Field trip Barrandian

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FIELD TRIP 'BARRANDIAN'

(selected outcrops of Palaeozoic limestones)

INTRODUCTION

GEOLOGY. The field trip focuses on a small part of the Barrandian Unit (BU) which encompasses the Prague Synform (PS) (customarily but rather inappropriately, also Prague Basin). The rocks of the inner parts of the PS are well exposed in the SW periphery of Prague and adjacent areas in this direction. In terms of large scale structural and regional geology, the PS belongs to Teplá-Barrandian Unit (TBU) (also Bohemicum). The first tectonic deformation was eo-Variscan, starting in the Givetian. This early deformation culminated in the Frasnian and was followed by the maximum structural burial in Famennian – Tournaisian (2.5 – ?5 km or more); with maximum burial temperatures 80 – 110 °C, at faults also ~ 150 °C. The old terrane segments of TBU show an apparent peri-Gondwanan affinity of precursors. However, these segments were incorporated into and amalgamated with other Bohemian Massif precursor structures successively, with continuation until the Viséan – Baskhirian metamorphic and magmatic events. In Moscovian, the surface of the PS was eroded and dissected to a degree that the first post-orogenic siliciclastics deposited. The post-orogenic sedimentary cover has a limited occurrence, particularly when overlying limestones. Besides the Pennsylvanian conglomerates and sandstones, only Cretaceous marlstones and Miocene and Quaternary sands occur. The analyses of this cover, together with fissure infills in limestones, show intermittent evidence of block tectonics over a very long period of time from the Pennsylvanian to Holocene. The origin of palaeokarst features is twofold: firstly, related to several islands/seamounts in Silurian – Devonian oceans, before orogeny began, and secondly, from the Pennsylvanian to Recent, after the deformation events (e.g., Triassic and Cretaceous, but mostly Cenozoic).

LANDFORMS AND LANDSCAPES. The area corresponding to the PS is geographically assigned to the Sub-province of the Berounka Catchment, the Brdy Region, and in detail, belongs to the Třebotov part of the Prague Plateau (NE) but mostly Karlštejn part of the Hořovice Hilly Land (SW). The flat elevated surface of the NNE sector, disappearing in the direction to the SW, represents a peneplain from the Cretaceous period. Relicts of Miocene valleys and depressions with lakes exist but are poorly discernible; the most visible geomorphologies are Pleistocene. The central and SW parts of this area are dominated by SW-NE stretched ridges or cuestas: limestones usually build an elevated ground and argillaceous rocks occur in depressions. These structures are transversely cut by valleys with brooks flowing into the Berounka River Valley. This canyon valley dissects the area roughly in the W – E direction; marked relicts of high river terraces are preserved on the valley edges. The limestone areas of the PS are alternatively referred to as Bohemian Karst (1922), and are subject of natural protection (1972). The subjects of protection are complex calciphilous ecosystems, relict steppe and dealpine floras, oak-hornbeam woodlands, caves and karstic phenomena, stratigraphic objects, palaeontological and archaeological sites, or montanistic and historical/ cultural monuments. In spite of protection measures, there is a lot of influence from industrial (e.g., quarrying), agricultural, traffic and various suburban activities, which allows us to examine a number of interactions at the intersection of natural processes and anthropogenic impacts.

MAGNETIC SUSCEPTIBILITY. The relevant techniques are employed more and more in the Bohemian Karst, e.g., for various projects in the fields of stratigraphy, palaeoclimate analysis, structural geology, and environmental management. The first two disciplines are the most relevant to the principal aims of the IGCP-580 project.

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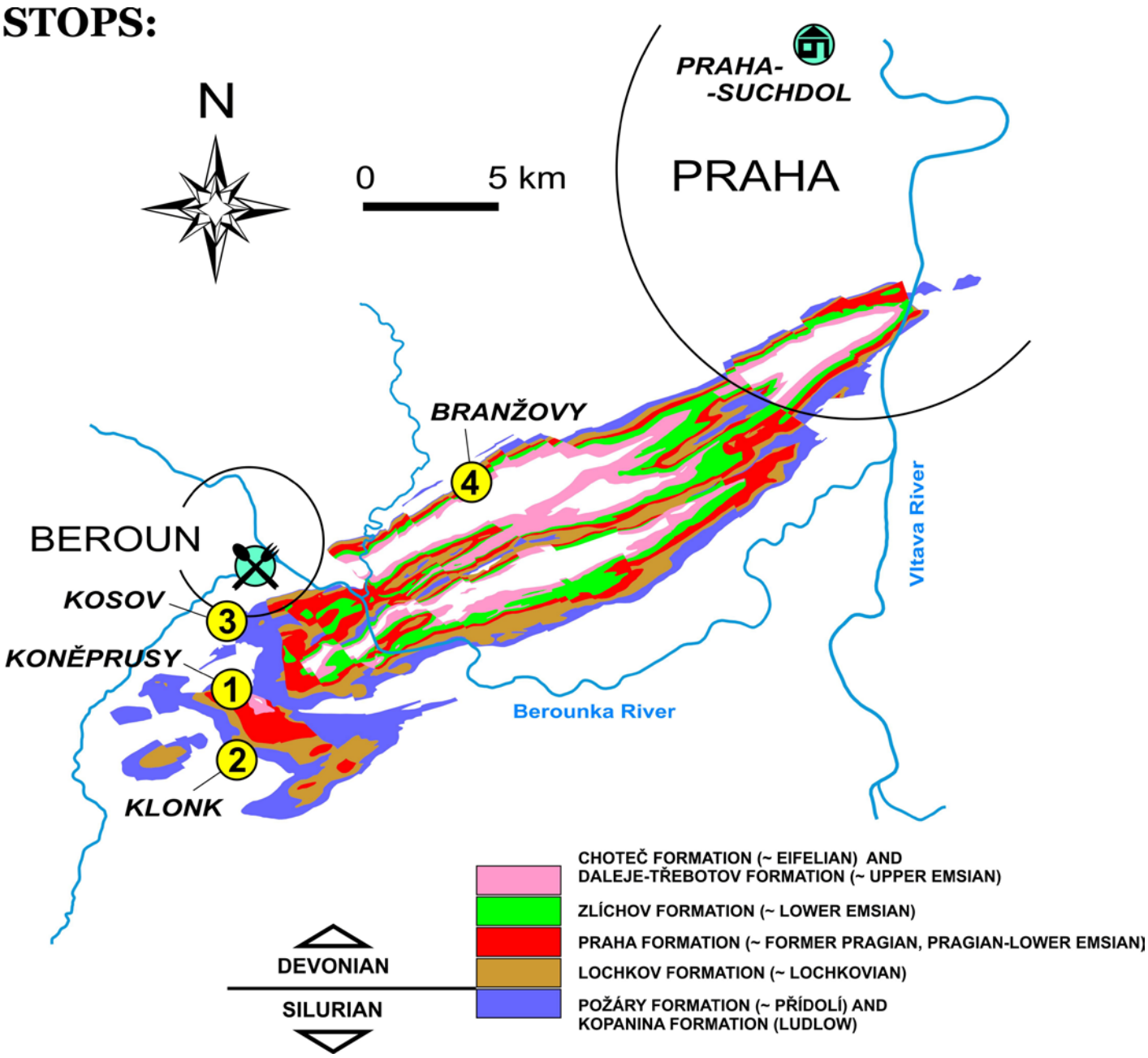
STOPS:



FIRST STOP – KONĚPRUSY

LOCATION. 49 54 50 N, 14 04 32 E (road junction at the upper entrance to quarried area).

STRATIGRAPHIC UNITS. Lochkov Formation (Kotýs Limestone), Praha Formation (Vinařice and Koněprusy Lst.), Daleje-Třebotov Formation (Suchomasty Lst.), Choteč Formation (Acanthopyge Lst.); underlying Požáry, Kopanina and Liteň formations. and overlying Srbsko Formation are nearby.

AGE. Lochkovian to Eifelian; and closely adjacent parts of Wenlock – Přídolí and Givetian ages.

SEDIMENTARY FACIES AND DIAGENESIS. The late Lochkovian dextral transpression zone (striking WSW – ENE, forming meso- and mega-scale Riedel shear faults) pushed up the blocks of Kotýs Lst. (calciturbidites of a moderately deep plateau), forming a linear submarine elevation rising sharply above the surrounding sea floor. The tilted topmost parts of towering blocks reached sea level during the low-stand episodes, as evidenced by their truncated, mesa-shaped tops. After a period of low accumulation rate and hiatuses, the linear elevation was capped by skeletal limestones: starting with crinoid-bryozoan facies with brachiopods, first on the flanks and then also on the summits. The major volume of whitish Koněprusy limestone deposited in the middle of the 'Praha Fm.' time span. The limestones on slopes have often pink colours and some of them are also blackish, due to interactions with seeping formation water and hydrothermal vents. Reefs, capping this elevation and containing also colonial rugose corals, stromatoporoids and algae, are of lesser thickness than underlying skeletal accumulations. The upper part of the Praha Fm. and entire Zlíchov Fm. are missing here: a ~ 7myr long hiatus encompasses much of the equivalent time. The prominent falling stage system tract, ending the Praha Fm. on the ridge, is marked by karstic phenomena, terraces, boulders, pebbles and oncoids. The first transgressive system tract, after the hiatus, contains the oceanward dipping, slope-to-outer ramp clinoforms (also stromatactis-containing skeletal lobes). This transgression roughly corresponds to the base of the Daleje-Třebotov Fm. – from the *nothoperbonus* Zone, but showing gradual onlaps of beds onto topographically higher areas; i.e. younger Emsian ages mark the drowning of these highs. The Eifelian Choteč Fm. is represented here by crinoidal Acanthopyge Lst. with three levels of coral – stromatoporoid faunas; these, together with conodonts and dacyoconarids, are indicative of open-sea platform edges and oceanward exposed slope. Note that practically all the stratigraphic members of the Koněprusy Devonian show different facies, and have also different names compared to those which are used for the other structural belts in the PS. This is due to great effects of such ocean-ridge barriers on separation of the inner basins, which were, most likely, almost encircled by islands, and seafloor was there never deeper than several hundreds of metres. Before the Kacak Event, the area was tectonically bulged (paleosols and karst cavities). However, this area was flooded again, just before the Eifelian/Givetian boundary (blackish styliolinid limestones with conodonts and fragments of drowned land flora). These were overlaid by channelized breccia flows, giving us information about small Early Givetian reefs and slopes dissected by downslope directed channels. The last sediments were sporadically preserved clays, connected with sediment-starved deepwater conditions, and rapidly accumulated argillaceous flyschoid successions of Givetian age.

DEFORMATION. All these Devonian structures were changed by early Variscan deformation, when the Očkov Thrust Fault with its overriding mass pushed the Lochkovian core of this linear elevation above the Pragian slope sediments to the south. A series of subvertical and north-dipping faults cuts the old contacts between the Lochkov Limestone and Koněprusy Limestone fills. The eo-Variscan thin-skinned structural style was found also in the direction to the S, reducing tectonically the former distances of facies (Bacín, Šámor – Vysoká skála hills/cuestas); this faulting and folding is parallel with the Borek Thrust Fault S of the Koněprusy area. Faults in weakened parts of allochthonous rigid limestones were also rejuvenated during the post-Palaeozoic and even geologically very recent times.

MS CHARACTERISTICS. Two data sets were obtained on the sites with early deposited middle-slope Koněprusy facies No. 3 (the facies with infrequent stromatactis containing pinkish-coloured geopetal infills). These sites are in the Quarry West and Quarry East. The mean MS values are -3.82 and -3.45 [10^{-9}, m^3/kg] and standard deviation 1σ = 0.21 and 0.79, respectively. Hence, the trends on this southern slope are interesting: 'no increase in mean MS values, at least for the first hundreds of meters of the depth, only moderately increased spread of the data was found'. This finding corroborates the earlier conclusions based on the isotope compositions of brachiopod shells as well as according to the coral – reef analysis: 'this slope was exposed to a huge and deep ocean'.

OTHER FEATURES TO OBSERVE. **Neptunian dykes**. The well-cemented skeletal accumulations of the Praha Fm. (buildups, reef, talus, fore-reef, drowned-terrace facies, etc.) were resting on relatively 'plastic' basement, where clayey-argillaceous rocks of Silurian and older ages were compacted. The rigid carbonate body of the Koněprusy Lst. was, therefore, subjected to tensional forces, and crevasses originated like in a glacier; it was as early as during the Early and Middle Devonian. This situation was particularly relevant to the major hiatus between the uppermost regressive system tract of the Koněprusy Lst. and transgressive system tract of the Suchomasty Lst., when, particularly before and after this hiatus, swarms of these fissures/crevasses were filled by the latest Koněprusy Lst., and then again by the first Suchomasty Lst. (and then also by the first Acanthopyge Lst.). The opening/infilling of these structures was, however, typically polyphase and very complex process; the formation of various granular or soft-flocculated sedimentary infills was closely combined with bacterially mediated precipitation of marine cements on the walls, gravitationally and driven brecciation, etc. Other structures, drilled and sampled by numerous boreholes, even resemble chasms and blue-holes. Some fills are rich in shells of hyoliths or other organisms living in darkness of deep-seated marine caves. Many neptunian dykes are striking W – E or WSW – NEN, but some follows sub-perpendicular or irregularly shaped wrench-fault systems. The major karstification episodes reflect the emergence of islands during the major hiatus. Another one, connected rather with tectonic bulging of this area than gravitational extension, developed concurrently with the early Kačák sea level lowering and the holes of that age were filled until the Early Givetian; some of the holes and leaks in limestones were also re-opened and injected by argillaceous flyschoid rocks. It is worthy of note that these neptunian dykes were often combined with hydrothermal venting or leakage of deep formation waters. A few of them developed at intersections with halocline caves or other types of deeper-seated solution holes. **Bitumens**. Dark-coloured, solid bitumens and waxy or semi-liquid to liquid residual oils were precipitated from ascending condensates; most of them are blackish or coloured in darker/lighter shades of brown, orange and green. They belong to many phases of organic matter maturation and migration, as the Lower

Palaeozoic source rocks were (and even are) almost continuously seated around 'the oil window'. The nests and inclusions are of pre-orogenic, but mainly of early post-orogenic ages. Live (gas saturated) oil occurs with rising distance from the faulted zone. Some hydrated liquid varieties contain light aliphatic fractions, showing various cerulean or pale opalescent shades; their origin is still subject to speculation, as they occur in the old (Carboniferous – Permian), but also very young (Cenozoic) aggregates of calcite crystals.

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SECOND STOP – KLONK

LOCATION. 49 54 02 N, 14 03 44 E (middle parts of the natural escarpment).

STRATIGRAPHIC UNITS. Požáry Formation and Lochkov Formation. The Požáry/Lochkov formation boundary is either seen as equal to the S/D GSSP level in very detail, or lithologically traced in the close stratigraphical neighbourhood. The Kopanina Formation is mostly covered by scree in the lower part of the slope.

AGE. Ludlow – Lochkovian, S/D boundary.

SEDIMENTARY FACIES AND DIAGENESIS. The sedimentation of the Přídolí – Lochkovian limestones at Klonk was controlled by factors which are at least threefold: 1) deposition of distal calciturbidites, 2) fluctuating activity of currents flowing transversely to gravitational flows ('contour currents' with erosion-corrosion and/or sediment-drift effects on the seafloor), and, mainly in lower parts of the Klonk section and during relatively calm periods, 3) slow accumulation of pelagic/hemipelagic sediment fed by particles 'raining' from a very high water column. Particularly the lower parts of Lochkovian show numerous examples of alternation between 'scyphocrinitid' and 'graptoloid' conditions, which may also mean a sort of difference between calcite sediments in relatively cold water conditions and aragonite ones with warmer situations. A lot of fauna was not truly benthic but originated from floating 'algal carpets' and 'aureoles around floating crinoids'. The near absence of any trace fossils is a typical feature for the Klonk conditions, with few exceptions: e.g. for *Zoophycos* from the bed 21. The earliest diagenetic processes are recorded by blocky calcite in skeletal tissues of crinoids, syntaxial rims, alteration zones and thin micrite coatings on hardgrounds, micropeloids formed close below the sediment surface, fibral rims in chambers of cephalopod-shell, etc. The processes of dissolution – cementation, exchange between the medium-purity and clayey beds, started very early. It is evidenced by nodules with original micro-stratification which occur in clayey (shaly) intervals (e.g., 4/5 according to numbering of the beds): compaction caused shortening of vertical dimensions to 1/6 – 1/8 or even more. The seafloor, after the deposition of drifted or calciturbiditic sedimentary material, was often sedimentary starving: firmgrounds and hardgrounds are common. The semi-lithified and lithified beds show plastic and rupture deformation features, respectively, related to creep and sliding on gently inclined slope. Dilated ruptures in some of the beds were filled by sediment from above, but the composition of the sediment trapped in fissures differs from both the host bed and immediately overlying bed. The network of tight and open ruptures is gradually missing towards the underlying and overlying, strongly compacted 'inter-beds', being indicative of their protracted 'plastic' behaviour. A more systematic re-crystallization started with sediment burial depths of several meters; fine-crystalline calcite (1 – 10μm) and dolomite (3 – 15μm) structures were produced. The calcite structures were often connected with high or low c-axis oriented normal or slightly oblique to plains of stratification. Dolomite was formed mainly in rocks with bioclasts. The formation of bedding-parallel stylolites increased with sediment burial of several tens of metres; larger skeletal fragments are often rimmed by solution sutures. Unstable siliceous silt was close to its definitive decay and dissolution. Authigenic albite and large-sized dolomite rhombohedra attracted the produced surplus of sodium and magnesium. Mutually compared successions of former carbonate crystals (ghost structures, growth substitutions, structures

related to changes of skeletal objects, etc.) suggest an already advanced re-distribution of silica and phosphates. Sponge spicules were dissolved and replaced by calcite, and many conodonts were almost dephosphatized. These processes continued until the load of several hundreds of meters was achieved, that means a continuation till the Givetian times. Concurrently, some enrichment in potassium is possible: proportions of main non-carbonate minerals are illite >> quartz > kaolinite. The next chapter in the diagenetic history of Klonk is marked by a change from the prograde to degrading re-crystallization, locally also with dedolomitization. The sub-vertical tectonic stylolites were rarely formed, only some parts of solid beds, while the 'shaly inter-beds' yielded to slip, so that bedding-parallel faults were formed and strain was significantly released. The occurrence of these faults is, besides sedimentary and diagenetic phenomena, also one of the reasons why some beds are missing laterally. In this stage, the burial depth was much exceeding the true 1km thickness of accumulated rock, and, thus, must be explained as a structural burial. Organic matter was in advanced stage of degradation and light fractions were escaping from the deeply buried formations up (with and just after the maximum thermal stress of ~ 110 °C). The subsequent fracturing of rocks is ascribed to regional Variscan – post-Variscan tectonic shear episodes; the temperatures decreased at least two times. Flat individuals of smoky quartz with petroleum inclusions originated in strike-slip faults. The formation of 'grape-shaped aggregates' is even younger. These aggregates are dominated by brownish chalcedony quartz (brownish due to dispersed bitumens), dolomite and iron oxides. Conodonts and skeletal fragments were strongly damaged on the periphery of these 'grapes'. The youngest, up to Pleistocene ages are assumed for star-shaped calcite aggregates (sized 30 μm – 2 mm) typical for the secondarily 'sharpened' contacts between the rigid beds and shaly inter-beds. These neomorphic structures occur in zones of weathering, are common in the Klonk outcrop but were not found in the drilled core of the Klonk-1 borehole.

DEFORMATION. With exception of the above mentioned bedding-parallel faults and slips, the outcrop shows a relatively undeformed block, without recumbent folds, etc. It is partly caused by the position on the S of a large syncline/synform with N-dipping axial plane and partly it only a case of an opportune geological block arrangement. The successions of deformations have been summarized together with characteristics of early and late diagenesis (see chapter above). Concerning the plastic deformation of fossils, there are two remarkable features: in vertical section, upper side to the SSE, but in horizontal section, prevalence of dextral shear.

MS CHARACTERISTICS. Several sets of MS data are available: they originated from sampling and measurement based on the samples from outcrop, different campaigns coordinated by F. Hrouda, J. Hladil, and B.B. Ellwood and the data have been published or at least referred to in these publications. The best data were measured using the rock core from the borehole Klonk-1, which was drilled in March 1999. These data are characterized by mean MS values of 18.75 and standard deviation $1\sigma = 8.52$ [10^{-9}, m^3/kg]. Six MS zones (MSZs) in the upper Ludlow - lowermost Lochkovian interval were formally defined and named in 2001: Háj, Telín, Občina, Tmaň, Klonk, and Voskop, each containing detailed subdivision to subzones.

OTHER FEATURES TO OBSERVE. There are many interesting aspects of the Klonk studies which are worthy of mentioning. Two examples only: Inclination of the seafloor was calculated according to unrotated geopetal fills, showing to about 3 degree slopes inclined to the S. The first occurrence of *Monograptus uniformis* at the GSSP boundary in the bed 20 coincided with remarkable change in bottom current

patterns; an abrupt onset of this graptoloid was possibly caused by a new, suddenly appearing ocean current that was coming to Klonk from the SW.

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THIRD STOP – KOSOV

LOCATION. 49 56 17 N, 14 03 08 E (the lowermost level of an abandoned quarry, with lake).

STRATIGRAPHIC UNITS. Liteň, Kopanina and Požáry fms.

AGE. Wenlock, Ludlow and Přídolí series/epochs (Silurian).

SEDIMENTARY FACIES AND DIAGENESIS. The allochthonous upper parts of the Prague Synform (PS), in contrast to tectonically underlying parallochthonous ones, are characterized by the presence of limestone development that started quite early, in the upper Wenlock (Homerian) stratigraphic levels. The Kosov Quarry is an outstanding outcrop related to the allochthonous parts showing the relatively shallower settings. The sea floor topography of these Silurian times was very complex. The fine-grained pelitic and micritic facies were deposited in the oceanic seas with depths that were not exceeding several hundreds of metres, and were often ascending to plateaus as high as at about 150m water depths. Numerous basalt intrusions formed the basalt sills in pelitic rock, but also submarine effusions with downslope-spreading flows of granulates and basalt blocks are characteristic for the Wenlock times; the latter in upper parts of the Liteň Formation. The domes above hypabyssal basalts and seamounts formed by erupted basalts often reached the sea level as evidenced by carbonate sediments and faunas. Locally, also pillow lavas were found. The carbonate microfacies are greatly diversified due to wild relief and many ecologically specific habitats; also 'zebra' limestones or brachiopod coquinas can be found, and various rocks with breccias and pebbles are common. The carbonate sediments of Ludlow show also this differentiation into more massive but complex structured buildups and well-stratified sedimentary infills of depressions in the relief of the seafloor. The most noticeable change is the truncation of limestone accumulation at the top of the Kopanina Fm. (Ludlow) when a flat or relatively less undulated surface of slopes and deep ramps was constituted. Therefore, the base of the Požáry Fm. (Přídolí) with widespread laterally continuous beds of tempestites - calciturbidites is a remarkable sequence boundary in this sector of the PS.

DEFORMATION. A lot of deformation reflects the intrusions of basalts, as well as differences in compaction and deformation mechanisms in the gravitationally driven structures. However, recumbent folds and thrusts corresponding to eo-Variscan tectonic deformation were also found on several places. Of course, the deformation domains often reflect the material heterogeneity and rotating directions of maximum stress.

MS CHARACTERISTICS. Most recently, the basalt sills and effusions are studied by means of rock magnetism techniques. The results are expected in the field of petrology, alteration history, and also as concerns the inner fabrics of the individual basalt formations. The palaeomagnetic studies have been focused on the contact zones around the sills. MS stratigraphic studies are possible, but there is a lack of long sections without complications arising from sedimentary structures, deformation and hydrothermal alterations. However, there are good perspectives for the development of microstratigraphic MS methods with implications for detailed knowledge about climatic regimes (laminated sedimentary rocks of Liteň Fm.).

OTHER FEATURES TO OBSERVE. Interesting objects of studies are the huge nodules occurring in the Liteň Fm., which have shape and size of rugby ball or loaf of bread. They preserve the original stratification and show, at least to certain degree, the differences between the original and compacted sedimentary rocks. Other attractive objects are also fragmented lavas with carbonate cements and/or lava bombs and boulders with cracks and channels after degassing.

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FOURTH STOP – BRANŽOVY

LOCATION. 49 59 10 N, 14 10 46 E (entrance to quarried area).

STRATIGRAPHIC UNITS. Lochkov, Praha and Zlíchov fms. .

AGE. Late Lochkovian – early/middle parts of Emsian.

SEDIMENTARY FACIES AND DIAGENESIS. The active quarry Na Branžovech belongs to a belt of outcrops which lies in the NNW limb of the PS. The length of this narrow, structurally limited belt is at least 20 km, connecting the quarries Na Chlumu, Stydlé vody (WSW) and Na Požárech (ENE). The linearly arranged outcrops show a considerably regular vertical succession of the upper Lochkovian to lower 'Zlíchovian' facies/members. These are, ordered from old to young ones, as follows: Kotýs, '?Koněprusy', Slivenec, Loděnice, Řeporyje, Dvorce-Prokop and Zlíchov limestones. There are at least two prominent features relevant for palaeogeographic and stratigraphic purposes. Firstly, the base of Zlíchov Lst. lacks thick channelized breccia flow deposits, and secondly, the upper part of the Dvorce-Prokop Lst. is separated by the 0.5 - 1m thick 'Graptolite Event' interval which consists of dark grey coloured, limestone 'beds' (7 to 8) interleaved by only slightly carbonated black shale inter-beds. If we consider the generally accepted, prevailing gravitational transport directions (and average sloping) to the SE (for upper parts of the Lochkov Fm. - uppermost parts of the Praha Fm.), it must indicate a considerable tectonic shortening, because the turbidite fans lack their directional continuations. Moreover, the consequences of hypothetical stop barriers have not been observed yet. They possibly existed, according to facies in the parallel belts of outcrops further to the SSE, but the original distance to them was much longer than today. The N rock faces of Branžovy outcrops show large surfaces of upper Lochkovian beds. These beds show a broadly spreading character of deep water calciturbidite fans. Deep water, however, means only a few hundreds of meters in this context, not more, because prevailing facies corresponds to definition of Kotýs Lst.: it means limestones with reduced occurrence of shales and/or cherts. The deposition of equivalents to Koněprusy Lst., and also Slivenec Lst., was interrupted by hiatuses and their surface was deeply truncated forming considerably furrowed relief. The crevasses and holes were often filled by rich and diversified skeletal accumulations (gastropods, trilobites, brachiopods, etc.). This relief was filled and evened out mainly during Slivenec/Loděnice times. Loděnice Lst. contains mud-mounds formed due to hydrothermal vents and bacterially mediated precipitation of carbonates. These mounds yield remarkable accumulations of large trilobites grazing possibly the bacterial mats or other biofouling formations. The vents-inhabiting rugose corals and ostracods resembling those of the Moroccan mounds are present (B. Berkowski). The succession of uppermost Loděnice, Řeporyje and Dvorce-Prokop limestones is of extraordinary stratigraphic importance. The 'tentaculitoid' facies of wackestones/packstones prevail and provide interesting conodont and also dacryoconarid faunulae, as partly already published. This succession shows gradual deepening, because many of these beds are undoubtedly calciturbidites. The same conclusions were made also according to faunas, e.g., cephalopods. The rutoceratoids together with some other nautiloid taxa are restricted to 'Prague basins' and this restriction is explained by existence of oceanic barriers around this area, in agreement with many previous results obtained using, e.g., the data on facies, corals and isotope compositions of limestones. The degree of diagenetic changes corresponds to localized effects of circulating

fluids on the stability of rock structures and compositions; Slivenec Lst. contains a great number of re-crystallized zones and also vugs and other corrosion holes with polyphase infills and cements.

DEFORMATION. The structures are significantly affected by post-orogenic faulting, complex block structures developed (due to rheology and older weak zones) particularly at the E end of the quarried area and then on the W between Branžovy and Záloženský quarries. Sub-vertical tectonic stylolites are relatively common in Řeporyje, Dvorce-Prokop, and even in Zlíchov lsts.

MS CHARACTERISTICS. The previous measurements related to palaeomagnetic studies are indicative of mean MS values of about of 5.86, standard deviation $1\sigma = 0.83$ [10^{-9}, m^3/kg]. The detailed sampling in the upper parts of the Praha Fm. is scheduled for working days of this conference. It may significantly contribute to improvements of 'Graptolite Event' position, as well as potential event levels lithologically indicated below. There is an advantage of detailed data on conodonts (links to biostratigraphy).

OTHER FEATURES TO OBSERVE. Miscellanea: The trilobite faunas with large ?*Paralejurus*, *Odontochile* and phacopid trilobites can be found in Slivenec, Dvorce-Prokop and Zlíchov lsts., respectively. Smaller trilobite *Reedops decorus* is abundant in the latter limestone. The upper Lochkovian limestones provided also ophiocistioids (mainly isolated goniodonts, e.g. *Branzoviella talpa*). Deep weathering affected the Zlíchov Lst. on several places along the S edge ('white beds', ?Cretaceous and Miocene). Optionally, various karst infills are also available for studies about their age determination.

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