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Upper crustal structure of the Vrancea Zone and Focsani Basin (Romania) from high density seismic and potential field data (DACIA-PLAN)

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The DACIA-PLAN seismic profile is about 140 km long and has a NW-SE orientation, crossing the seismically-active Vrancea Zone of the south-eastern Carpathians orogenic belt and the foreland Focsani Basin. The DACIA-PLAN seismic data were recorded using approximately 640 autonomous one-component digital seismographs ("Texans"). These were set out at (nominally) 100 m intervals on three successive deployments using 334 recorders on Deployment 1 and the full contingent of recorders on Deployments 2 and 3 (637 and 632), recording 29, 47, and 55 explosive shots respectively. As such the respective lengths of deployments 1-3 were 22.1, 55.8, and 55.9 km, which included some overlap of recordings between deployments 1 and 2 and 2 and 3. Nominal shot spacing was 1 km but varied according to the availability of appropriate drilling and shooting circumstances. In total, 127 successfully detonated shots were recorded on 67951 seismic traces, of which 46235 were considered robust enough to be used in a first arrival travel time inversion to determine velocity structure in the upper crust. Ray-trace modelling of these as well as some secondary seismic phases including reflected phases has also been carried out.

Velocity structure in the resulting 2.5D tomographic model and 2D ray tracing model is imaged to a depth of about 5 km within the western part of the DACIA-PLAN profile, where it crosses the external thin-skinned thrust belt of the East Carpathians (Vrancea Zone), and up to about 10 km further to the east, beneath the thick Tertiary Focsani Basin. Depth to basement, as well as lateral structural heterogeneity at the basement level, beneath the Focsani Basin resolved by the tomographic model is highly correlatable with structure in this area based on the interpretation of numerous

industry seismic reflection lines. Accordingly, the tomographic velocity structure implied for the foreland basin-thrust belt transition zone and the external thrust belt itself, where independent seismic constraints on geological architecture at depth are essentially lacking, are considered to be fairly robust. The results in this area strongly imply that pre-Tertiary basement in the Vrancea Zone is shallower ($<$5 km) than previously deduced in published geological cross-sections (as deep as 3 km) and indeed shallower than the less resolved basement "uplift" in the same and surrounding areas inferred from regional refraction data. Further, complexities observed in the travel-time data and their implications for the velocity modelling suggest that basement material (in any case, material characterised by velocities greater than 5.5 km/s) is likely involved in Carpathian thrusting. In particular, the degree of basement involved in large scale backthrusting along the western flank of the Focsani Basin appears to be significant and implies a detachment level well within sedimentary (or other) units underlying the ˜12 km thick Miocene and younger strata of the Focsani Basin. Analysis of existing gravity and magnetic data suggests similar results but have insufficient resolution for imaging upper crustal structure at the scale of the seismic data. A campaign to collect more detailed potential field data will be carried out in 2005 along the DACIA-PLAN profile complex integrated interpretation of these new data with the seismic data is expected to lead to greater structural resolution of the upper crust and basement-nappe complexities in the Vrancea Zone.