

**A short description of the N-Iceland  
sedimentary basins**

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## A short description of the N-Iceland sedimentary basins

The Tjörnes Fracture Zone is a complex tectonic region on the insular shelf of N-Iceland, formed by the westward offset of the volcanic spreading axis in NE-Iceland to the Kolbeinsey Ridge axis. Major active transform faults and en echelon rift zones are found, and seismicity is widespread. Subsidence and extensional tectonics have affected an area of roughly 100 by 150 km, forming conditions for exceptional accumulations of sediments. Sparse regional multichannel seismic data show that sediments are commonly 1.0-1.5 km thick, and 2-3 km and possibly 4 km thick in a restricted area on the inner shelf, possibly 2500 sq.km in area.

The onshore geology is dominated by basaltic volcanism, but a sedimentary section is found exposed along the coast of the peninsula of Tjörnes, ranging in age from pre-glacial sediments, about 4-5 My old, to the present. The sediments are clastic, ranging from silt to conglomerate, with intercalated lava flows. This shows deposition in variable near-shore conditions, and transgression/regression cycles reflecting the many Pleistocene glaciations. The only possible source rocks observed are some lignite beds.

No offshore drilling in the sediments has been done, except for one 550 m deep hole on an island where the sedimentary basin is believed to be 2-2.5 km deep. The section recovered is about 1-2 My old, comparable to the upper part of the Tjörnes section, but thicker units indicate greater subsidence rates. Measurements of samples indicate high porosity but relatively low permeability, probably due to cementation of the clastic material of volcanic origin. Total organic carbon tests gave only very low values.

The plate tectonic history of the region predicts that the TFZ was formed about 4-6 My ago. This would then be the likely age of initiation of basin formation, and is in fair agreement with the geological evidence. Seismic data suggest that the bulk of the sedimentary accumulation took place during the later half of this period.

A 500 m deep well has been drilled on the coast in the Öxarfjörður sub-basin, the sedimentary graben formed in the junction with the inland spreading-axis. The area is affected by geothermal activity. Traces of thermogenic hydrocarbon gasses have been detected in the discharge from this hole, the only direct evidence of this kind. The sediments drilled are Recent to probably late Pleistocene in age, and show the effects of several glaciations. Seismic profiling in the vicinity of the borehole indicates extensive faulting, reflecting the effects of fissure swarms originating in the volcanic centers further inland. The post-glacial strata (less than 10,000 years old) are thought to be 400 m thick, indicating rapid subsidence in recent times, while seismic velocity structure indicates basement at about 1 km depth.

Reykjavík, February 1998, Karl Gunnarsson.