1990). As proposed by BOTTJER et al. (1984a), the Early Palaeozoic tracemakers of *Thalassinoides* might be reduced sharply by the Late Ordovician extinction: phyllopods are one of the groups that might be involved in this process. Therefore, the occurrence of *Thalassinoides* in the Barrandian Middle Cambrian is not surprising and it corresponds well with the presumed assessment of the relevant ichnoassemblages to the *Cruziana* Ichnofacies (although *Cruziana* has not been found there). *T. foedus* was described by MIKULÁŠ (1990) from siltstones and fine-grained sandstones of the Zahořany Formation (Upper Ordovician of the Barrandian area). It consists of horizontal network systems of tunnels; size of polygons is up to 15 cm and width of tunnels ca. 15 mm. Their surface is smooth or sulcate. The specimens found in the Bohemian Middle Cambrian differ from *T. foedus* only in minor (about half) dimensions and in the widening of the tunnels close to the branchings in some specimens. For relations of *T. foedus* to other representatives of the ichnogenus see MIKULÁŠ (1990).

Thalassinoides cf. *suevicus* (REITH, 1932)

Pl. XXIII, fig. 2

Material: Sole, favourably preserved specimen (full relief) from the locality Luh (coll. P. Šlehofer).

Description: Horizontal network of tunnels forming closed pentagonal and hexagonal meshes. The tunnels are of constant diameter (2.5–3 mm), their surface is smooth; sections between branchings are straight or curved. Inner diameter of the meshes varies from 8 to 18 mm. Fill of the tunnels contrasts in its yellow colour from the surrounding greyish-green shale: it is formed by greywacke, originally probably carbonatic and cemented secondarily by limonite. Preserved part of the trace occupies area of 7 x 10 cm. There are no or sparse widenings of the tunnels close to the branchings.

Remarks: *Thalassinoides suevicus* has been described by numerous authors (e.g., FREY and BROMLEY 1985, FREY and HOWARD 1985; 1990) mostly from the Cretaceous. The above-mentioned authors place to *T. suevicus* more or less regular tunnel systems, mostly horizontal, Y-branching, showing tunnel diameter usually more than 1 cm. The find from Luh falls to this diagnosis except of the minor size. Regardless a mere one-parameter difference in size is considered generally as a poor ichnotaxobase, the specimen is placed to *T. suevicus* with the reservation.

Thalassinoides isp.

Pl. XXIII, fig. 4; Pl. XXIV, figs. 3, 4

Material: Several tens of rock samples with the described trace from various localities [e.g., Koníček, Ostrý, Medový Újezd, Dubinky a), Jezírka c)].

Description: Irregular subsurface tunnel systems showing roughly comparable amount of vertical, oblique, and horizontal components. The vertical ones are short and their mouths are distant at the horizontal fractures or polished sections at 2–5 mm. The horizontal and oblique components are straight or (more often) curved tunnels, in places Y-branching. Diameter of the shafts and tunnels varies from 2 to 5 mm. Fill is passive, often contrasting from the surrounding rock by its composition and colour.

Remarks: The trace occurs typically in rhythmical sequences (greywackes alternating with shales), covering considerable areas of beds and bedding planes. It often passes to undeterminable bioturbate texture.

6. Character of the ichnoassemblages

The ichnofacies characteristics of the locality Buchava, published by CHLUPÁČ (1993), i.e. "the rather shallow-water Cruziana Ichnofacies: frequent epi- and intrastratal, planar or oblique burrows mostly ranged with Fodichnia (feeding structures) and Pascichnia (grazing traces) made by deposit feeders" is generally acceptable for most of the localities of the Skryje and Jince Shale. The ichnofacies evaluation using the concepts published, e.g., by FREY and PEMBERTON (1984), FREY, PEMBERTON and SAUNDERS (1990) and BROMLEY and ASGAARD (1991) has been involved to preliminary reports on the ichnological study of the Cambrian of the Barrandian area (MIKULÁŠ 1993, 1994). These preliminarily published conclusions have been supplemented during the last phase of the fieldwork and laboratory study.

The first phase of the marine transgression in the Brdy area is documented by finds of *Diplocraterion parallelum* in the lowermost layers of the Jince Formation (siltstones alternating with greywackes and subgreywacke layers of various thickness). *Diplocraterion* is a representative of the Skolithos Ichnofacies (e.g., FREY and PEMBERTON 1984) typical for shifting substrates in settings of high physical energy. The Skolithos Ichnofacies shows usually low diversity (but in places high density) of the original benthic assemblage. The localities of the middle part of the Jince Formation, and the Skryje Shale, yielded most often the following ichnofossils: *Planolites* isp., *Teichichnus rectus* SEILACHER, 1955, *Daedalus* isp., *Thalassinoides* div. isp., *Palaeophycus* isp., coprolites, and in places a taxonomically unrecognizable bioturbate texture is also important. Locally, very specific forms as *Amanitichnus omittus* CHLUPÁČ et MIKULÁŠ, 1995 (the Buchava locality) or *Rejkovicichnus necrofilus* MIKULÁŠ et al., 1996 (the Potůček locality) are also common. The ichnoassemblages may be placed to the Cruziana Ichnofacies (e.g., PEMBERTON and FREY 1984), representing most often a shallow sublittoral, below a daily wave base and above a storm wave base. This was the space for the development of the most diversified benthic assemblages in siliciclastic substrates in the Early Palaeozoic, comprising may K-selected forms (e.g., Pemberton /ed./ 1992).

From the upper part of the Jince Formation, finds of *Skolithos rotundus* isp. nov., *Daedalus* isp., "*Thalassinoides*" isp. and *Skolithos* isp. are common. This assemblage is comparable with the Skolithos Ichnofacies by a low diversity, high density and numerous vertical components of the burrows.

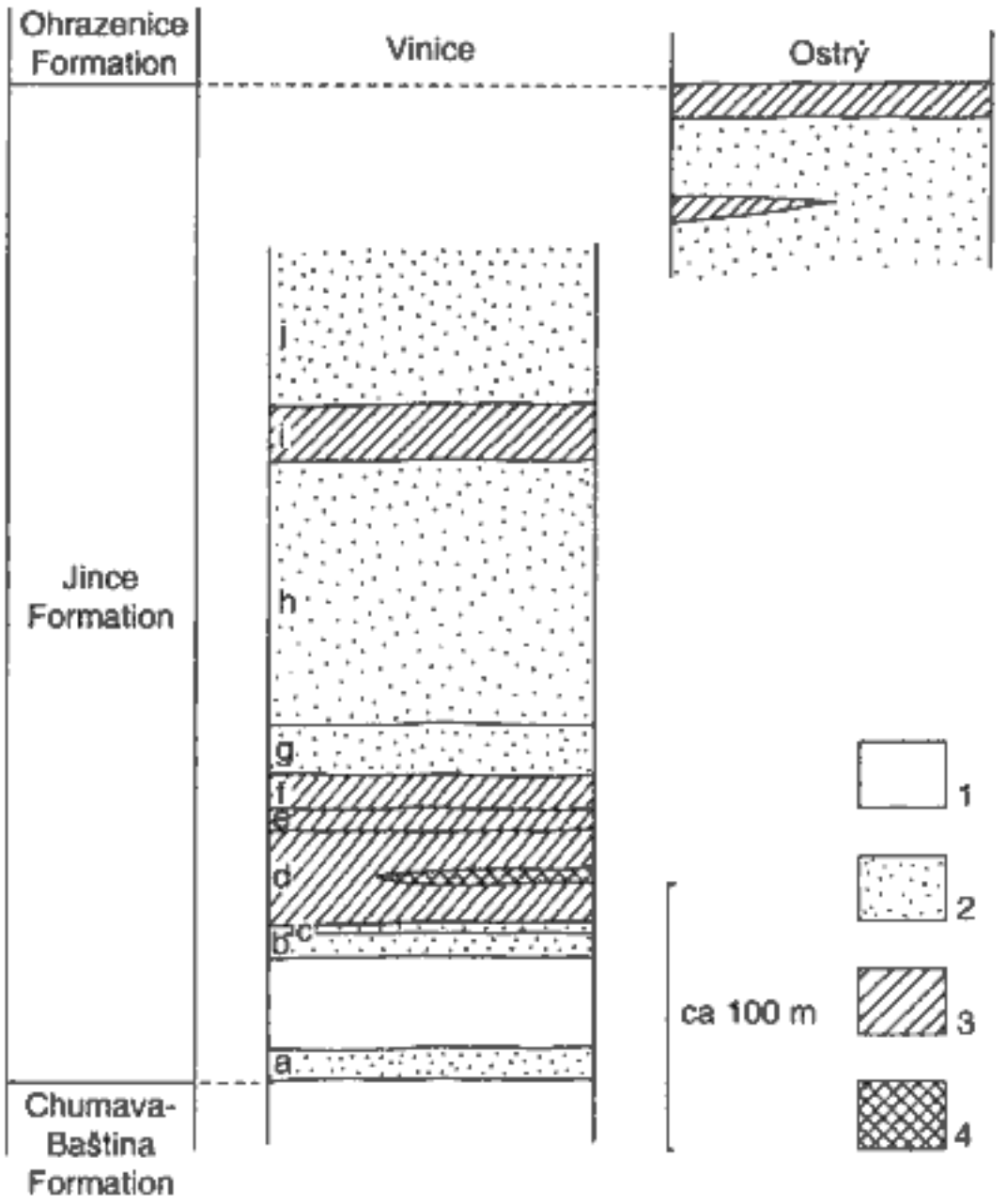
In the Central Bohemian region, the marine transgression in the beginning of the Middle Cambrian enabled a development of simple, later even highly diversified benthic assemblages demonstrated by the ichnofossils. Regression of the sea at the end of the Middle Cambrian led to a decrease of the diversity again. The deepest part of the Middle Cambrian sea in the region is characterised by the *Cruziana* Ichnofacies; margins of the sea fall to the *Skolithos* Ichnofacies. This ichnofacies is limited to the earliest and the latest period of the sedimentation in the central part of the basin (e.g., Vinice and Vystrkov localities) or, near the geographical margin of the transgression, all the preserved sequence is characterised by the *Skolithos* assemblages (e.g., Medový Újezd).

7. Intensity of bioturbation

Measurement of intensity of bioturbation was introduced by works of REINECK (1967) and later in numerous papers by BOTTJER and DROSER (e.g., 1991). The above-mentioned authors proposed to use the semiquantitatively based *ichnofabric index*. The attitude of TAYLOR and GOLDRING (1993) is slightly different: they proposed a descriptive *bioturbation index*. Regardless the published exception taken to these indices, there are indisputable profits from it: 1) the indices enable us to describe objectively a degree of visible bioturbation of a certain rock, regardless other interpretations, and 2) the indices put altogether taxonomically determinable traces and morphologically poorly defined bioturbate textures (here in Pl. I, fig. 1; Pl. III, fig. 7; Pl. VII, fig. 1; Pl. XVII, figs. 1–8). I used the ichnofabric index as a supplementary criterion in the study of the ichnoassemblages of the Central Bohemian Early Ordovician (MIKULÁŠ 1994c).

I have attempted to describe the intensity of bioturbation through over the thickness of the Jince Formation. However, it was not fully possible because (1) great thickness of the formation in the area of its optimum development, i.e. several hundred of metres, and (2) the lack of suitable exposures. The best outcrops are at the Vinice locality but even there they do not yield a complete profile; moreover, detailed study in decimetre to centimetre scale of all the profile would require (because of the hardness of the rock and the necessity of making new trenches and pits) many years of the field work. Therefore, I attempted to characterise generally the ten layers only as distinguished in the description of the Vinice locality. Uppermost layers of the Jince Formation, ill-exposed at Vinice at present, have been evaluated in the near Ostrý locality where they are exposed in nice natural outcrops.

Moreover, in the monotonous siltstones and greywackes of the Jince Formation, the bioturbation is mostly invisible, although the bioturbated laminae of material different in colour (e.g., carbonatic sandstone) point to the presence of "hidden" bioturbate textures also in these rocks. Therefore, I attempted to evaluate only those sections of the profile



10. Intensity of bioturbation in the profiles at Vinice and Ostrý in the Jince Formation (ichnofabric indices). 1 – i.i = 1; 2 – i.i. = 2; 3 – i.i. = 3; 4 – i.i. = 4. Layers a–j correspond to the designation of individual layers as used in the description of the Vinice locality (see Chapter 4.1).

where the rock composition enables to visualise the bioturbation (e.g., vicinity of lenses and laminae contrasting in colour, and other lithological boundaries). This, of course, is joint with the risk that the change of the sedimentation changed the benthic assemblage producing the traces.

However, the picture of intensity of bioturbation given in this way (Fig. 10) corresponds well with the concept of a single transgressive-regressive cycle represented by the Jince Formation (FATKA 1987). Maximum intensity of the infaunal activity falls to the upper part of the *E. pusillus* Zone and to the lower part of the zone *P. gracilis*. Sparse or none bioturbation was observed in the lower layers of the formation. In the final phase of marine sedimentation in the central part of the Příbram-Jince Basin, simple assemblages persisted showing high density of tracemakers; it disappeared abruptly when the first conglomerate layer of the Ohrazenice Formation appeared.

8. Conclusions

The Middle Cambrian sediments in the Barrandian area are well-known for its unique "*Paradoxides* fauna". The systematic evaluation of its trace fossils show, that the fauna (probably mostly its non-shelly components) was joined also with some unique behavioural patterns which demonstrate in geological record as new or unusual ichnotaxa