Reviewed research article

Plate boundaries, rifts and transforms in Iceland

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Abstract – *The Iceland hotspot has a pronounced effect on the appearance and structure of the plate boundary between the North America and Eurasia Plates that crosses the island. The thick crust produced by the excess magmatism of the hotspot leads to a wider and more complicated plate boundary deformation zone than is observed along normal oceanic plate boundaries. Furthermore, the relative movement of the boundary with respect to the roots of the hotspot leads to unstable boundaries and rift jumps, when crustal blocks or microplates are transferred from one major plate to the other. The plate boundary zone can be divided into segments that are physiographically relatively homogeneous and possess distinct tectonic characteristics. The segments are more or less oblique to the relative spreading direction of the two major plates. The divergent component of the movements is taken up by diking and normal faulting and is usually concentrated in the fissure swarms of the volcanic systems. The transcurrent component of the movements is often accommodated by strike-slip faulting on faults that are transverse to the plate boundary segment, so-called bookshelf faults, witnessing to the transient nature of the segments. In highly oblique segments, such as the Reykjanes Peninsula Rift and the Grímsey Oblique Rift, both types of active structures occur superimposed on each other. In the South Iceland Seismic Zone, that is almost parallel to the local spreading direction, the bookshelf faults dominate the structure, producing earthquakes as large as magnitude 7. More mature transform zones, such as the Húsavík-Flatey faults, have developed strike-slip faults that are sub-parallel to the plate movements. The activity on this transform zone, however, appears to be declining because of transfer of movement over to the Grímsey zone. This is supported by the lack of Holocene volcanism along the Eyjafjarðaráll Rift that connects the transform to the Kolbeinsey Ridge plate boundary off shore. A ridge-jump appears to be in progress in South Iceland, where rifting is occurring in two sub-parallel rift zones, the very active Eastern Volcanic Zone and the less active Western Volcanic Zone. The block between them is seismically and volcanically inert and may be defined as a microplate, the Hreppar Microplate. It is rotating in response to the southward propagation of the Eastern Volcanic Zone and corresponding recess of the Western Volcanic Zone. Poles of relative rotation with respect to the North America and Eurasia Plates are suggested near 65.2°N, 20.1°W, and 62.8°N, 21.3°W, respectively.*