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Tectonic reinterpretation of a section of the Mid-Atlantic Ridge south of the Kane fracture zone.

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Recent surveys of the Mid-Atlantic Ridge have shown that entire segments, many tens of kilometres long, may be spreading on one side or the other principally by faulting rather than by dyke intrusion, and may continue to spread in that way for as much as 10 Ma (Smith et al., 2008). Adjacent segments may have spread principally by dyke intrusion with relatively minor faulting for similar periods of time. These surveys have identified a number of bathymetric features that can be used to distinguish the two types of segment. Characteristics of the fault-dominated segments are blocky topography consisting of domal core complexes that are often corrugated, symmetrical linear ridges with steep outward- and inward-facing slopes and oval basins on the outward side of the ridges. We interpret the domal core complexes as exposures of long-lived detachment faults that have been rotated to low angles as they emerge, and the linear ridges as highly rotated fault blocks with the steep outward facing slopes representing volcanic seafloor that was erupted originally close to horizontal in the median valley floor. Sampling of serpentinite, gabbro and metabasalt is common in fault-dominated segments. Characteristics of magmatic-dominated segments are linear ridges with steep inward-facing scarps and well-preserved volcanic features such as cones and terraces. We interpret these as slices of the median valley floor uplifted by faulting, but scarcely rotated. The axes of the volcanic ridges are commonly curved towards segment ends. Plutonic rocks are not recovered from magmatic segments. The axis of the median valley floor has a volcanic morphology in both types of segment; the differences develop at the edges and on the walls of the median valley. We apply

these new criteria to a reanalysis of a well-surveyed area of the Mid-Atlantic Ridge running south for over 200 km from the Kane Fracture Zone and reaching out more than 100 km on each side. The area covers about 50,000 km^2 of Atlantic Ocean floor. The segmentation of this area was first studied by Gente et al. (1995), who showed that the pattern of segmentation is complex, with spreading segments apparently growing and shrinking on times scales of around 1 Ma. Our analysis shows that within this area about half of the ocean floor carries the fault-dominated signal. Along the 205 km of active spreading axis, five spreading segments can be identified. Of these one (35 km long) is spreading magmatically on both flanks, while the other four are spreading by faulting on one flank and magmatically on the other. This indicates that at present about 40% of the new ocean lithosphere generated in this area is fault-dominated. Each different type of lithosphere is organised for the most part into separate segments. It is unusual here for fault-dominated and volcanic-dominated units to be part of the same segment.

References:

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