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Active compressive intraoceanic deformation: early stages of ophiolites emplacement?

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Oceanic lithosphere is strong and continental lithosphere is weak. As a result, there is relatively little deformation in the oceanic domain away from plate boundaries. However, the interior of oceanic lithosphere does deform when highly stressed. We review here places where intraoceanic compression is at work. In the more than 30 years since the first observations of active compressive intraplate deformation in the Central Indian Ocean through seismic profiling (Eittreim et al., 1972), compressive deformation has been identified in a variety of other oceanic tectonic settings: as a result of small differential motion between large plates (between North America and South America in the Central Atlantic; between Eurasia and Nubia offshore Gibraltar; between Macquarie and Australia plates in the Southern Ocean), within back-arcs (northwest Celebes Sea, Okushiri Ridge in the Japan Sea, on the eastern border of the Caroline plate), and ahead of subduction (Zenisu Ridge off Nankai Trough). Deformation appears to be more diffuse when larger plates are involved, and more localized for younger plates, perhaps in relation with the increasing rigidity of oceanic plates with age. The best example of diffuse deformation studied so far remains the Central Indian Ocean. Numerous marine data have been collected in this area, including shallow and deep seismic, heat flow measurements, multibeam bathymetry. The present-day deformation field has been modeled using GPS and earthquakes as far field and near field constraints respectively. Reactivation of the oceanic fabric (including for portions of the Indo-Australian plate which are now in subduction as evidenced by the September 2009 Padang earthquake), selective fault abandonment (Delescluse et al., 2008) and serpentinization (Delescluse and Chamot-Rooke, 2008) are some of the important processes that shape the present-day pattern of deformation. These rare intraplate deformation areas constitute excellent natural laboratories to investigate the very early stages of formation of faulted oceanic bodies that may further be incorporated into mountain belts as ophiolites. They allow to discuss rates and duration of deformation, diffuse vs localized deformation, re-activation vs neo-formed faults, serpentinization and thermal regime, spacing of minor and major thrust faults.

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