Geophysical Research Abstracts,
Vol. 11, EGU2009-10931, 2009
EGU General Assembly 2009

Seismic Structure and Geodynamic Evolution of the Lithosphere and Upper Mantle in the Pannonian - Carpathian Region

G. Houseman (1), G. Stuart (1), B. Dando (1), G. Hetenyi (1), P. Lorinczi (1), E. Brueckl (2), E. Hegedus (3), S. Radovanovic (4), and A. Brisbourne (5)

(1) University of Leeds, School of Earth and Environment, Leeds, United Kingdom (greg@earth.leeds.ac.uk, +44 113 343 5259), (2) Institute of Geodesy and Geophysics, TU-Wien, A-1040, Vienna, Austria, (3) Eötvös Loránd Geophysical Institute, 1145 Budapest, Columbus u. 17-23, Hungary, (4) Seismological Survey of Serbia, 11000 Beograd, Park Tasmajdan, Serbia, (5) SEIS-UK, University of Leicester, University Road, Leicester, LE1 7RH, UK

The Pannonian Basin is the largest of a group of Miocene-age extensional basins within the arc of the Alpine-Carpathian Mountain Ranges. These basins are extensional in origin, but the surrounding Carpathians result from sustained convergence during and since the period of active extension. A significant part of the mantle lithosphere here has been replaced, as gravitational instability caused an overturn of the upper mantle. The Carpathian Basins Project (CBP) is a major international broadband seismology experiment, supported by geodynamical modelling and designed to improve our understanding of the structure and evolution of the lithosphere and upper mantle beneath the Pannonian and Vienna Basins. Between 2005 and 2007 we deployed 56 portable broadband seismic stations in Austria, Hungary and Serbia, spanning the Vienna Basin and the western part of the Pannonian Basin. Arrival time residuals from teleseismic earthquakes are delayed by about 0.8 sec in the Vienna Basin and early by a similar amount in southwest Hungary. Tomographic inversion of the travel time residuals shows relatively fast P-wave velocities in the upper mantle beneath the western Pannonian Basin and slow P-wave velocities beneath the West Carpathians. Seismic anisotropy (SKS) measurements reveal an intriguing pattern of lithospheric anisotropy: in the north-west the fast direction is generally elongated EW, perpendicular to the shortening direction across the Alps. Across the Vienna Basin the fast direction is NW-SE, perpendicular to the major bounding fault systems. Across the Pannonian Basin the dominant fast direction is EW, but in several locations the vectors are rotated toward NW-SE. The Mid-Hungarian Line, a major strike-slip structure already clearly identified in the gravity field, also is associated with abrupt changes in the azimuth of lithospheric anisotropy. Receiver function analysis of the seismic discontinuity at 670 km shows significant structure on scales of order 100 km, and in general it is anomalously deep by 10's of km beneath the Pannonian Basin. The object of these investigations is to use the seismic data to discriminate between different models for how this orogenic system evolved. In support of this aim we are developing 2D and 3D mechanical models of lithospheric deformation driven by boundary stresses and gravitational instability of the mantle lithosphere.