ORIGIN AND TECTONIC EVOLUTION OF ACTIVE CONTINENTAL LITHOSPHERIC DELAMINATION IN THE VRANCEA ZONE, ROMANIA: PROJECT DRACULA

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The Vrancea seismic zone (VSZ) of Romania (Fig. 1) constitutes one of the most active seismic zones in Europe, where intermediate-depth (70-200 km) earthquakes of magnitude in excess of Mw=7.0 occur with relative frequency in a geographically restricted area within the 110 degree bend region of the southeastern Carpathian orogen (Knapp et al., in press). Project DRACULA (Deep Reflection Acquisition Constraining Unusual Lithospheric Activity), focused on the geodynamic origin of intermediate-depth seismicity of VSZ and utilized a new, comparatively low-cost approach for acquisition of low-fold deep seismic reflection data. Funded by NSF Tectonics, Project DRACULA was carried out during the summer of 2004 and resulted in the acquisition of 320 km of high-quality deep reflection data in three separate profiles (DRACULA I, II, and III) concentric about the VSZ in order to discriminate among three contrasting geodynamic models (Fig. 2). The deep (60 s TWT) high resolution (4 ms sampling interval) seismic reflection data were recorded with the full complement of 800 stand-alone Reftek-125 (Texan) seismometers and 4.5 Hz geophones from the combined PASSCAL/UTEP instrument pool. A 50 m station spacing provided industry-standard spatial resolution, while the 1 km shot spacing economized on cost. The source effort consisted of 10 kg in each of two holes drilled to 12 m, for a total of 20 kg per shotpoint.

Preliminary results of Project DRACULA show exceptional reflectivity on many single-fold shot gathers. In particular, coherent laterally extensive, sub-horizontal reflections are evident throughout the crust and upper mantle beneath the Carpathian hinterland, in some cases down to 30 s TWT. Beneath the Carpathian foreland, coherent reflectivity is evident to 36 s TWT. Integration of these data with crustal seismicity, surface geology, and topography shows little if any evidence for subduction of a relic oceanic slab, and implies other viable geodynamic mechanisms, such as active continental lithosphere delamination (e.g., Nelson, 1991; Seber et al., 1996; Fig. 2), to explain the Vrancea zone seismicity.