



Iceland: ridge, plume and basalt

Tectonic forces

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Let's now turn to examine how the crust of Iceland responds to the extensional tectonic forces that also occur at mid-ocean ridges. Iceland is part of the mid-Atlantic ridge, and therefore you expect to find some evidence that the crust is being stretched. This is exactly what we see here. The prominent cliff on the right is a fault scarp. And the blocks on the left have clearly faulted downwards. This is excellent evidence for crustal stretching in Iceland. During crustal stretching, blocks of crust often subside between parallel normal faults to produce a graben. Here's a simple example.

In the western rift zone there's a spectacular graben some eight kilometres in width and about forty kilometres long, which is aligned in a north-east/south-west direction. We're looking from the eastern side of the graben over the western side, which is eight kilometres away. But this graben is not a simple structure. There's been repeated movements on multiple faults for thousands of years. But the overall structure is still that of a graben, with a crustal block subsiding between parallel normal faults.

Let's now pull together the various observations we've made, and see what they reveal about the main characteristics of the western rift zone. In this western rift zone we see abundant basalt fissures and ridges. Are these distributed at random, or is there some pattern? Look at this graphic.

The dashes show recent basalt fissures, indicating where magma has moved through the crust in dykes. You can see they are all aligned north-east/south-west. These fissures can be grouped into three separate zones, which are called fissure swarms. They represent zones in the crust through which basaltic magmas from the mantle are channelled. These fissure basalts, and the basalts forming the nearby shield volcanoes, are mostly olivine tholeiites.

Remember that olivine tholeiite is the dominant basalt erupted at mid-ocean ridges, so it seems that melt generation conditions beneath the western rift zone are broadly similar to those beneath mid-ocean ridges.