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The Pärvie endglacial fault system, northern Sweden: A microseismicity study

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The Pärvie fault extends for over 150 km and is one of the largest known endglacial faults. The fault exhibits reverse faulting throw of more than 10 m and based on studies of Quarternary deposits, landslides and liquifaction structures it is inferred to have ruptured as a one-step event. An earthquake of this size would have had a magnitude of approximately 8. Today, the fault is still active and from geology it is inferred to be a subvertical fault but the mechanics of it is poorly known. Knowledge of the fault geometry at depth would significantly contribute to our understanding of the mechanics of endglacial faulting. In an ongoing seismological study of the Pärvie fault, we have acquired a 20 km long seismic reflection profile across the fault. The results of the reflection seismic processing images the faults from the near surface down to about 2 km depth and the profile crosses three surface mapped faults where the westernmost, main fault strand, is dipping about 50-60 degrees to the east, the middle fault dipping 70-80 degrees east and the easternmost fault dipping 50-60 degrees to the west. Using eight temporary seismic stations, in addition to the six permanent northernmost stations of the Swedish National Seismic Network and a collaborating Finnish station, we are currently recording microearthquake activity along the fault. The seismic stations have recorded numerous small events, most of which are mining induced microearthquakes from the nearby Kiruna iron ore mine. About 400 microearthquakes are detected from the vicinity of the Pärvie fault system. T he current station geometry allows detection and location of events as small as magnitude -2. From inversion we have estimated the velocity structure in the area and also made attempts of 3D-tomography. The events are concentrated to the east side of the surface trace of the main fault of Pärvie and spread along its whole north-south elongation ($\sim$150 km) giving few events with similar waveforms. However, some clusters exist e.g. a main cluster at the center of the fault. Correlation of these clustered events can help in giving better control of the depth estimates which is very important in determining the geometry of the fault. The clustered events have also been relocated with both a joint hypocenter determination and a double difference algorithm. We present hypocenter locations and focal mechanisms of all recorded events.