Imaging crustal structures in the West Bohemia Seismic Zone, Czech Republic and Germany

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The West Bohemia Seismic Zone is located in the area of the Cheb Basin, Czech Republic at the border with Germany (Central Europe). Historically, West Bohemia and Vogtland are known to be seismically active. In fact, the term *earthquake swarm* was originally coined to describe the West Bohemian seismicity. It is characterized by time periods of intense low-magnitude activity lacking a clear main-shock. At the time of peak activity during a strong swarm, the local broadband seismic network WEBNET can record thousands of earthquakes per hour. Luckily for the local population, the magnitudes are low and seldom felt. However, some swarms seem to correlate with temporary decreased flow at nearby springs, which is especially concerning for the local spa industry.

Though the whole region is seismically active, the main swarm area is located near the village Nový Kostel. The swarms occur near the NW-SE trending Mariánskě Lázně Fault, which borders the eastern end of the Cheb Basin and runs almost perpendicular to the neighboring Eger Rift. The tectonic situation is further complicated by the N-S striking Regensburg-Leipzig-Rostock shear zone. Moreover, the Cheb Basin is dotted with dry gas emission sites (mofettes) and springs. Chemical analysis of the gases emitted at these sites point to their mantle origin. There are several theories to explain the swarm trigger. One of the most prominent hypothesis states that mantle fluids migrate upwards through the crust and accumulate at fluid traps, creating overpressure conditions which eventually trigger the swarms. Testing this theory is just one part of the ongoing ICDP project 'EGER' which is currently targeting this area.

Over the last decades, there have been many varied studies into the causes of the swarm seismicity. However, one key piece of information that is missing is a structural model of the crust around and beneath the West Bohemia Seismic Zone. Past passive and active seismic studies showed the basin crust to be thin, with a lower crust above the Moho that ranges in character from strongly reflective to transparent. In the shallow crust, several highly reflective structures, or Bright Spots, have been imaged at about 7 km depth. Since the reflections correlate with the termination of the shallowest seismicity, the Bright Spots may be fluid traps. However, beyond these Bright Spots and the Moho, little else is known about the crustal structures beneath Nový Kostel and the Cheb Basin.

In this study, we address this problem by using both active seismic and earthquake data to image these and other structures in the crust with the goal of building a structural map of the West Bohemian Seismic Zone. We do this by applying Kirchhoff Pre-Stack Depth Migration and more advanced imaging methods such as Coherency Migration, to image reflective structures in the crust. For example, what was previously imaged as a single Bright Spot is now understood to be composed of several reflective structures. Furthermore, by applying the migrations in three dimensions, we have a better estimate of the strike and dip of these structures. This information can enhance our understanding of the potential relationship between the swarm seismicity and mantle fluids, and the overall tectonic setting in the West Bohemia Seismic Zone.