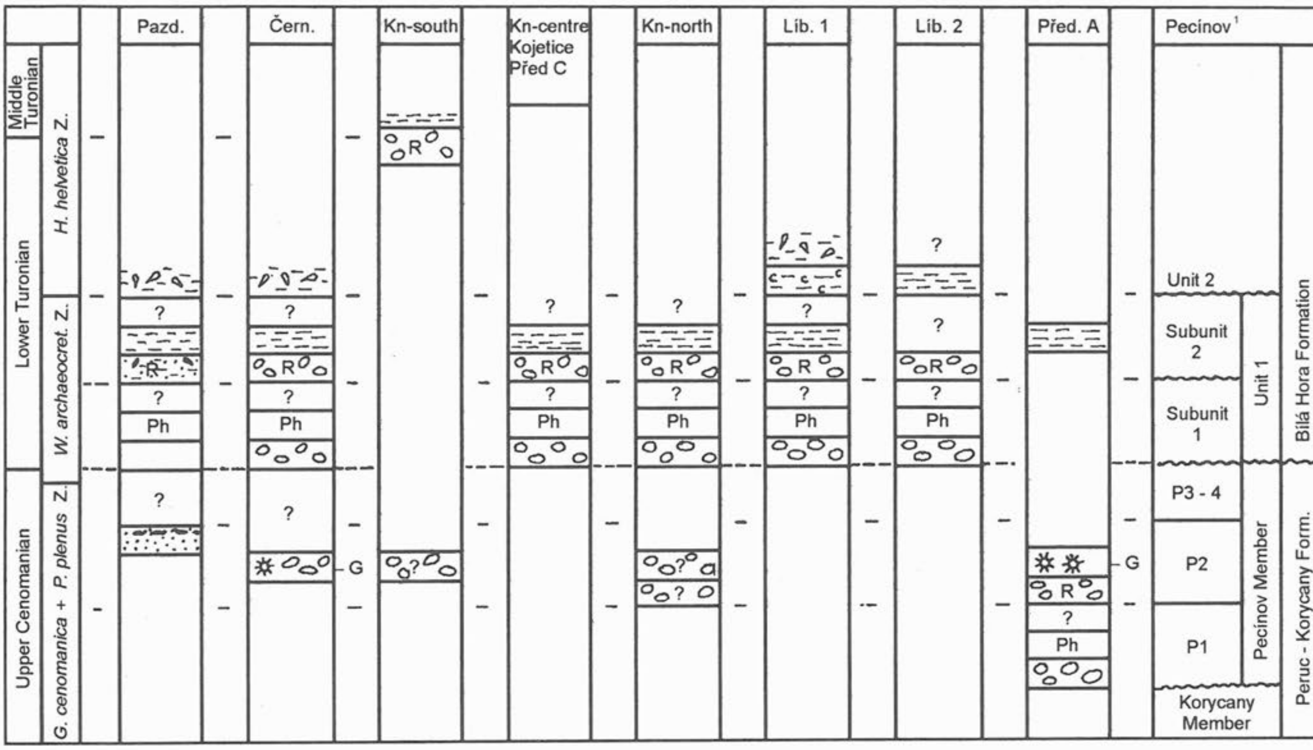
2. The other deposits of Korycany Member

The occurrences of phosphatic crusts are in part analogic to that reported previously from the Předboj-quarry A. Preservation of the crusts is, however, much better. The crusts are often preserved in situ on the rocky bottom (Kněžívka, Líbeznice, Pazderna - see Žítt and Nekvasilová 1990, 1992a, 1997, respectively), and the reworked clasts with phosphatic relics are much more numerous. At Černovičky-quarry A, the fragmented crusts occur in the topmost conglomerate matrix (sample 4). The conglomerate matrix is marly at all key localities except Pazderna with the sandy development. This matrix in Černovičky-quarry A (sample 4), Kněžívka-centre and north (samples C, D) Líbeznice-section 1 (sample 4) and Předboj-quarry C (sample C) in which are the fragmentary crusts and reworked clasts with phosphates embeded, belongs to the *W. archaeocretacea* Zone (at Kojetice unknown). The underlying rocky bottom is sometimes coated with in situ crusts or their relics. However, both reworked and underlying conglomerates of the mentioned localities never contain *Gavelinella cenomanica* and/or *Praeactinocamax plenus*. As the reworked conglomerate is locally matrix supported, the reworking must be dated identically, i.e. to the *W. archaeocretacea* Zone. Proper phosphogenesis may thus simply belong to the transgressive part of the preceding cycle (parasequence or unit), analogically to the older phosphatic episode (see above). Precise age determination of reworking relative to the Cenomanian-Turonian boundary is rather speculative because of the transition of *W. archaeocretacea* Zone to basal early Turonian. The overall character of macrofauna is, nevertheless, rather Turonian (Appendix 1), comparable to similar lithologies at Velim (e.g. the section VI; Žítt et al. 1997a, b) and many other rocky coast localities of the BCB. This fauna is basically identical with that of basal Bílá Hora Formation in the same sections. Most recently Uličný and Laurin 1996 found that the lowermost part of the Bílá Hora Formation at Pecínov (unit BH1) is composed of two cycles of the sea-level rise (with phosphogeny) and fall (with reworking). We therefore tentatively suggest that the reworking belongs to this early Turonian interval and preserved phosphatic crusts could be formed both within the older (text-fig. 19) and the younger subunits.

Very surprising is the late early Turonian age of a part of conglomerates at Kněžívka-south (southernmost section in the quarry, samples 2, 3). Some foraminiferal forms (*Tappannina*, *Astacolus*) may indicate even the early middle Turonian age (pers. comm. of J. Hercogová 1984). The conglomerate is composed of abraded lydite pebbles; macrofauna with prevailing indeterminable oyster remains is scarce and badly preserved. We tentatively interpret this deposit as a product of reworking of the older late Cenomanian-early Turonian sediments. This example at all events documents relatively shallow-water environment during the respective time interval (late early-?early middle Turonian) and the existence of relatively thin older sedimentary cover of the area.

3. Deposits of the Bílá Hora Formation

The basal irregularly developed coarse conglomerate is at Líbeznice overlain by several metres thick coprolitic and spongolitic beds of the Bílá Hora Formation, belonging to the *Helvetoglobotruncana helvetica* Zone. Within these rocks an irregular streak of marls of the *W. archaeocretacea* Zone was



Text- fig. 19 - A tentative interpretation and correlation of deposits and events as recorded in studied sections. Not in the scale. For lithology see text-fig. 9. Ph - phosphogenesis, R - reworking, G - *Gisilina*? *rudolphi* - *Goniopygus* cf. *menardi* taphocoenose. Sections: Pazd. - Pazderna, Čern. - Černovičky-quarry A, Kn.- Kněžívka, Před. A, C - Předboj-quarry A, C, Líb. 1, 2 - Líbeznice, section 1, 2. [1] modified after Uličný and Laurin (1996) and Uličný et al. (1997a). P1-P4 - parasequences.

found (see text-fig. 9A, sample 4). We suppose here a slight post-Cretaceous, probably Quaternary plastic deformation of strata causing a small partial uplift of a part of the basalmost rocks. The sedimentologic characteristics of the boundary between both zones were thus obscured. The section was located in the close vicinity of lydite elevation with phosphatic crusts (Žítt and Nekvasilová 1992a) on the surface of which probably even older but as well post-phosphogenic (?early Turonian second phosphogenic episode) hard reddish sandstone-siltstone remains with indetermimnable oyster fragments were preserved in small depressions. Marls of *W. archaeocretacea* Zone are distinct by thin-walled oysters of *Gryphaeostrea canaliculata* type and by *Amphidonte (A.) reticulatum*; the invertebrate coprolites and ichthyolites are relatively scarce unlike many other localities of the BCB. On the other hand, the deposits of the *H. helvetica* Zone consist basally of extreme accumulation of invertebrate coprolites with richly admixed ichthyolites (see section on phosphates) and the streaks and horizons enriched by coprolites are frequent even in the overlying spongolitic rocks. The coprolitic marl covered also the oldest studied conglomerate deposits of the UTH at the Předboj-quarry A (Svoboda 1986) but its age is unknown. This type of sedimentation probably reflected conditions of sedimentary condensation during the *W. archaeocretacea* and *H. helvetica* Zones. The marly sedimentation at Kněžívka-south is most probably younger than that at Líbeznice (late early to early middle Turonian, see above). The micropaleontological examination shows here the deepenning of the sedimentary area during upper parts of *H. helvetica* Zone.

The age of spiculites - spongolites trangressing the post-phosphatic surface at Pazderna were not determined but we suppose this is comparable to the *H. helvetica* Zone at the sections of Líbeznice. The spongolitic siltstones of Černovičky (sample 5) do not contain any index foraminifers. We therefore only tentatively suggest they also belong to some part of *H. helvetica* Zone. Their geological position close laterally to the coarse conglomerate deposits of the quarry A documents here very long-term local survival of older deposits, comparable to that of Kněžívka locality (see above).

The palynologic data are scarce from the UTH deposits (only the Líbeznice-section 1) and regarding the age determination, they more or less agree with the data on foraminifers. The representatives of *Cribroperidinium* reflect inner neritic group affected by occasional salinity, temperature and nutrient fluctuations (cf. Lister - Batten 1988).

Conclusion

Two sedimentary settings composed of the rocky coast and succesive facies of the late Cenomanian-early Turonian age have been distinguished on the Unhošt-Tursko High. Each of the two settings is basally clastic and contains a record of phosphogenesis. The older setting is preserved at two localities, i. e. the Předboj-quarry A and Černovičky-quarry A, the younger encircles top parts of the majority of the studied sections (Kněžívka, Černovičky- quarry A, Kojetice, Líbeznice and Předboj-quarry C). Some other localities belong also to this stage (e.g. Odolena Voda, Středokluky, Svrkyně, Žákova skála). Some part of the basal conglomeratic bodies is dated only approximatively (Kněžívka). They may represent both the relics of older unknown deposits and some parts of the two just distinguished settings in which the fauna is badly preserved due to the late diagenesis or the destructive Quaternary processes.

Age determinations have been enabled by macrofauna, foraminifers and palynomorphs in combination with sedimentologic characters and features of phosphatic relics. The updip correlation is only tentative due to unknown range of *Metoicoceras geslinianum* Zone within the siltstone Pecínov Member in Pecínov. The conglomerate with first recorded phosphogenic episode is tentatively interpreted as being coeval with the transgressive part of the parasequence 1 of Pecínov Member (lower part of *M. geslinianum* Zone). The reworking of this deposit and subsequent infilling of vacant interstices could correspond with the upper parts of recorded *M. geslinianum* Zone (parasequence 2 of Pecínov Member). This environment which is well recorded and dated (upper parts of *Gavelinella cenomanica* Zone and following *Praeactinocamax plenus* Zone) at the Předboj locality, is typical by a taphocoenose with the brachiopod *Gisilina*? *rudolphi* and the echinoid *Goniopygus* cf. *menardi*. This horizon may be correlated with the Saxonian Hoher Stein exposure. The second phosphogenic episode, the age of respective phosphatized deposits (conglomerates) and their reworking correspond with the lower Turonian part of *W. archaeocretacea* Zone, updip correlable with subunits 1 and 2 of the Unit 1 of the Bílá Hora Formation at Pecínov. General features of macrofauna correspond with the early Turonian.

The Bílá Hora Formation covering the rocky-coast sediments is composed of basal, often rather thin horizon of marls/marlstones of *W. archaeocretacea* Zone and of thick overlying, mostly spongolitic, rocks of the *H. helvetica* Zone. These deposits document deeper environment and updip they may be correlated with the Unit 2 or 3 of the same formation in the Pecínov section.

The late Cenomanian - early Turonian rocks were exposed to the late early - early middle Turonian erosion as evidenced at the Kněžívka locality. Local burial of older successions could, on the contrary, help in their preservation in other sites. In this way the deposits in the Předboj-quarry A could survive high-energy conditions renewed on the base of younger cycle of Předboj-quarry C, lying only some metres higher. It seems that age differences between some other geographically closely situated and altitudinaly corresponding sections might be explained in this way. Variegated physiography of the sea-floor in relatively shallow-water environments with a wide scale of changing hydrodynamic factors, lithologies and carbonate amounts (and corresponding rates of cementation) provide basic arguments for the wide scale of preservation possibilities of the strata even during the Cretaceous.

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Explanations to the plates

If not indicated, the specimens are deposited in the Institute of Geology, Acad. Sci, Prague. Plates 1 - 3 - photo J. Žítt.

PLATE 1

Fossils of the Předboj-quarry A, conglomerate, samples 1+2 (text-fig. 11B).

1. *Gryphaeostrea canaliculata* (SOWERBY) cemented on the spine of *Stereocidaris vesiculosa* (GOLDFUSS). × 3.8.
2. *Magas* sp. in dorsal view. × 2.9.
3. *Gisilina*? *rudolphi* (GEINITZ) in dorsal view. × 5.9.
4. *Goniopygus* cf. *menardi* (DESMAREST) in dorsal view. × 6.0.
5. *Sellithyris phaseolina* (VAL. in LAM.) in dorsal view. Brachial valve overgrown by cementing epibionts (see fig. 17 of this plate). × 1.8.
6. *Cyclothyris* aff. *difformis* (VAL. in LAM.) in dorsal view. × 1.4.
7. A part of cemented organic debris with a fragment of *Cyclothyris* aff. *difformis* (VAL. in LAM.) and young *Sellithyris phaseolina* (VAL. in LAM.)(upper specimen). Collections of the Nat. Musem, Prague, Os 496. × 1.3.
8. Tubes of worm *Pomatoceros triangularis* (MÜNSTER) on the pedicle valve of *Sellithyris phaseolina* (VAL. in LAM.). × 2.9.
9. *Sellithyris phaseolina* (VAL. in LAM.) in dorsal view. Brachial valve overgrown by *Gryphaeostrea canaliculata* (SOWERBY) and some bryozoans. × 2.0.
10. Tube of *Mucroserpula* sp. × 3.6.
11. *Thecidiopsis bohemica* BACKHAUS, inner surface of brachial valve. × 6.0.
12. *Glomerula solitaria* REGENHARDT on the inner surface of fragmented *Cyclothyris* aff. *difformis* valve. × 4.7.
13. *Chlamys acuminata* (GEINITZ) (left) and *Spondylus striatus* (SOWERBY), isolated valves. Determined by J. Pražák, Czech Geol. Survey, Prague. × 0.9.

14, 15. *Lichenopora multiradiata* (REUSS) in upper (14) and basal (15) views. × 6.5.

16. *Sporolithon* sp. and a goniasterid ossicle (G). × 2.2.
17. A colony of c. three cyclostome bryozoan species overgrowing the brachial valve of *Sellithyris phaseolina* (VAL. in LAM.) (see fig. 5 of this plate). × 7.1.

PLATE 2

1. *Hyotissa semiplana* (SOWERBY), int. left (originally attached) valve. Předboj-quarry A, probably conglomerate corresponding with our samples 1+2 (text-fig. 11B). Collections of the Nat. Museum, Prague, O 6300. Natural size.
2. *Arctostrea colubrina* (LAMARCK) (syn. *Rastellum carinatum* (SOWERBY)), lateral view of the right valve. The same locality. Nat. Museum, Prague, Os 497. × 1.1.
3. *Cubitostrea sarumensis* (WOODS), int. left valve. The same locality. Nat. Mus., Prague, Os 494. × 1.1.
4. *Gryphaeostrea canaliculata* (SOWERBY), left valve filled with skeletal remains of *Roveacrinus alatus* DOUGLAS (probably syn. with *R. carinatus* NEKVASILOVÁ et PROKOP). Předboj-quarry A, conglomerate, samples 1+2 (text-fig. 11B). × 4.3.
5. *Amphidonte* (*Amphidonte*) *reticulatum* (REUSS), ext. right valve. The same locality, sample 3. × 2.7.

6, 7. *Radiolites saxoniae* (ROEMER) in lateral (6) and upper views. Note a boring in the base of shell. The same locality, lithology as in fig. 1 of this plate. Nat. Mus., Prague, Os 495. × 1.3.

8. Phosphatized filling of a burrov with "Fremdskulpturen" (Voigt 1971). The same locality, sample 1+2. × 3.4.
9. *Neithea phaseola* (LAMARCK). The same locality and sample. × 2.6.
10. *Neritopsis nodosa* (GEINITZ) in lateral-apical view. The same locality and sample. × 2.1.

11, 12. *Neritopsis nodosa* (GEINITZ), another specimen in apical (11) and lateral views. The same locality and sample. × 1.4.

13. Phosphatic internal mould of a gastropod shell, probably *Neritopsis nodosa* (GEINITZ). The same locality and sample. × 1.3.
14. Fragment of internal mould of *Nerinea*? sp. Černovičky-quarry A, conglomerate, sample 2. × 1.2.
15. *Lithodomus pistilliformis* (REUSS), phosphatic mould of the shell surrounded by phosphatic fill of the boring. Předboj-quarry A, conglomerate, sample 1+2. × 2.9.
16. A fragment of phosphatic filling of boring of *Lithodomus pistilliformis* (REUSS). The same locality and sample. × 3.0.

17, 18. *Rastellum diluvianum* (LINNÉ), right valve in internal (17) and external (18) views. The same locality. Nat. Museum, Prague, O 6299. Natural size.

19. Strongly bored fragment of an oyster. The same locality, sample 1+2. × 1.3.

PLATE 3

Epibionts of the rock substrates (lydite clasts and rocky bottom). All specimens deposited in the Institute of Geology, Acad. Sci., Prague.

1. *Bdelloidina cribrosa* (REUSS), strongly weathered phosphatized specimen. Kněžívka, topmost boulder of northern section (text-fig. 7C). × 4.0.
2. *Acruliammina longa* (TAPPAN), various growth stages. Černovičky-quarry A, conglomerate, sample 2 (text-fig. 11A). × 9.0.
3. The base of a cementing bivalve (possibly a rudist). Černovičky-quarry A, conglomerate, sample 2. × 2.5.
4. *Atreta* sp. 1 attached to the lydite clast. Líbeznice, lydite rocky bottom near section 1 (text-fig. 9A). × 2.5.
5. *Acruliammina longa* (TAPPAN), a cluster of specimens. Kněžívka, conglomerate in central section, sample B (text-fig. 7B). × 4.5.
6. *Spondylus* sp. cemented to the lydite boulder. Líbeznice, basal conglomerate near section 1 (text-fig. 9A). Scale is on the right, 1 bar = 1mm.

PLATE 4

Palynomorphs of Líbeznice-section 1, Bílá Hora Formation. Magnification × 1000 except where indicated (micrographs by M. Svobodová).

1, 2. *Complexiopollis* sp., sample 2, 592/2.
3, 4. *Atlantopollis* cf. *microreticulatus* W. KRUTZSCH., sample 1, 591/2.
5. *Atlantopollis* sp., sample 2, 592/2.
6, 7. *Complexiopollis complicatus* GÓCZÁN forma minor DINIZ, KEDVES, SIMONCICS, sample 2, 592/2.
8. *Tricolpites* sp., sample 3, 593/1.
9. *Micrhystridium* sp., sample 2, 592/2.
10. *Complexiopollis* sp., sample 3, 593/1.
11. *Pilosisporites* cf. *notensis* COOKSON et DETTMANN, sample 2, 592/2.
12. *Odontochitina operculata* (O. WETZEL) ALBERTI, × 400, sample 1, 591/2.
13. *Subtilisphaera* cf. *perlucida* (ALBERTI) JAIN et MILLEPIED, sample 2, 592/2.
14. *Fromea amphora* COOKSON et EISENACK, sample 2, 592/2.
15. *Cribroperidinium* cf. *edwardsii* (COOKSON et EISENACK) DAVEY, × 500, sample 2, 592/2.
16. *Psaligonyaulax* cf. *deflandrei* SARJEANT, sample 2, 592/2.

Appendix 1

Distribution of macrofaunal remains at Předboj, Černovičky and Kněžívka. K. M. - Korycany Member, B. H. F. - Bílá Hora Formation; 1-6 and A-D - samples. Species mentioned from unspecified samples of Černovičky (probably collected in various levels of intact conglomerate of Korycany Member) by following authors: A - Zelenka (1990; determined by P. Svoboda), B - Zelenka in Mašek et al. (1990), C - Eliášová (1995), D - Eliášová (1997). Species in sample A from Kněživka according to Svoboda (1982). +[§] - redeposited specimens.

Species	Localities																
	Předboj, our samples			Černovičky										Kněžívka			
	quarry A		quarry C	authors				our samples						authors	our samples		
	K.M.		B.H. F.	K.M.; B.H.F.?				K.M.					B.H.F.	K.M.	K.M.	B.H.F.	
	1+2	3		A	B	C	D	1	2	3	4	6	5	A	B	C	D
Porifera																	
isolated spicules	-	+	-	-	-	-	-	-	-	-	+	+	+	-	-	-	-
mesh fragments	+	+	-	-	-	-	-	-	-	-	+	+	+	-	+	+	+
Cliona sp. (borings in shells)	+	-	+	-	-	-	-	+	+	-	-	+	-	-	-	+	+
Coelenterata																	
Octocorallia																	
Moltkia foveolata (REUSS)	-	+	+	-	-	-	-	-	-	-	+	-	-	-	-	+	+
alcyonarian spicules	-	+	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-
Scleractinia																	
Actinastrea cribellum (POČTA)	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
? *Baryphyllia* sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-
Colonicyathus geinitzi (BÖLSCHE) (=*Placoseris*)	+	-	-	+	-	-	+	-	-	-	-	-	-	-	-	-	-
Heliocoenia vadosa (POČTA)	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Latimeandra meandrinoides (REUSS) (=*Microphyllia*)	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-
Negoporites michelini (REUSS)	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-
N. cf. *michelini* (REUSS)	+	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-
Polytremacis edwardsana (STOLICZKA)	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Porites textilis POČTA	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-
Psammohelia granulata BÖLSCHE	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Stylina sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-
Synhelia gibbosa (GOLDFUSS)	-	+	+	-	-	-	-	-	-	-	+	-	-	-	-	+	+
Thamnasteria tenuissima MILNE-EDW. et HAIME	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Vermes																	
Glomerula gordialis (SCHLOTHEIM)	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
G. scitula REGENHARDT	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
G. solitaria REGENHARDT	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
G. sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+
Hamulus hexagonus (ROEMER)	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Martina parva ZIEGLER	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mucroserpula sp.	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pomatoceros biplicatus (REUSS)	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P. triangularis (MÜNSTER)	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Proliserpula ampullacea (SOWERBY)	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sarcinella plexus (SOWERBY)	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Serpula antiquata SOWERBY	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S. prolifera GOLDFUSS	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Spiraserpula spirographis (GOLDFUSS)	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S. subinvoluta (REUSS)	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Spirorbis asper (HAGENOW)	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S. margarita ZIEGLER	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Species	Localities																
	Předboj, our samples			Černovičky										Kněžívka			
	quarry A		quarry C	authors				our samples						authors	our samples		
	K.M.		B.H. F.	K.M.; B.H.F.?				K.M.					B.H.F.	K.M.	K.M.	B.H.F.	
	1+2	3		A	B	C	D	1	2	3	4	6	5	A	B	C	D
S. milada ZIEGLER	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
c. 2 serpulid species Gen. et sp. indet.	-	-	-	-	-	-	+	+	+	+	-	-	-	-	-	-	-
Bryozoa																	
Biforicula multicincta (REUSS)	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Callopora perisparsa (NOVÁK)	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C. tuberosa (NOVÁK)	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cellarinidra fertilis VOIGT	+	-	+§	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C. turonensis (d'ORBIGNY)	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Clausa lepida (NOVÁK)	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Crisisina angulosa (d'ORBIGNY)	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Diaperoecia bohemica bohemica (NOVÁK)	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Discocystis eudesi (MICHELIN)	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Discosparsa laminosa d'ORBIGNY	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
D. patula PRANTL	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ditaxia multicincta REUSS	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Entalophora anomalissima NOVÁK	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
E. fecunda NOVÁK	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
E. cf. *madreporacea* (GOLDFUSS)	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
E. zazvorkai PRANTL	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
E. sp.	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Heteropora coronata REUSS	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-
H. michelini coalescens REUSS	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lichenopora multiradiata (REUSS)	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Marginalia ostiolata REUSS	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
M. cf. *ostiolata* REUSS	-	-	-	-	-	-	-	+	+	-	-	-	-	-	-	-	-
Meliceritites cenomana (d'ORBIGNY)	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
M. sp.	-	-	+§	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Membranipora bohemica PRANTL	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
M. bronnii (REUSS)	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Multicrescis surculacea (MICHELIN)	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Onychocella michaudiana (d'ORBIGNY)	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
O. reussi PRANTL	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
O. sp.	-	-	+	-	-	-	-	+	+	-	-	-	-	-	-	-	-
Plagioecia folium (NOVÁK)	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P. sarthacensis (PERGENS)	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Plethopora bohemica PRANTL	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Proboscina sp.	-	-	-	-	-	-	-	+	+	-	-	-	-	-	-	-	-
P. cf. *simplicissima* NOVÁK	-	-	-	-	-	-	-	+	+	-	-	-	-	-	-	-	-
Reptoceritites zahalkai PRANTL	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Reptoclausa sp.	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Reptomulticava phymatodes (REUSS)	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R. spongites (GOLDFUSS)	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R. substellata (d'ORBIGNY)	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Spirentalophora inconspicua VOIGT	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Spiropora verticillata (GOLDFUSS)	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Stomatopora calypso turoniensis PRANTL	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S. minuscula POČTA	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Species	Localities																
	Předboj, our samples			Černovičky										Kněžívka			
	quarry A		quarry C	authors				our samples						authors	our samples		
	K.M.		B.H. F.	K.M.; B.H.F.?				K.M.					B.H.F.	K.M.	K.M.	B.H.F.	
	1+2	3		A	B	C	D	1	2	3	4	6	5	A	B	C	D
Supercystis lebenharti PRANTL	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tholopora cf. *virgulosa* (GREGORY)	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Truncatula carinata (REUSS)	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tyloporella sp.	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Umbrellina stelzneri REUSS	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
? *Vinella* cf. *cretacea* VOIGT	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
cheilostomes Gen. et sp. indet. (approx. number of species)	-	-	1	-	-	-	-	1	-	2	1	-	-	-	-	1	-
cyclostomes gen. et sp. indet. (approx. number of species)	-	-	-	-	-	-	-	1	-	5	1	-	-	-	-	-	-
Brachiopoda																	
Ancistrocrania cf. *gracilis* (MÜNSTER)	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
A. sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	+
Argyrotheca sp. A (sensu Nekvasilová 1983)	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
A. sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+
Cyclothyris aff. *difformis* (VALENCIENNES in LAMARCK)	+	-	+§	+	-	-	-	-	-	-	-	-	-	+	-	-	-
C. aff. *zahalkai* NEKVASILOVÁ	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-
Eothecidellina imperfecta (NEKVASILOVÁ)	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+
Gisilina? *rudolphi* (GEINITZ)	+	-	+§	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Praelacazella lacazelliformis (ELLIOT)	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+
Magas geinitzi SCHLOENBACH	+	-	+§	-	-	-	-	-	-	-	-	-	-	-	-	-	-
M. sp.	+	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-
Monticlarella sp.	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sellithyris phaseolina (VAL. in LAM.)	+	-	-	+	-	-	-	+	-	+	+	-	-	+	-	-	-
Thecidiopsis bohemica BACKHAUS	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Terebratulina "chrysalis" (SCHLOTHEIM)	-	-	+	-	-	-	-	-	-	-	+	-	-	-	-	+	+
fragments of thecideids Gen. et sp. indet.	-	-	-	-	-	-	-	-	-	+	+	-	-	-	-	-	-
fragments of a rhynchonellid Gen. et sp. indet.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	+
Mollusca																	
Bivalvia																	
Amphidonte (Amphidonte) haliotoideum (SOWERBY)	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
A. (A.) reticulatum (REUSS)	+	+	+	-	-	-	-	-	+	-	+	-	-	-	+	+	+
A. (A.) sigmoideum (REUSS)	-	+	+	-	-	-	-	-	+	-	+	-	-	-	-	+	+
Apiotrigonia sulcataria (LAMARCK)	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-
Arctostrea colubrina (LAMARCK) (syn. *Rastellum carinatum* (SOWERBY))	+	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-
Atreta sp. 1 (sensu Nekvasilová and Žítt 1988)	-	+	+	-	-	-	-	-	-	-	+	-	-	-	-	+	+
A. sp. 2 (sensu Nekvasilová and Žítt 1988)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-
Caprina striata Počta	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-
C. cf. *striata* POČTA	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-
Cubitostrea sarumensis (WOODS)	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Species	Localities																
	Předboj, our samples			Černovičky										Kněžívka			
	quarry A		quarry C	authors				our samples						authors	our samples		
	K.M.		B.H.F.	K.M.; B.H.F.?				K.M.					B.H.F.	K.M.	K.M.	B.H.F.	
	1+2	3		A	B	C	D	1	2	3	4	6	5	A	B	C	D
Gryphaeostrea canaliculata (SOWERBY)	+	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-
G. cf. *canaliculata* (SOWERBY)	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	+	+
Hyotissa cf. *semiplana* (SOWERBY)	+	-	-	-	-	-	-	-	-	-	+	-	-	-	-	+	+
Chlamys acuminata (GEINITZ)	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ch. rosinaldina (d'ORBIGNY)	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ichtyosarcolithes ensis POČTA	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
I. sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-
Lima ornata d'ORBIGNY	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-
L. (Ctenoides) tecta GOLDFUSS	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-
Lithodomus pistilliformis (REUSS)	+	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-
Neithea digitalis (ROEMER)	+	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-
N. phaseola (LAMARCK)	+	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-
N. sp.	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Perna lanceolata GEINITZ	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-
Petalodontia sp.	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-
Plicatula sp.	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pseudolimea granulata (NILSSON)	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pycnodonte (Phygraea) vesiculare (LAMARCK)	+	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Radiolites saxoniae (ROEMER)	+	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-
Rastellum diluvianum (LINNÉ)	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Septifer lineatus SOWERBY	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-
Spondylus hystrix (GOLDFUSS)	+	+	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-
S. latus (SOWERBY)	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S. striatus (SOWERBY)	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Venilicardia sp.	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-
oyster Gen. et sp. indet. (Žítt et al. 1997a, Pl. 1, figs. 13-15)	-	-	+	-	-	-	-	-	-	-	+	-	-	-	-	-	-
base of cemented bivalve Gen. et sp. indet. (dtto Pl. 3, fig. 3)	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-
fragments of oysters Gen. et sp. indet.	-	-	+	+	-	-	-	+	+	+	+	-	-	-	-	+	+
upper valves of juv. oysters Gen. et sp. indet.	-	-	-	-	-	-	-	+	-	+	-	-	-	-	-	-	-
fragments of pycnodonteine oysters Gen. et. sp. indet.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	+
fragments of pectenids Gen. et sp. indet.	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-
fragments of spondylids Gen. et. sp. indet.	-	-	+	-	-	-	-	-	-	-	+	-	-	-	-	-	+
fragments of rudists Gen. et sp. indet.	+	-	-	-	-	-	-	+	-	+	-	-	-	-	-	-	-
fragments of bivalves Gen. et sp. indet.	-	-	-	-	-	-	-	+	+	-	-	-	-	-	-	+	+
Gastropoda																	
"Fusus" electus (GEINITZ)	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-
Nerinea sp.	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-
Nerinea? sp.	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-
Neritopsis nodosa (GEINITZ)	+	-	-	+	-	-	-	-	-	+	+	-	-	-	-	-	-
Plesiptygmatis cf. *nobilis* (MÜNSTER)	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-
P. sp.	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-

Species	Localities																
	Předboj, our samples			Černovičky										Kněžívka			
	quarry A		quarry C	authors				our samples						authors	our samples		
	K.M.		B.H.F.	K.M.; B.H.F.?				K.M.					B.H.F.	K.M.	K.M.	B.H.F.	
	1+2	3		A	B	C	D	1	2	3	4	6	5	A	B	C	D
Turbo sp.	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-
Trochus sp.	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-
fragments of internal moulds Gen. et sp. indet.	-	-	-	-	-	-	-	+		+	+	-	-	-	-	-	-
phosphatic moulds - c. 5 species	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cephalopoda																	
Praeactinocamax plenus (BLAINVILLE)	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
rhyncholite Gen. et sp. indet.	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda **Cirripedia**																	
Pollicipes sp.	+	-	-	-	-	-	-	+	-	+	-	-	-	-	-	-	-
Scalpellum crassum KAFKA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	+
S. maximum SOWERBY	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+
S. sp.	+	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-
Malacostraca																	
a dactylopodite Gen. et sp. indet.	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ostracoda																	
indetermined Bairdiidae and Cytheridae	+	+	+	-	-	-	-	-	+	-	+	-	+	-	-	+	-
Bairdia sp.	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-
Bairdopillata sp.	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-
Kamajcythereis sp.	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-
Echinodermata **Crinoidea**																	
Cyathidium aff. *depressum* SIEVERTS-DORECK	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Orthogonocrinus sp.	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Roveacrinus carinatus NEKVASILOVÁ et PROKOP	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R. sp.	-	-	+	-	-	-	-	-	-	-	+	-	-	-	-	-	-
Isocrinus? aff. *lanceolatus* (ROEMER)	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
I. ? cf. *cenomanensis* (d'ORBIGNY)	+	-	+	-	-	-	-	-	-	-	+	-	-	-	-	+	-
crinoid brachials Gen. et sp. indet.	+	+	-	-	-	-	-	-	-	+	+	-	-	-	-	+	-
crinoid cirrals Gen. et sp. indet.	-	-	+	-	-	-	-	-	-	+	+	-	-	-	-	+	+
Echinoidea																	
Codiopsis doma (DESMAREST)	+	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-
Cottaldia benettiae (KÖNIG)	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Goniopygus cf. *menardi* (DESMAREST)	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
G. sp.	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Orthopsis miliaris (d'ARCHAIC)	+	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-
Phymosoma cenomanense (COTTEAU)	+	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-
Pseudarbacia? sp.	+	-	-	-	-	-	-	-	-	+	+	-	-	-	-	-	-
Pyrina desmoulinsi d'ARCHAIC	+	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-
Salenia liliputana GEINITZ	+	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-

Species	Localities																
	Předboj, our samples			Černovičky										Kněžívka			
	quarry A		quarry C	authors				our samples						authors	our samples		
	K.M.		B.H. F.	K.M.; B.H.F.?				K.M.					B.H.F.	K.M.	K.M.	B.H.F.	
	1+2	3		A	B	C	D	1	2	3	4	6	5	A	B	C	D
a salenioid Gen. et sp. indet.	+	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-
Stereocidaris vesiculosa (GOLDFUSS)	+	+	+	-	-	-	-	-	-	-	+	-	-	-	-	+	+
Stereocidaris sorigneti (DESOR)	+	+	+	-	-	-	-	-	-	-	+	-	-	-	-	+	+
indetermined elements of Aristotle lanterns	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
phymosomatoid (?) spines Gen. et sp. indet.	+	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-
Asteroidea																	
goniasterid ossicles Gen. et sp. indet.	+	-	+	+	-	-	-	-	-	+	+	-	-	-	-	+	-
Ophiuroidea																	
Ophiura? *substriata* RASMUSSEN	+	-	-	-	-	-	-	-	-	+	+	-	-	-	-	-	-
Ophiura? sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	+
Vertebrata																	
Acrodus polydictyus AGASSIZ	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cretolamna appendiculata (AGASSIZ)	-	+	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Paramotodon angustidens (REUSS)	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	+	+
Ptychodus mammillaris AGASSIZ	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Scapanorhynchus subulatus (AGASSIZ)	-	+	+	-	-	-	-	-	-	-	-	-	-	-	-	+	+
S. raphiodon (AGASSIZ)	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cretoxyrhina mantelli (AGASSIZ)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-
shark teeth Gen. et sp. indet.	-	+	+	-	-	-	-	-	-	-	+	-	-	-	-	-	-
Algae																	
Corralinacea Gen. et sp. indet.	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-
Sporolithon sp.	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Thalamopora cribrosa (GOLDFUSS)	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

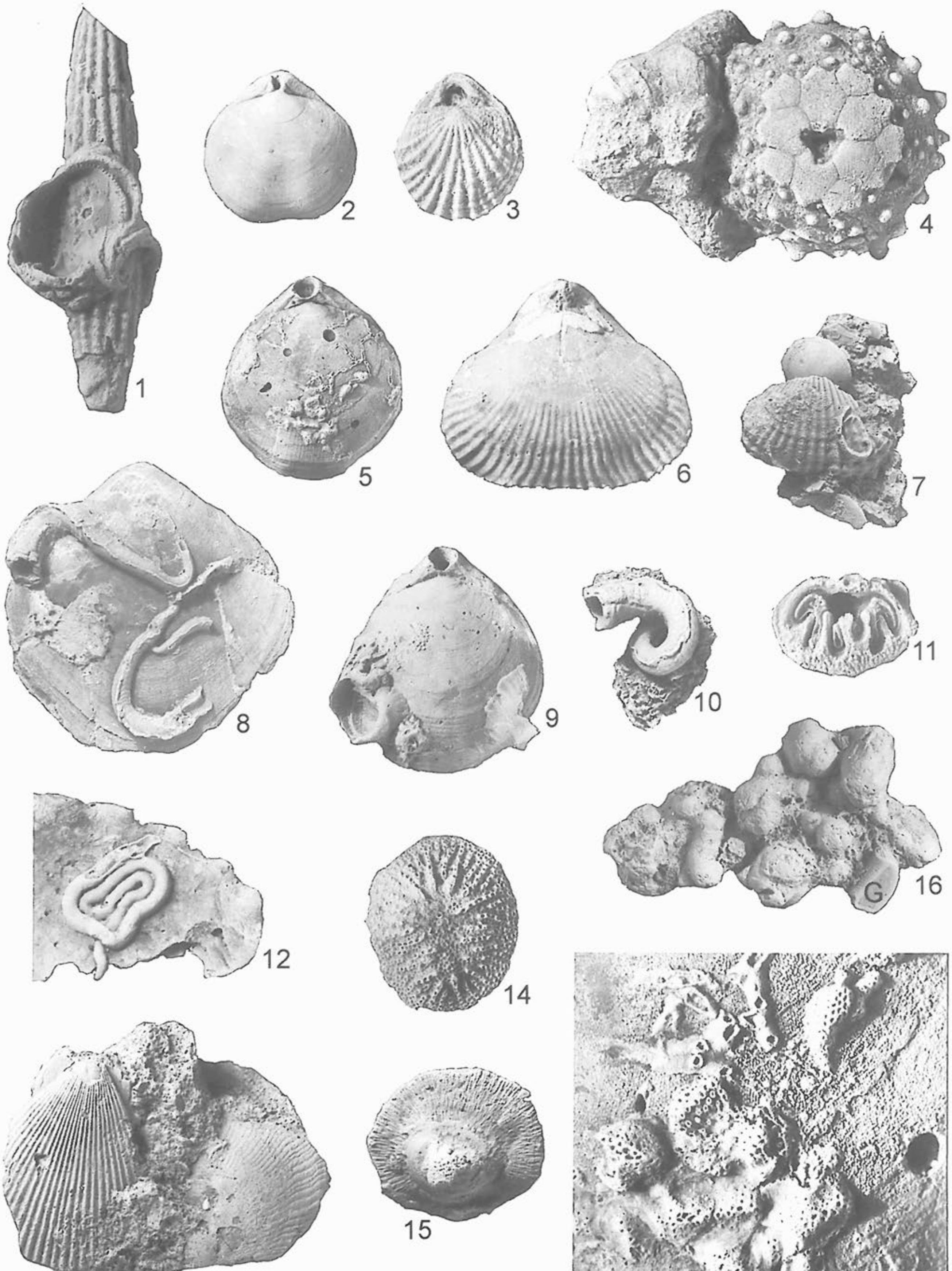
Appendix 2

Distribution of foraminifera in selected sections. P.-Pazderna; A, C-quarries; B, D, 1-7 - samples (text-figs. 4, 7, 9, 10, 11). Other explanations - see Appendix 1.

Species	Locality																				
	Předboj					Černovičky						Kněžívka				Líbeznice					P.
	K. M.			B. H. F.		K. M.					B.H.F.	K. M.		B. H. F.		B. H. F.					K.M.
	A		C	B	D	1	2	3	4	6	5	2	3	6	7	1	3	4	5	6	4
	1	2																			
agglutinated benthos																					
Acruliammina longa (TAPPAN)	+	-	+	-	-	+	+	+	+	+		+	+	+	+	+	+	+	-	-	+
A. sp. (according to Žitt and Nekvasilová 1990)	-	-	-	-	-	+	+	-	-	-	-	-	-	-	+	-	-	-	-	-	-
Ammobaculites lepidus HERCOGOVÁ	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
A. reophacoides BARTENSTEIN	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
A. sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-
Ammodiscus cretaceus (REUSS)	+	+	-	-	-	-	-	+	+	-	-	-	-	-	-	-	-	-	-	-	-
Arenobulimina brevicona (PERNER)	+	+	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-
A. conoidea (PERNER)	+	-	-	-	-	-	-	-	-	-	-	-	-	+	+	-	-	+	-	+	-
A. macfadyeni CUSHMAN	-	-	-	-	-	-	-	-	+	+	-	-	-	-	-	-	-	-	-	-	-
A. preslii (REUSS)	+	+	-	+	+	-	+	-	+	-	+	+	+	+	-	+	+	+	+	+	+
A. sp.	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-
Ataxophragmium depressum (PERNER)	+	-	+	-	-	-	-	+	+	+	+	+	+	+	+	+	-	+	+	-	+
Axicolumella cylindrica (PERNER)	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-
Bdelloidina cribrosa (REUSS)	-	-	-	-	-	-	-	-	+	-	-	-	-	-	+	-	-	-	-	-	-
Bigenerina deciusi CHURCH	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. selseyensis HERON-ALLEN-EARLAND	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dictyopsella fragilis HERCOGOVÁ	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dorothia filiformis (BERTHELIN)	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
D. oxycona (REUSS)	+	-	-	-	-	-	-	+	+	-	-	-	-	-	-	-	-	-	-	-	-
D. sp.	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Gaudryina trochus (d´ORBIGNY)	+	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-
Glomospira sp.	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-
Gyroidina nitida (REUSS)	-	-	-	-	-	-	-	-	+	-	+	-	-	-	-	-	-	+	+	+	+
Haplophragmoides nonioninoides (REUSS)	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
H. ovalis JENDREJÁKOVÁ	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
H. sp.	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Marssonella oxycona (REUSS)	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-
Placopsilina sp.	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pseudotextulariella cretosa (CUSHMAN)	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-
Reophax sp.	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Saccammina sp.	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Saracenaria cf. *crassicosta* (EICHENBERG)	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-
Spiroplectammina goodlandana LALICKER	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S. laevis (ROEMER)	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Textularia foeda REUSS	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
T. sp.	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-
Trochammina albertensis WICKENDEN	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Species	Locality																			
	Předboj					Černovičky						Kněžívka				Líbeznice					P.
	K. M.			B. H. F.		K. M.					B.H.F.	K. M.		B. H. F.		B. H. F.					K.M.
	A		C	B	D	1	2	3	4	6	5	2	3	6	7	1	3	4	5	6	4
	1	2																			
calcareous benthos																					
Astacolus richteri (BROTZEN)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-
Bullopora sp.	+	-	+	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-
Cassidella tegulata (REUSS)	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-
Cibicides aff. *apprima* VOLOSHINA	-	-	-	-	-	-	+	+	-	-	-	-	-	-	-	-	-	-	-	-	-
C. gorbenkoi AKIMEC	+	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-
C. lepidus PLOTNIKOVA	-	-	-	-	-	-	+	+	+	-	-	-	-	-	-	-	-	-	-	-	-
C. polyrraphes (REUSS)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-
C. sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-
Dentalina legumen REUSS	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-
D. sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	+	-	+	-	-
Frondicularia bohemica (PERNER)	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-
F. canaliculata REUSS	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-
F. inversa REUSS	+	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-
F. verneuilina d´ORBIGNY	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-
F. sp.	-	+	-	-	-	-	-	-	+	-	-	-	-	-	-	+	-	-	-	-	-
? Gavelinella ammonoides (REUSS)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-
G. baltica BROTZEN	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-
? G. baltica BROTZEN	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-
G. belorussica (AKIMEC)	+	-	+	+	+	-	+	+	+	-	+	-	-	+	-	+	-	+	-	+	-
G. berthelini (KELLER)	+	+	+	+	+	-	+	-	+	-	-	-	+	+	+	+	+	+	-	+	+
G. cenomanica (BROTZEN)	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
?G. cenomanica (BROTZEN)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+
G. polessica AKIMEC	+	-	-	+	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-
G. schloenbachi (REUSS)	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	+	-	-	-
Globulina lacrima (REUSS)	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lenticulina comptoni (SOWERBY)	+	+	+	-	-	-	-	-	+	-	-	+	+	-	-	-	+	-	-	-	+
L. rotulata (LAMARCK)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-
L. sp.	+	+	+	-	+	-	+	-	+	-	+	-	-	-	-	-	-	-	+	-	-
? Lingulogavelinella albiensis arachnoides GAWOR-BIEDOWA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-
L. globosa (BROTZEN)	+	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-
L. pazdroae GAWOR-BIEDOWA	+	-	-	+	-	-	+	-	+	-	-	+	-	-	+	-	-	+	+	+	-
Marginulina aequivoca REUSS	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Palmula cordata (REUSS)	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Patellina subcretacea	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CUSHMAN et ALEXANDER	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Praebulimina crebra ŠTEMPROKOVÁ	-	-	-	-	-	-	-	+	+	-	-	-	+	+	-	-	+	-	-	-	-
P. sp.	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-
Quadrimorphina allomorphinoides (REUSS)	+	-	-	-	+	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-
Quinqueloculina kochi (REUSS)	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ramulina sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	+	-	-	-
Tappanina eouvigeriniformis (KELLER)	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-
Vaginulina recta REUSS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	+	-	+	-
V. robusta (CHAPMAN)	+	+	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
V. sp.	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-
Valvulineria lenticula (REUSS)	+	-	+	-	+	-	-	-	+	-	+	-	-	+	-	+	+	-	-	-	+

Species	Locality																				
	Předboj					Černovičky						Kněžívka				Líbeznice					P.
	K. M.			B. H. F.		K. M.					B.H.F.	K. M.		B. H. F.		B. H. F.					K.M.
	A		C	B	D	1	2	3	4	6	5	2	3	6	7	1	3	4	5	6	4
	1	2																			
plankton																					
Dicarinella hagni (SCHEIBNEROVA)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-
D. imbricata (MORNOD)	+	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	+	-	+	-	-
D. sp.	+	-	+	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-
Guembelitria cenomana (KELLER)	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-
Hedbergella delrioensis (CARSEY)	+	+	-	-	-	-	+	-	+	-	-	-	-	-	-	-	+	-	+	+	-
H. planispira (TAPPAN)	-	+	-	-	-	-	-	-	+	-	-	-	-	-	-	+	-	-	-	-	-
H. simplex (MORNOD)	-	-	+	-	+	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-
H. sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+
Helvetoglobotruncana helvetica (BOLLI)	-	-	-	-	-	-	-	-	-	-	-	+	-	-	+	+	-	+	+	-	-
H. praehelvetica (TRUJILLO)	+	+	+	-	-	-	-	-	-	-	-	-	+	-	-	+	+	+	+	+	+
Heterohelix moremani (CUSHMAN)	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-
H. sp.	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-
Praeglobotruncana delrioensis (PLUMMER)	+	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P. stephani (GANDOLFI)	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	+	+	-	-	-	-
P. sp.	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	+	+	-	-	-
Whiteinella aprica (LOEBLICH et TAPPAN)	+	+	+	-	+	-	+	-	-	-	-	-	+	-	-	+	+	+	-	-	-
W. archaeocretacea PESSAGNO	+	+	+	-	+	-	-	+	+	-	-	+	-	-	+	-	-	+	-	-	-
W. baltica DOUGLAS et RANKIN	-	+	-	-	-	-	+	-	+	-	-	-	+	+	-	-	-	-	-	-	+
W. brittonensis (LOEBLICH et TAPPAN)	+	+	+	-	-	-	-	-	+	-	+	+	-	-	-	+	+	+	-	+	+
W. paradubia (SIGAL)	+	+	-	-	+	-	-	-	-	-	-	-	-	+	-	-	-	-	-	+	+
W. praehelvetica (TRUJILLO)	-	-	-	-	-	-	-	-	-	-	-	+	-	+	-	-	-	-	-	-	-
W. sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-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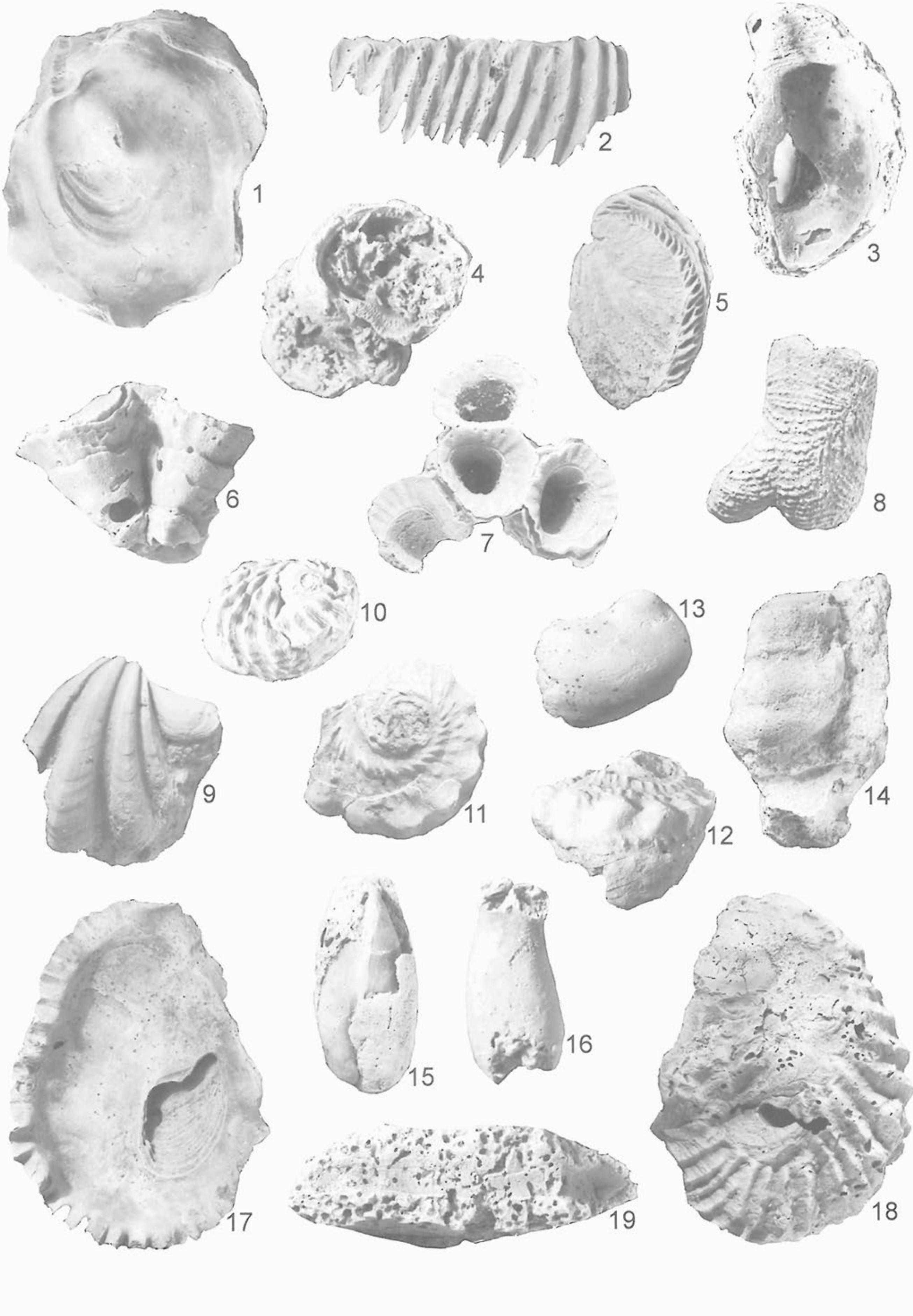
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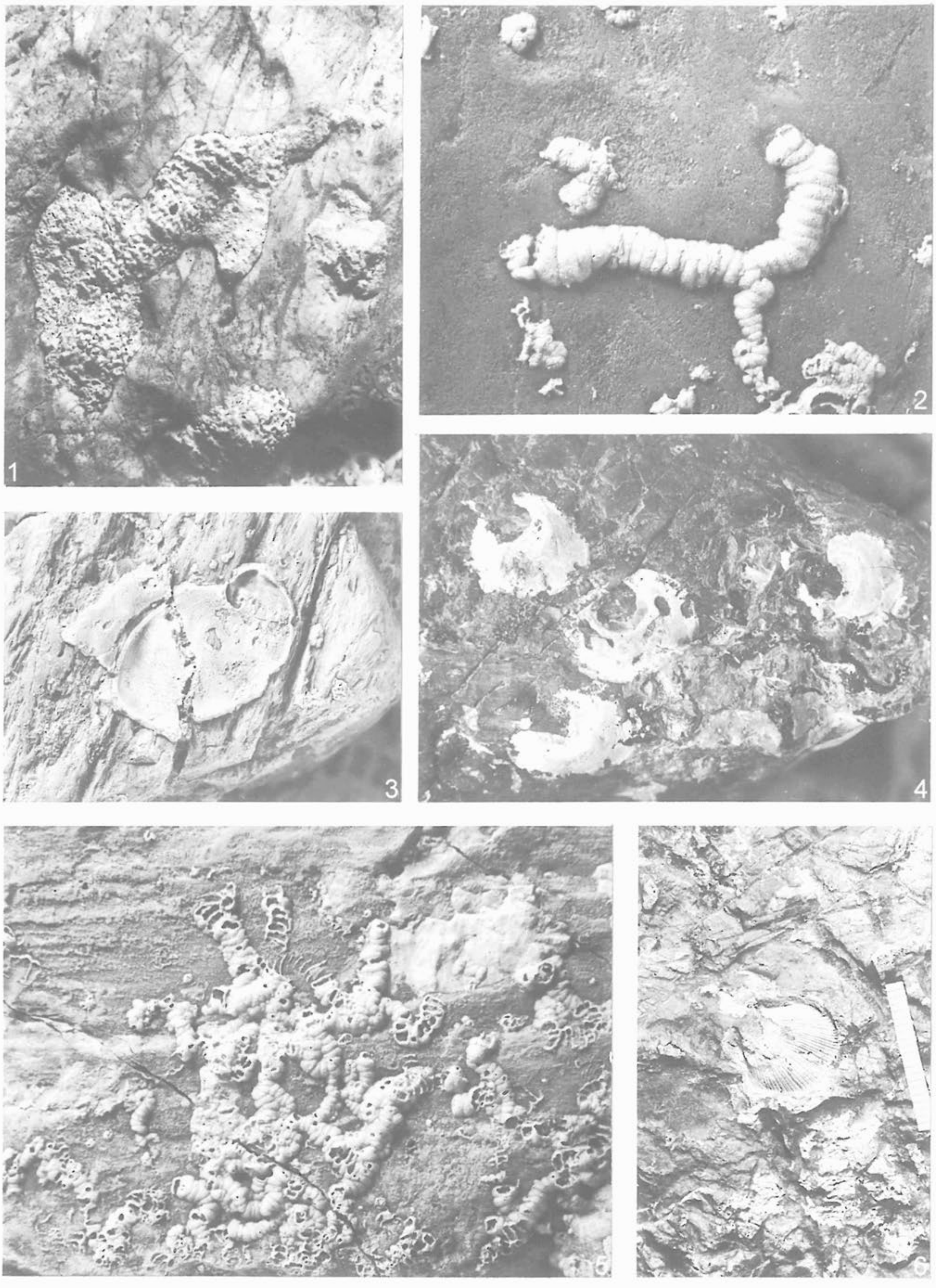
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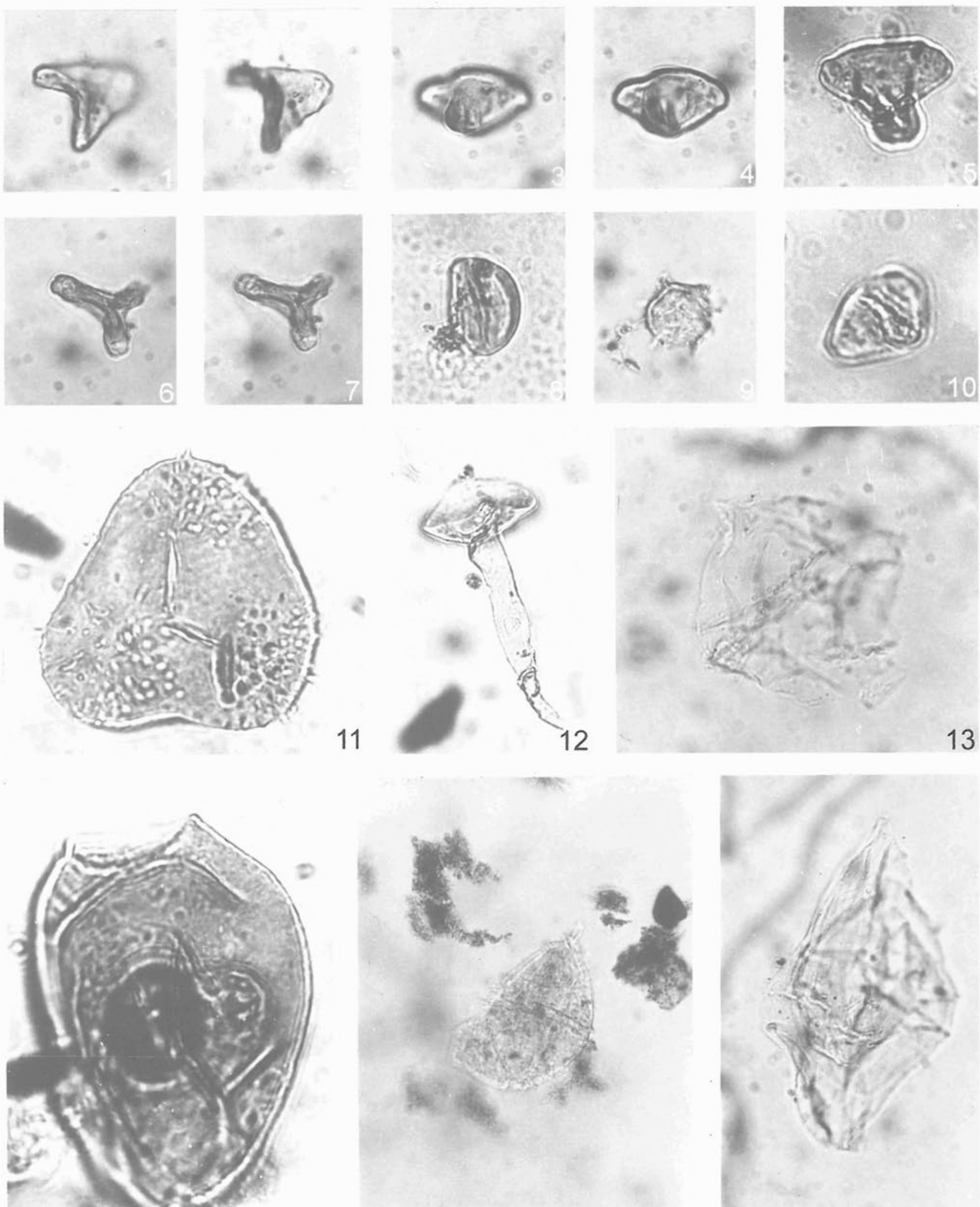
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