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Multibeam bathymetric maps of the Kolbeinsey Ridge and Tjörnes Fracture Zone, N-Iceland.

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Rifting in Iceland has been unstable since the onset of spreading in the Norwegian Sea in early Eocence. Branched crustal accretion zones in this region express rift jumps and oblique spreading under influence of the Iceland plume. The Tjörnes Fracture Zone (TFZ) links the northern rift zone (NVZ) in Iceland with the Kolbeinsey Ridge north of Iceland. The TFZ was initiated during the Miocene (about 7 Ma), following an eastward jump of the spreading axis in northern Iceland. A roughly 150 km long (EW) and 50 km wide (NS) deformation zone has since developed incorporating both right-lateral movement and oblique extension (105°). Recently collected EM300 and RESON8101 multibeam bathymetric data combined with CHIRP subbottom data have enhanced our understanding of rift-transform interactions within the TFZ. The transform motion is incorporated within two seismically active WNW trending zones, the Grímsey Seismic Zone (GSZ) and the Húsavík-Flatey fault (HFF), spaced roughly 40 km apart along the margins of three extensional basins, Eyjafjarðaráll, Skjálfandi and Öxarfjörður. A propagating continuation of the NVZ offshore the GSZ has both the characteristics of an oblique rift zone and a transform whereas the HFF is more akin to oceanic transform faults. Four left-stepping, en-echelon, NS-striking rift segments (volcanic systems) exist along the GSZ. Large GSZ earthquakes, however, seem to be mainly associated with lateral strike-slip faulting along WNW- or NNE-striking fault planes. Fissure swarms transecting the offshore volcanic systems have been subjected to right-lateral strike-slip motion parallel to the spreading direction. The HFF has an

overall strike of N65°W and can be traced continuously onshore and offshore along its 75–80 km length, between the NVZ, across Skjálfandi and into Eyjafjarðaráll. Four pull-apart basins occur along the fault, the largest at the intersection with Eyjafjarðaráll, the southward but magma-starved, continuation of the KR. Tertiary dikes, parallel to the HFF indicate it has been a leaky transtensional feature. Destructive earthquakes occurred on the HFF in 1755, 1867 and 1872. The southwestern margin of the fault is characterized by NE-striking lavas which dip steeply (30–50°) towards Eyjafjarðaráll. The lavas are dissected by en echelon arrays of conjugate strike-slip faults intersecting the HFF fault at angles of N20°–30°W and N20°E. Some can be traced onto land where they exhibit complicated flower patterns. Although oblique spreading and transform motion within the TFZ is currently confined to two main branches the Tjörnes microplate will merge with the North American plate as continued northward propagation of the divergent plate boundary gradually deactivates the extensional basins and HFF.