



Intraplate Seismicity in Fennoscandian Shield

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Fennoscandian Shield is situated in a seismically quiet intraplate setting in northern Europe. Based on a subset of the most recent earthquake data (2000-2012), most of the earthquakes (80%) occur in the upper crust down to 17 km in depth, a minority (19%) in the middle crust (17-31 km) and only a few in the lower crust 31-45 km (1%). The seismogenic layer is less than 30 km in depth and has a rather uniform thickness across Fennoscandian Shield. Reflection profiles suggest only few of the outcropping deformation zones penetrate the upper-middle crustal layer boundary and even fewer reach the lower crust. We suggest that the middle to lower crustal boundary may add compositional and rheological constraints to the depth extent of the seismogenic zone

The orientation of the overall maximum horizontal stress field in northern Europe is WNW–ESE to NW–SE. The current strain rates are rather low and thus cannot produce new structures but rather reactivate old structures where stress overcomes fault friction. Pre-existing deformation zones that are optimally oriented in the present stress field can potentially be reactivated. The deformation zones were analysed for their length and azimuth and they were assigned a potential reactivation type (reverse, normal or strike slip) based solely on their azimuth.

The earthquakes in the seismically most active area, close to Skellefteå, Sweden along the western coast of the Gulf of Bothnia and its north-easterly continuation, appear to cluster around the shoreline and along post-glacial faults, which are mostly oriented optimally for reverse or strike slip faulting. The seismically active Kuusamo area in Finland is transacted by wealth of deformation zones all trending in directions optimal for reactivation.

The fault plane solutions of the most recent moderate size surprise earthquakes (Sveg 15.9.2014 MI 4.4, Bothnian Bay 19.3.2016 MI 4.1) suggest strike slip movement in optimally oriented for strike slip faulting according to the azimuth analysis.