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# Shallow seismic imaging in hard rock environments – an example from the nuclear waste storage study site of Forsmark, Sweden.

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We have acquired high-resolution seismic data along 12 separate profiles and total 42 kilometers in the Forsmark Area, located on the Swedish coast about 140 km NE of Stockholm. This area consists of a c. 1.85 Ga tectonic lens about 10-15 km long and 3-4 km wide. The data were acquired with a 10 m source and receiver spacing and 100-250 active channels in two steps, 16 kilometers in 2002 and 26 kilometers in 2004. The bedrock within the lens is known to have a lower degree of ductile deformation relative the surrounding rock and appears to be bounded by steeply dipping faults.

Numerous reflectors have been imaged and their dip and strike directions have been determined. Some of the profiles have been further processed to obtain velocity information of the more shallow bedrock structures at 0 to 500 meters depth. We have used pre-stack time migration to handle the high-fold and long offsets of the data since common CDP processing reach its limits. Seismic tomography was done to provide field static corrections using all the information from the relatively far shooting offset (2-5 times the depth of interests). The tomography calculations where done with a routine capable of simultaneous static correction and velocity model inversion (Pstomo_eq). Our processing has improved the images at shallow depths in the seismic sections. The reflectivity can be traced closer to the surface on our new images and thus makes it possible to improve the accuracy of our interpretations. The velocity models are well correlated with the shallow reflectivity and we have been able to make estimates of the thickness of the loose glacial till and clay rich soil sediments that cover the bedrock basement. The range of successfully applied methods and the results from this study should help increase the interest of using seismic methods for site investigations of the

bedrock basement related to engineering and construction projects.