

## **Iceland's Western Rift Zone – Field trip**

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The interaction of the Mid-Atlantic Ridge (MAR) and the mantle plume under Iceland is responsible for a complex plate boundary pattern in Iceland that is in continuous development. Rift jumps have occurred in response to gradual drift of the MAR relative to the mantle plume. The different branches of the plate boundary in South Iceland include the oblique spreading Reykjanes Peninsula plate boundary (the structural onland continuation of the submarine Reykjanes Ridge), the overlapping western and eastern rift zones, and the South Iceland Seismic Zone linking the southern ends of the western and eastern rift zones. The South Iceland Seismic Zone is a transform zone taking up motion between the Reykjanes Peninsula and the Eastern Rift Zone. GPS-measurements show that currently most of the spreading in South Iceland is accommodated by the ERZ, but little in the WRZ. Left-lateral shear is accumulating across the SISZ where majority of the 2 cm/year of relative plate motion appears to be accommodated. West of the SISZ, the Reykjanes Peninsula oblique rift accommodates the plate motion.

On this field trip we will come into the western rift zone at the Hengill triple junction. It is the junction of the Reykjanes Peninsula oblique rift, the western rift zone and the SISZ. The three plates meeting at this place are the North American plate, the Eurasian plate, and the Hreppar microplate, located between the western and eastern rift zone.

The Hengill triple junction is named after the Hengill central volcano which is the main volcanic production focus in the area, and is associated with a high-temperature geothermal area. The Hengill volcanic system encompasses the Hengill central volcano and its transecting fissure swarm, extending from the coast south of Hengill to the north of Lake Þingvallavatn.

Stops during the field trip include Nesjavellir, south of Lake Þingvallavatn, and at Þingvellir, north of Lake Þingvallavatn. The geology of the area is described in details in the appended article by Kristján Sæmundsson (Geology of the Thingvallavatn area, *Oikos*, 64, 40-68, 1992).

Despite the impressive appearance of the WRZ, it appears that currently most of the plate motion is accommodated by the ERZ, and not the WRZ. GPS measurements show that most of the extension in south Iceland is accommodated by the ERZ, and history of rifting episodes in historical times does support similar partition of crustal spreading between the rift zones for the last 1000 years. Four major rifting episodes are known in the ERZ since 900 A.D. (Eldgjá 934, Vatnaöldur ~900, Veiðivötn 1480, Laki 1783). During this time no volcanic activity is known in the WRZ. The last eruption occurred there about 2000 years B.P., but there has been at least one rifting episode in the WRZ without an eruption, in 1789.

On a longer time scale than 1000 years, a different partition of crustal spreading between the ERZ and WRZ is apparent. The maximum combined width of the surface fractures and faults in the WRZ is over 100 m. The faults are cut into the 9000-year old Thingvellir lava field, indicating an average spreading rate of about 1 cm/year in the WRZ during the postglacial period at this latitude.

**Selected References:**

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