## Lochkovian – Pragian boundary in the Prague Synform: lithological, mineralogical, geophysical and geochemical aspects as results of sea-level fall

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The studied section Požár 3 is part of an active quarry located in the NW limb of the Prague Synform and the SW periphery of the capital Prague. It comprises an uninterrupted, 126 m thick succession from the lowermost Lochkovian to the Zlichovian (Lochkov Formation, Praha Formation and Zlíchov Formation). Here we report on the results of analyses from the Lochkovian – Pragian subsequences approximately between the 60 and 90-meter marks (arbitrarily selected).
The upper part of the Lochkovian succession (Lochkov Formation) consists of quasi-cyclic alternation of dark and medium grey sets of calciturbidites with weak shaly intercalations. Distal calcisiltites to fine-grained skeletal grainstones occur, with the latter sediment type prevailing. Well-preserved or resedimented hemipelagic material is less abundant, although the pelagic fauna is not rare. The depositional environment corresponds to lower and middle parts of slope. The proportion of fresh and altered skeletal particles is equal as well as the proportion between cements and dissolution-seam residues. Grain-size distributions are unimodal to slightly bimodal. Fragments of crinoid stems and ossicles are most abundant and accompanied frequently by ostracods, sponge spicules and trilobites. Brachiopod shell fragments, dispersed microfragments of bryozoan and coral skeletons are also present. Toward the Pragian boundary (Praha Formation) the colour of rocks becomes increasingly lighter. Additionally, the amount of tentaculitoids is increased, although the last 5 m interval is significantly enriched in sponge spicules. The Lochkovian – Pragian boundary is defined here in accordance with FOD of the conodont taxon *Icriodus steinachensis* beta (SLAVÍK *et al.* 2007). The lowest part of the Pragian succession is represented by light grey (or pinkish), bioclastic limestones of unimodal grain-size distribution. Altered large crinoidal grains dominate and the proportion of calcite cement reaches maximum values (up to 1/3 of rock volume). Beds immediately above show increased grain-sizes, which corresponds to the globally recognised sea-level fall identified as the base of the classical Pragian (e.g. WALLISER 1996). The grain-size distributions are up to tetramodal (from mud to sand/gravel grain size). Skeletal fragments are mainly well preserved and the amount of cement is diminished.
The Lochkovian – Pragian boundary interval is recorded and well-recognized by both detailed laboratory magnetic susceptibility (MS) measurements of rock samples (with the step of 10 for the Lochkovian succession and 5 cm for the Pragian succession) and gamma-ray spectrometry (GRS) outcrop logging (with the interval of 0.5 m for the Lochkovian and 0.25 m for the Pragian). A very fast rise of MS values appears very close above the base of the Pragian beds which exactly corresponds to the biostratigraphical boundary (Fig. 1). Elevated MS values with high-amplitude oscillations continue through the entire Pragian here. The GRS logs provide evidence of a significant change in Th/U ratio (Fig. 1). The entire Lochkovian GRS log is driven by dominant concentrations of uranium (GRS Th/U 0.45) whereas in the entire Pragian Th/U ratio values are elevated (Th/U 2.78). For the studied upper part of the Lochkovian sequence (60.0 to 77.6 m) values are equal to 0.39, and for the lowest Pragian (77.7 to 90.0 m) values are 2.11. The K concentrations rise from 0.33 (within the Lochkovian) to 0.86 at the base of the Pragian. Concentrations of lithophile elements also follow this trend and increase above the Lochkovian – Pragian boundary for about 2-3 times. This suggests that the proportions of fine non-carbonate admixtures scattered in the Pragian carbonates are considerably increased. This is explained by elevated background sedimentation mechanisms and weathering product recycling.
40-element instrumental neutron activation analyses (INAA) were used in the entire Požár 3 section (35 analysed points). The averages related to the upper Lochkovian and lowermost Pragian parts, 60.0 - 77.6 and 77.7 - 90.0 m are based on 10 analyses (5 each). The PAAS and Lu

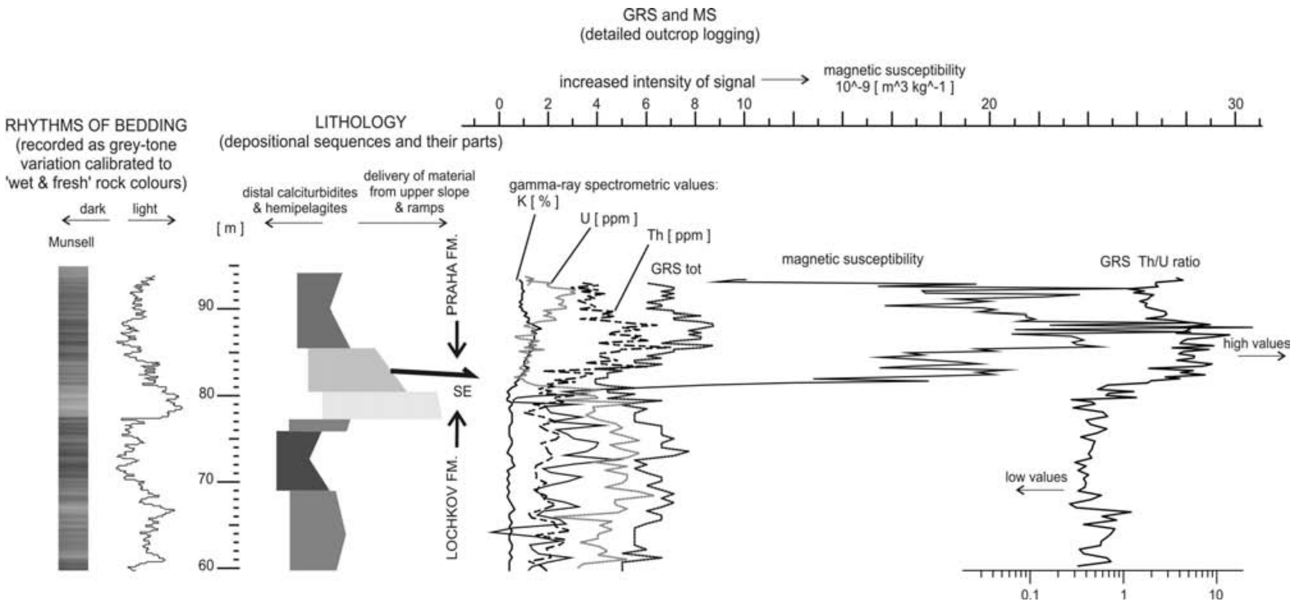


Fig. 1: GRS and MS data across the Lochkovian – Pragian boundary.

normalized REE distributions were used to identify the possible sources of the impurities (based on flux estimates made by NOZAKI 2001). The REE distribution and patterns are most comparable to originally eolian sources of impurity and input to the sea water in the Lochkovian (with slight shifts due to remineralization processes – LREE up and precipitation of sea water solutes – Ce down, HREE up). The major change in this studied section is located at the Lochkovian – Pragian boundary interval where the remineralization pattern becomes more visible and soon dominates, although the generally high correlation coefficients for the eolian source are still present (0.64-0.89). The riverine and sea-water-solute sources show a slight to negative correlation with REE compositions of the Pragian limestone impurities. The riverine signatures are almost absent in this section. Two gradients are characteristic for the Lochkovian – Pragian boundary change: enhancement of LREE/HREE and rise of total REE concentrations. The K/Al ratio stays more or less constant but with slightly descending tendency (from 0.58 to 0.54). Also the Ti/Al ratio is very uniform (change from 0.08 to 0.06). The slight dropping of K/Al balances the fading detrital feldspar delivery (and partly authigenic microcline and kaolinite) and rising K concentrations from distal and remineralized chemical weathering products. The Ti/Al ratio has a tendency to decrease since the Silurian with waning stages of volcanism.

Few detrital grains from insoluble residues were obtained by fast dissolution of samples in hydrochloric acid. The samples cover places with the MS maxima, minima and medium-values. The light and heavy fractions (boundary at 2.83 g/cm$^3$) were analyzed separately by EDX, X-ray diffraction and SEM-EMP techniques. The light fractions include ultra-fine, porous structures that consists of crystalline to subcrystalline or amorphous mixtures. These aggregates are usually smaller than 2 µm. Polished surfaces of these aggregates and grains unveiled locally embedded larger particles and also euhedral and corroded grains of diamagnetic, paramagnetic, and rarely also ferromagnetic properties (e.g. quartz, K-feldspar, plagioclase, clay minerals, amphibole, pyroxene, muscovite, ilmenite, epidote, chlorite, glauconite, pyrite, pyrrhotite; Fig. 2). Concentration of minerals from finely crushed whole-rock samples (without acids; gravitational, flotation, density and electromagnetic techniques) yielded a lot of material for continued studies in mineralogy and geochemistry of pyrrhotite, iron oxides and oxyhydroxides (often with high content of Ti), olivine, pyrite, ilmenite, chalcopyrite, amphibole, Fe-rich dolomite, rutile and other minerals common in UCC-MCC complexes and basaltic mounds). The Lochkovian limestones differ from the overlying Pragian limestones by higher abundance of pyrrhotite-pyrite whereas the Pragian is characterized by predominace of Fe-oxides and oxyhydroxides. Barite and apatite occur mainly in the Lochkovian and in the levels immediately below the biostratigraphic boundary. In the heaviest fraction (>3.3 g/cm$^3$), the zircones were extracted from several levels both from the Lochkovian and Pragian strata (several hundreds of grains). Zircon populations are studied now, but analyses on their fabrics and elemental/isotope compositions are still in progress (BSE analyses, U-Pb dating, transport mechanisms and possible source areas).

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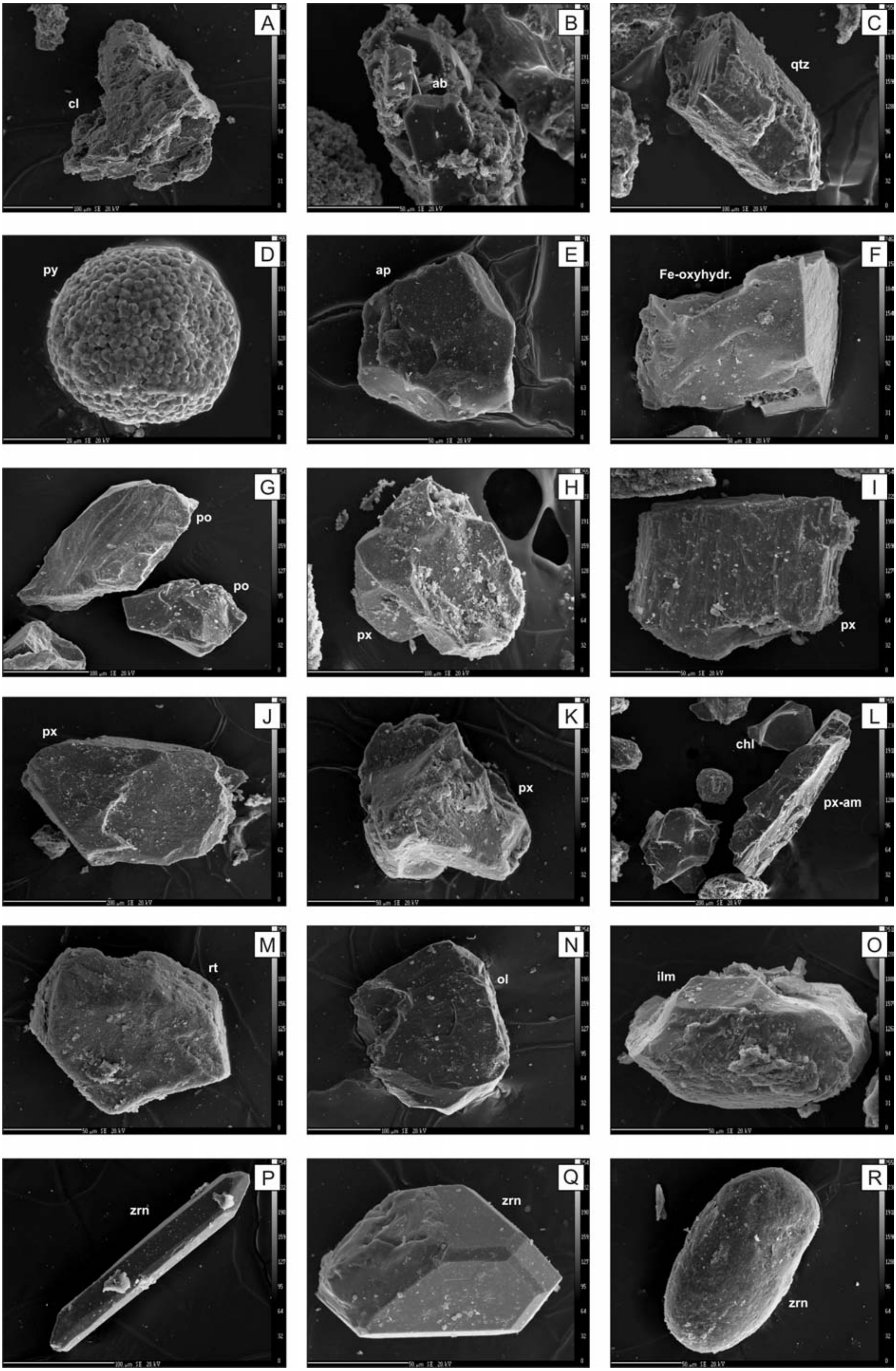
Fig. 2: SEM images of mineral assemblages in insoluble residues from the Požár 3 section.
A-G. minerals of authigenic or possible detrital origin; H-R. grains of pure detrital origin.
A. clay mineral (20.5m); B. albite (31.1m); C. quartz (69m); D. framboidal pyrite (69m); E. apatite (9.7m); F. oxyhydroxide (20.5m); G. ilmenite (98.5m); H. pyroxene (112.7m); I. pyroxene (20.5m); J. pyroxene (20.5m); K. pyroxene (9.7m); L. grain of pyroxene or amphibole composition and chlorite (45.5m); M. rutile (9.7m); N. olivine (54.7m); O. pyrrhotite (79.7m); P. zircone (65m); Q. zircone (98.5m); R. zircone (79.7m).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