

Hydrographic Evidence for Enhanced Mixing in Fracture Zone Canyons

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Abstract

The only way for a parcel of water in the abyssal ocean to gain buoyancy is by mixing with another parcel with a lower density. For this reason, mixing can be seen as a source of buoyancy flux needed to close the global overturning circulation. An increasing body of work suggests that a significant amount of abyssal water modification due to mixing occurs in fracture zone canyons along slow spreading mid-ocean ridges. Here a new method for observing mixing with a single conductivity/temperature/density profile is explored by using buoyancy frequency profiles, a measure of density gradients. Analysis of buoyancy frequency profiles in fracture zone canyons revealed a consistent pattern of a spike in buoyancy frequency occurring within fracture zone canyons, but not occurring over abyssal plains. Also shown in many of the profiles is a reduction in buoyancy frequency variation in the bottom 500m of the water column. Results were repeated over all mid-ocean ridges studied, though the pattern is not as clear over the East Pacific Rise. The pattern in buoyancy frequency was also repeated temporally by looking at stations from repeat cruises. These results indicate that there is a canyon specific process causing mixing within these canyons.