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Detachment faulting at slow-spreading centres

T. J. Reston (1), C.R. Ranero (1)
(1) IFM-GEOMAR, Wischhofstr. 1-3, 24148 Kiel, Germany (treston@ifm-geomar.de)

Corrugated surfaces at the ends of oceanic spreading segments are interpreted as the exhumed slip surface of large offset normal faults. As such their extent in the transport direction represents a minimum estimate of the displacement along the fault. However whereas most normal faults have displacement that are only a fraction of their extent in the strike direction, the corrugated surfaces are commonly close to equidimensional. We suggest that this implies that the corrugated surface do not represent the full along strike length of the faults. By analogy with seismic depth images from old oceanic crust and with structures observed at rifted margins, we suggest that the corrugated surfaces continue along strike toward the segment middle beneath a layer of small fault blocks. This interpretation is consistent with observations made from bathymetric mapping at the current spreading center. The interpretation can be explained by a rolling hinge model in which the lateral variation (exposed or buried slip surface) is controlled by the laterally varying lithospheric structure along the segment, in particular at what depth flexed normal faults become inactive. These results imply that detachment faulting is important along much of some spreading segments and that tectonic strain may be more important at segment centers than previously suggested.

It is however unclear how much of the total spreading at the end of segments is accommodated by such faults; if more than 50%, spreading would likely be asymmetric with the inside corner growing faster than the outside corner. Unless a similar asymmetry persisted down the ridge axis, such a process would rapidly distort the ridge segment and might be followed by a ridge jump through the oceanic core complex, as inferred for the 5°S region. If detachment faulting accommodates less than 50%of the total strain, the symmetry or not of the spreading system would depend on the amount of magmatic growth of the inside corner. The interplay at depth between tectonics and magmatism along segments is likely complex.