MAPPING OF HOLOCENE SURFACE RUPTURES IN THE SOUTH ICELAND SEISMIC ZONE

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Abstract

The South Iceland Seismic Zone is a transform zone marking the southern boundary of the Hreppar microplate. It is the source area of some of the most destructive earthquakes in Iceland's history. The surface formations of the zone are ground moraines, alluvial planes and Postglacial lava flows, and show widespread evidence of Holocene faulting. The fractured area is 15 km wide and 70 km long. A project to map by GPS-instruments all recognisable Holocene fault structures in this zone is described here. A large majority of all fractures strike NNE to NE and form left-stepping, en echelon fracture arrays with a northerly trend. They are associated with right-lateral faulting at depth. Right-stepping arrays also exist, apparently associated with faulting on conjugate faults with ENE strike, but they are an order of magnitude les frequent and mostly of secondary nature. Other fault trends also occur, but are rare. Push-up structures are prominent in association with the en echelon arrays, sometimes reaching heights of several meters. Fractures active during a few of the large, historical earthquakes in this region have been identified and traced, e.g. the 1630, 1784, 1896, and 1912 events. The fractures are found within narrow, N-S trending zones crossing the seismic zone. Thus the large scale, left- lateral transform motion across the plate boundary is accommodated by right-lateral slip on a series of transverse faults arranged side by side within the zone and by slight rotation of the blocks between them, a process sometimes called "bookshelf tectonism". Fractures formed during the earthquakes of June 17 and 21 (M_ω=6.5) in 2000 and May 29 in 2008 (M_ω=6.3) follow this pattern and confirm this general model of faulting along the transform zone. The size of push-up structures gives a clear indication of relative sizes of the earthquakes. The push-ups formed in 1630 and 1912 are an order of magnitude larger than the ones formed in the 2000 and 2008 earthquakes.

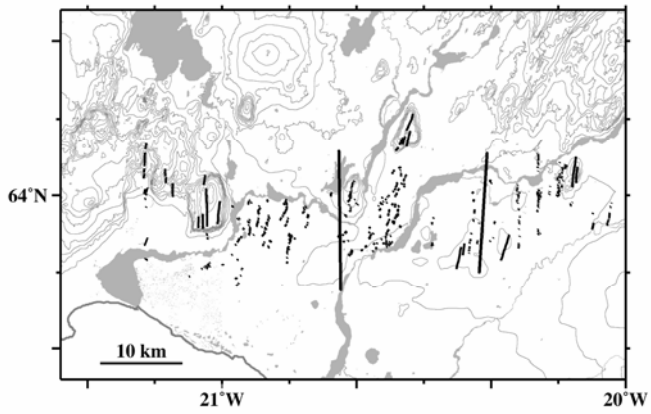

Figure 1. Surface fractures in the SISZ, active before 2000, shown with thin lines. Large thick lines show the source faults of the 2000 earthquakes.

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