Abstract

The composite reference section in the Lower Devonian succession was established using the magnetic susceptibility (MS) and gamma-ray spectrometric (GRS) logs from 5 sections representing both deep- and shallow-water environment of carbonate slope systems in the Prague Synform. Both background data and data across the boundaries of geological units or event intervals were acquired with the emphasis on obtaining continuous data series. Such a complex, detailed and multidisciplinary data set (petrophysical, lithological, mineralogical and geochemical parameters) has never been collected here. They were linked to the existing biostratigraphical scales and offer complex information for interregional and global correlations now with the precision of a few centimetres, which is a resolution 10 to 100 fold higher than in any established biostratigraphic scale in the Devonian of the Prague Synform.

Major changes in the MS, GRS logs and mineralogy concentrate to the proximity of the Lochkovian–Pragian boundary (close to the Lochkov–Praha Fm. boundary). At this level, a reversal point in Th/U ratios is observed (dominant Th concentrations in the Praha Fm. vs. dominant U concentrations in the underlying Lochkov Fm. and overlying Zlíchov Fm. There is a general transgressive trend for the Lochkov and Praha Fm. followed by a significant regression close to the Lochkovian–Pragian boundary. Then 3rd-order transgressive pulse, a drop in sedimentation rate and a decrease in carbonate productivity follow. The position of K, Th, MS maxima and barite enrichment in the Praha Fm. is interpreted here as an increase in the flux of non-carbonate impurities (mostly of paramagnetic character). It might reflect a major change in the atmospheric circulation (changes in wind directions or intensities). A regressive trend toward the Zlíchov Fm. commences in the upper parts of the Praha Fm.

Fe-oxides and oxyhydroxides (magnetite, hematite, goethite), pyrrhotite, ilmenite, pyroxene, amphibole, olivine, chlorite, biotite, glauconite, clay minerals (illite, kaolinite, montmorillonite), ankerite, Fe-rich dolomite, pyrite, chalcopyrite, epidote were identified in insoluble residues as the MS carriers. Quartz, muscovite, dolomite, feldspars (orthoclase, microcline, albite), zircon, barite, apatite, rutile were identified as diamagnetic phases. To sum up, minerals with paramagnetic characteristics were revealed as dominant MS carriers. The Lochkov Fm. (to a certain extent also the Zlíchov Fm.) is characterized by an elevated abundance of pyrite–pyrrhotite assemblages and a low abundance of Fe-oxides (goethite prevailing over hematite or magnetite) whereas the Praha Fm. is dominated by Fe-oxides. Geochemical parameters (mostly the REE and trace elements distributions) show very uniform patterns across the entire reference composite section, and are indicative aeolian origin of the limestone impurities.

The correlative MS and GRS patterns (a point of reversal in the Th/U ratio, a drop in MS values followed by oscillations) through the Emsian–Eifelian successions were found regionally but also on very distant places around the world. Tentative global links of the MS pattern across the Basal Choteč Event interval (BCE) were outlined across different palaeogeographical settings between Portugal (Ossa-Morena Zone), Czech Republic (Prague Synform), USA (Nevada, Central Great Basin), Morocco (Anti-Atlas), Uzbekistan (Zeravshan-Gissar Mountain Region). The BCE interval was interpreted as a transgressive pulse connected with upwelling. Mineral assemblages in insoluble residues might be of aeolian origin. MS record is driven rather by grains of paramagnetic characteristics.