TECTONICS OF SHORT-OFFSET, SLOW-SLIPPING TRANSFORM ZONES IN THE FAMOUS AREA, MID-ATLANTIC RIDGE

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Abstract. ANGUS photographs and ALVIN observational data from Fracture Zones A and B on the Mid-Atlantic Ridge near 37°N were examined for structural and sedimentological indications of the area's tectonics. Both transform fault zones are characterized by volcanic rubble, breccias, chalks, and undisturbed sediments typical of slow-slipping transforms.

The photographic data consist of 16 camera-sled traverses from the FAMOUS Expedition using the ANGUS deep-towed camera system. These data cover several different morphotectonic provinces along the strike of both slow-slipping (2 cm yr⁻¹) fracture zones. ALVIN data come from two dives in the central part of Fracture Zone B. The two fracture zones differ in their distribution of fractured and sheared chalks which indicate regions of strike-slip deformation along the transform. Evidence of shearing is confined to a very narrow region in the center of FZ A, whereas the zone of shear deformation is as much as 6 km wide across FZ B. Other differences include the morphology and depth of the transform valleys and their contiguous nodal basins and the extent of exposures of fresh-looking volcanic ridges in the nodal basin.

1. Introduction

Transform faults are an integral part of mid-ocean ridge spreading systems. In the North Atlantic, they are spaced at approximately 50 to 80 km intervals along the Mid-Atlantic Ridge (MAR), each offsetting the ridge by 20 to 180 km. They comprise a distinctive class of fault for which the sense of motion across the transform zone is opposite to the direction of offset of the ridge segments across the fault zone (Wilson, 1965). The frequency of transform zones along spreading centers makes them an important element in the formation and deformation of oceanic lithosphere, and as such they have been the subject of numerous structural, petrologic and seismic studies. Nonetheless, basic geologic characteristics such as the width of zones of shearing across the transform and the extent of volcanism on the ridge axis near ridge-transform intersections have not been clearly defined for transform zones with similar offsets and slip-rates.

This study examines outcrop-scale features along two short-offset (~20 km) transform faults on a slow-spreading (~2 cm yr⁻¹) segment of the Mid-Atlantic Ridge near 37°N (Figure 1). The transforms are the actively-slipping portions of Fracture Zones A and B, and are separated by approximately 50 km. The data reported here are photographs from 16 ANGUS bottom camera traverses, observational and photographic data from 2 ALVIN dives, and samples from 19 dredges, taken during three separate cruises as part of the French-American Mid-Ocean Undersea Study (FAMOUS) project in 1973–74. The photographs are

Fig. 1. Generalized bathymetric map of the FAMOUS Area based on multi-narrow beam maps of Phillips and Fleming (1978). Depths greater than 2200 m are stippled. Boxes labeled 3a–3d indicate the locations of detailed charts in figures with corresponding numbers. Insets show the location of the FAMOUS Area (upper left) and the local plate boundary geometry (lower right).

located primarily in three regions along Fracture Zone B (FZ B), with a smaller data set from two areas near FZ A (Figure 1). FZ A was previously studied during FAMOUS (Choukroune et al., 1978) and with the data presented here a comparison of the two transforms is possible. To present a more complete picture of the geology and tectonics of the region, the geological observations are