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Reprocessing of historical offshore BABEL seismic reflection lines 1, 6, 7, C and B – New insights into tectonic history of the Fennoscandian Shield

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Crustal-scale seismic data provide valuable information on the tectonic juxtaposition of different crustal segments, the formation of basins, and the emplacement of dykes and sills in the crust at various scales and depth ranges. The BABEL project acquired crustal-scale marine seismic reflection data during 1989. A seismic vessel towed a 3-km-long cable with 60 receiver groups at intervals of 50 m, and 42 airguns were used as source with a shot interval ranging between 60 m and 75 m. The recording length varied between 22 s and 25 s, and the sampling rate was 4 ms for all profiles. Important initial results showed, for example, that plate-tectonic processes were active during Paleoproterozoic time, demonstrating the potential of the data for basic scientific studies.

We present here results of the reprocessing of the offshore BABEL reflection lines 1, 6, 7, C and B mainly in central Sweden, with a total length of c. 1330 km, from raw shot gathers to depth converted migrated sections. These five lines cross four major lithotectonic units inside a 2.0 - 1.8 Ga orogenic system, including the Bergslagen ore province. These crustal segments are separated by major shear zones and breaks in metamorphism, and are intruded or overlain by younger crustal material. Compared with the original processing scheme, we applied additional pre- and post-stack deconvolutions, and the relatively new technique of curvelet denoising for signal improvement. Most of the reflections are much more enhanced. Features, which were not seen before, are visible now at different depths, including sub-Moho levels. For example, we uncover the shallow basin in the southern part of line 1, previously obscured by multiples.

The reprocessing and new interpretation of these lines suggest new ideas for the emplacement of 100 km-scale saucer-shaped sills, formation of basins, and the relationships between the sub-Moho reflections and the amalgamation of crustal segments during the 2.0 - 1.8 Ga orogeny.

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