

RECENT EARTHQUAKE SWARMS IN THE TJÖRNES FRACTURE ZONE IN N-ICELAND: RESULTS FROM SPATIAL AND TEMPORAL ANALYSES

Kristín JÓNSDÓTTIR, Gunnar B. GUNNARSSON, Martin HENSCH and the SIL-team

Icelandic Meteorological Office, Bústaðavegur 7-9, 150 Reykjavík, Iceland

The Tjörnes Fracture Zone (TFZ) in N-Iceland is a right lateral transform offset connecting the offshore Kolbeinsey Ridge to the onshore Northern Volcanic Zone some 120 km to the south-east. Seismicity has been recorded in the area since 1994 by the regional SIL seismic network operated by the Icelandic Meteorological Network (IMO). It reveals the major structures of the fracture zone, three N-S aligning grabens; The Eyjafjarðaráll Graben (EYG), the Skjálftanda Graben and the Öxarfjörður Graben, and three SE-NW aligning seismic lineaments separated by some 35 km; The Grímsey Oblique Rift, The Húsavík Flatey Fault (HFF) and the less active Dalvík Fault.

Here we present analyses of recent intensive seismic activity in the the EYG and the western most part of the HFF, which lies accross the inhabited island Flatey and the coastal town Húsavík increasing the seismic risk to its inhabitants. Only two historical events on the HFF are known in 1755 and 1872 and have been estimated to Mw 7 and Mw 6,5 respectively. New analyses of deformation data collected in the area suggests seismic potential equivalent to a Mw6.8 earthquake on the HFF.

Over a period of a few weeks in late October and first half of November in 2012, several hundred seismic events where recorded, both within the EYG as well as on the HFF. These are the most intensive earthquake swarms in the area since 1997. The largest event, Mw 5,6 occurred in the EYG and its source mechanism indicate normal faulting. Earthquakes within the EYG tend to be aligned on westwards dipping faults in agreement with structural studies of the graben. The events on the HFF show however strike-slip behaviour and have a maximum magnitude of 3,5. This activity extended over some 30 km.

In late September in 2013 another swarm occurred on the HFF. The swarm activated a 7 km long part of the fault which was left out in the swarm in 2012. The events are very similar, have the same strike-slip mechanism and correlate well. Relative locations based on a method that uses both p- and s-wave arrivals give extremely precise locations and the strike can be estimated with a few degrees error. We show that these events occurred in a very narrow depth range (at 8,5-11 km) or at the bottom of the seismogenic crust in that area. The fault (HFF) seems to be locked above the area where the swarm took place. Possibly the swarms are triggered by compressible fluids penetrating from below.