How fracture zones work on subducting lithosphere?

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A fracture zone extends past a transform fault that is a fault along a plate boundary with predominantly strike-slip movement resulting from the action of offset mid-ocean ridge axis segments. Once the fracture zone is away from the ridge axis, it becomes seismically inactive because both plate segments are moving in the same direction horizontally. On the other hand, the fracture zone cut all through lithosphere vertically and each lithosphere both side of it is expected to independently move in vertical direction due to different ages and different subsidence rates. This suggest that the fracture zone is a mechanically weak linear line in the lithosphere. Then, the fracture zone could work as a slit in the lithosphere where water could be transported through it from the ocean to the lithosphere, which results in further weakening the lithosphere mechanically. We investigate this possible mechanically weak linear line of the fracture zone, and we found characteristic topographic features of the subducting lithospheres with related to the fracture zones: Outer rise that is subtle ridge on the seafloor near an oceanic trench due to bending lithosphere, does not appear (or does appear in much smaller level than others) in two areas: Izu-Ogasawara subduction system, and Tonga-Kermadec Trench subduction system, where the old Pacific lithospheres are subducting. The fracture zones of the old Pacific lithospheres in both two areas shows their directions parallel to the trench. We propose that the fracture zone, which is a mechanically weak linear line in the lithosphere, prevents the subducting lithosphere from making an outer rise; the fracture zone disconnects the stiff core of the lithosphere to transfer bending stress, so that the lithospheric flexure to generate the outer rise is reduced. We will present these results with further investigations on fracture zones with related to subducting lithosphere.

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