



Structure and Tectonics of the Cheb Basin (NW-Bohemia) from a shallow reflection seismic survey

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In the seismically active region of Northwest Bohemia, we imaged structural characteristics of the Cenozoic Cheb Basin with a shallow 3.5 km reflection seismic survey to find proof of faulting along the Počátky-Plesná shear zone (PPZ). Previously, the shear zone's existence has been inferred from earthquakes that occur in swarms and concentrate in the focal zone of Nový Kostel, below the Cheb Basin, along a plane striking at 170° . The difference in strike between the planar focal zone and the 145° oriented, crustal-scale eastern border fault of the Cheb Basin, which forms the northern termination of the geomorphologically dominant Mariánské Lázně fault, was interpreted to hint to the existence of a second major crustal fault zone. With additional interpretations of river drainage patterns, a distinct 25 m terrain escarpment and the distribution of Quaternary sediments around the Plesná river, the surface outcrop of the PPZ was thought to be found.

A P-velocity model which we obtained from tomographic inversion of the first arrivals revealed an uppermost layer of very slow seismic velocities (about 1 km/s) that varies strongly in thickness. We interpret this layer as unconsolidated Quaternary sediments, which impacted the quality of our recorded shot gathers negatively with increasing thickness of the layer. The result of our standard reflection seismic processing, challenged by strong ground roll, is an image of the eastern Cheb Basin's layers and several tectonic features along a cross-strike profile with varying resolution. Our seismic image shows undisturbed younger sediments of the upper neogene Vildštejn and Cypris Formation, overlying the early miocene Main Coal Seam Formation and a structured basement. The imaged maximum basin depth of 300 m and unconformities below and above the Vildštejn Formation correspond well with lithostratigraphic borehole data and previous sedimentological and tectonic models. We observe reverse faults in the lower part of the Main Coal Seam Formation on top of the basement, which we interpret as signs of a pop-up structure related to the N-S oriented Počátky-Plesná shear zone. Additional draped folds and signs of normal faults inside the Main Coal Seam Formation illustrate the early Miocene east-west directed extensional regime in the area. Sediment layers thicken towards the east, which indicates that synsedimentary extension of the Cheb Basin was accommodated at the basin-bounding Mariánské Lázně fault. We do not observe any vertical fault offsets in the younger sedimentary layers, which suggests that any normal or reverse faulting must be older than 20 Ma. Our explanation for the formation of the escarpment at the eastern bank of the Plesná valley, which has previously been interpreted as outcrop of the PPZ, relies solely on incision of the Plesná river into Quaternary sediments.