Microstructural Study of Natural Fractures in Cape Roberts Project 3 Core, Western Ross Sea, Antarctica

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This work analyzes microstructures in core recovered offshore from Cape Roberts, in the westernmost Ross Sea of West Antarctica, in order to understand the rifting evolution of the Victoria Land Basin (VLB) and its relationship to the uplift of the Transantarctic Mountain (TAM) rift flank. Textures, fabrics and grain-scale structures observed in microfaults, veins, and clastic dikes are indicative of the deformation mechanisms that produced those structures and the mechanical state of the sediment during deformation. This information provides new constraints on the relative timing of faulting and sedimentation in the VLB along the TAM rift flank boundary.

Microfaults are abundant and display two main types of textures. Some microfaults are characterized by grain-size reduction, poorly sorted angular grains and preferred orientation of clays and/or clast long axes parallel to fault zone walls; these are associated with brittle shear of dewatered and cohesive sediment. Others are "shear zones" where bedding drag, sediment smearing, and no grain-size reduction indicate pre-lithification ductile flow of sediment by sliding of grains due to abundant pore fluid. Veins commonly follow pre-existing fault planes and abundant fibrous calcite perpendicular to vein walls suggests opening-mode origin. Clastic dikes are present throughout the core and also commonly follow fault planes, indicating that injections of liquefied sediment used pre-existing faults as conduits for "dewatering bursts".

The close association of clastic injections, diagenetic mineralization, and faulting indicates that faulting was synchronous with deposition in the rift basin. Because the CRP cores were obtained in close proximity to the border fault zone between the VLB and the TAM rift flank, this zone was likely active during rifting and sedimentation in the basin. Chronological data obtained from the Cape Roberts core constrains the time of rifting in this part of the VLB to early Oligocene (~ 34 Ma) to early Miocene time. In contrast, apatite fission track data from the TAM front structural boundary onshore reveals a much earlier time for the onset of TAM uplift at ~55 Ma (Fitzgerald, 2002). There thus appears to be a ~21 m.y. difference between onset of uplift of the rift flank and main-phase rifting in the adjacent VLB. Further studies designed to obtain ages for faults along the rift flank boundary should aid in understanding this significant time gap.

References

Fitzgerald, P.G., 2002, Royal Society of New Zealand Bulletin, v. 35, p. 435-469.