

Episodic rifting events within the Tjörnes Fracture Zone during Holocene.

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The multi-branched plate boundary across Iceland is made up of divergent and oblique rifts, and transform zones, characterized by entwined extensional and transform tectonics. The Tjörnes Fracture Zone (TFZ) is a complex transform linking the northern rift zone (NVZ) on land with the Kolbeinsey Ridge offshore. Extension across TFZ is partitioned across three N-S trending rift basins; Eyjafjarðaráll (EB), Skjálíandadjúp (SB) and Öxarfjörður and three WNW-NW oriented seismic lineaments; the Grímsey Oblique Rift, Húsavík-Flatey Faults (HFFs) and Dalvík Lineament. The rift basins are made up of normal faults with vertical displacements of up to 50-60 m, and post-glacial sediments of variable thickness. The SB comprises N5°W obliquely trending, eastward dipping normal faults as well as N10°E striking, westward dipping faults oriented roughly perpendicular to the N104°E spreading direction, indicative of early stages of rifting.

Correlation of Chirp reflection data and tephrochronology from a sediment core within SB reveal major rifting episodes between 10-12.1 kyrs BP activating the whole basin, followed by smaller-scale fault movements throughout Holocene. Onshore faults have the same orientations as those mapped off shore and provide a basis for the interpretation of the kinematics of the faults throughout the region. These include transform parallel right-lateral, strike-slip faults separating domains dominated by spreading parallel left-lateral bookshelf faults. Shearing is most prominent along the HFFs, a system of right-lateral strike-slip faults with vertical displacement up to 15 m. Vertical fault movements within the Eyjafjarðaráll and Skjálíandadjúp Basins reflect increased tectonic activity during early postglacial time coinciding with isostatic rebound enhancing volcanism within Iceland.

We compile the tectonic framework of the TFZ ridge-transform from aerial photos, satellite images, multibeam bathymetry and high-resolution seismic reflection data (Chirp).