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The Burträsk endglacial fault: Sweden's most seismically active fault system

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Approximately 10,000 years ago, as the Weichselian ice sheet retreated from northern Fennoscandia, large earthquakes occurred in response to the combined tectonic and glacial isostatic adjustment stresses. These endglacial earthquakes reached magnitudes of 7 to 8 and left scarps up to 155 km long in northernmost Fennoscandia. Most of the endglacial faults (EGFs) still show considerable earthquake activity and the area around the Burträsk endglacial fault, south of the town of Skellefteå in northern Sweden, is not only the most active of the EGFs but also the currently most seismically active region in Sweden. Here we show the preliminary results of the first two years of a temporary deployment of seismic stations around the Burträsk fault, complementing the permanent stations of the Swedish National Seismic Network (SNSN) in the region. During the two year period December 2012 to December 2014, the local network recorded approximately 1,500 events and is complete to approximately magnitude -0.4. We determine a new velocity model for the region and perform double-difference relocation of the events along the fault. We also analyze depth phases to further constrain the depths of some of the larger events. We find that many of the events are aligned along and to the southeast of the fault scarp, in agreement with the previously determined reverse faulting mechanism of the main event. Earthquakes extend past the mapped surface scarp to the northeast in a similar strike direction into the Bay of Bothnia, suggesting that the fault may be longer than the surface scarp indicates. We also find a number of events north of the Burträsk fault, some seemingly related to the Röjnoret EGF but some in a more diffuse area of seismicity. The Burträsk events show a seismically active zone dipping approximately 40 degrees to the southeast, with earthquakes all the way down to 35 km depth. The Burträsk fault area thereby has some of the deepest seismicity observed in Sweden. We correlate our results with those of a seismic reflection survey carried out across the fault in 2008. Focal mechanisms are calculated for all events and the highest quality mechanisms are analyzed for faulting style variations in the region. We invert the mechanisms for the causative stress state and shed light on the long-standing issue of what causes earthquakes along the Swedish northeast coast, tectonics or current glacial isostatic adjustment.