Geophysical Research Abstracts
Vol. 14, EGU2012-5032, 2012
EGU General Assembly 2012

High resolution geophysics reveal a new Neogene basin southeast of the Leitha Mountains – The Winden Syncline (Burgenland, Austria)

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The Lower Austroalpine of the Leitha Mountains separates the Southern Vienna Basin in the north from the Eisenstadt Basin and the Pannonian Basin in the south. The latter two are separated by the Lower Austroalpine of the Rust Range. The Southern Vienna Basin and Eisenstadt Basin came to exist in the Lower Miocene (Badenian) time whereas the northern part of the Pannonian Basin rapidly sunk down in Upper Miocene (Pannonian) times. Southeast of the crystalline horst of the Leitha Mountains another small crystalline horst remained, 5 by 1 kilometers in size, the Lower Austroalpine Hackelsberg Range. This isolated block is partly overlain and completely surrounded by Neogene deposits. Combined geophysical investigations carried out in 2009 aimed at deciphering the geologic structure below the Winden depression, which extends between the Leitha Mountains and the Hackelsberg Range.

Along a 5,600m northwest-southeast trending profile, ranging from the Leitha Mountains to the Hackelsberg Range and further down to the plain of Lake Fertő, high resolution seismics and electrical resistivity tomography (ERT) measurements were carried out crossing the Winden depression.
The seismic survey was carried out with 576 channels, 10m geophone distance and dynamite source every 100m. Reflection- and refraction processing resulted in a hybrid seismic section down to a depth of about 3,500m. While the reflection seismics reveals strong Variscan to Alpine folding and subsequent faulting of the crystalline basement, the seismic refraction tomography proofs an up-doming of high velocity rock (> 4,000m/s) in the near subsurface. At this location a tectonically fractured slice of crystalline, covered by Permomesozoic rocks, is exposed at the surface (natural heritage “Windener Bärenhöhle”). A basin-like zone of lower velocities (< 2,500m/s), located between the southern edge of the Leitha Mountains and the Hackelsberg, reaches a maximum of 130m in thickness, which we interpret as Miocene soft rocks, predominantly of Sarmatian to Pannonian age. The faulted Hackelsberg block borders both the Winden Syncline to the north, and the Pannonian Basin to the south.

Additional ERT measurements match the structure of a Neogene basin as derived from the seismic survey, featuring very low resistivities for the basin fill (< 30ohm.m), which we interpret as Pannonian cover. These can be clearly distinguished from the underlying older Neogene deposits, which are characterized by resistivities exceeding 80ohm.m. Subvertical faults at the borders of the syncline indicate post-Pannonian faulting.

To sum up both hybrid seismics and ERT profiles across the Winden depression reveal a prominent syncline structure between the Leitha Mountains and the Hackelsberg Range, which was formed before the northern Pannonian Basin sunk down and Lake Fertő came to exist.