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High-resolution seismic techniques applied to the construction of a train tunnel

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High-resolution seismic techniques have been applied to the investigation of the subsurface structure along the trace of a tunnel for the high-speed train. The tunnel crosses a complex region of Variscan deformation in northern León (Spain). Geological studies indicate that the area is underlined by Paleozoic rocks deformed within two thrust sheets corresponding to the thrust systems of the southern Cantabrian Zone. In addition, the area includes several, brittle, high angle fractures and a thick cover of fluvioglaciar deposits across a rugged topography. High-resolution geophysical data was acquired. These included borehole measurements and a 2,12 km long, seismic profile. Interactive process between structural interpretation and integration of geological cross-sections was carried out during processing of the seismic data in order to better resolve the target zones. The existence of a 3 m thick layer of weathered rocks at the surface, together with the large variability of the topography caused a great dispersion of the energy. An important part of the processing was taken by application of static corrections. Construction of a pseudo density profile and a synthetic seismogram from well-log data (750 m deep) aided in selection of the best reflections. Seismic tomography and pre-stack depth migration was also performed. Migration was highly hampered by the high dispersion of la high frequency energy. The results indicated that at tunnel projected depth a 150 m long carbonate layer (Láncara Fn) would be encountered.