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Mantle wedge hydration and the subduction of serpentinized fracture zones

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Oceanic fracture zones are recognized as areas where parts of the oceanic lithosphere can be partially serpentinized. Therefore, when subducting, these fracture zones have the potential to carry significant amounts of fluids which are released at certain depths, depending on the slab dynamics.
There are several places along the Ring of Fire where subducting oceanic plates contain fracture zones and a high-water content signature is recorded in the associated active volcanism. These areas comprise the subduction of Mocha fracture zone and the Nevado de Longavi volcano in southern Chile, the subduction of Tehuantepc fracture zone and the El Chichon volcano is southern Mexico, the Blanco fracture zone and Mount Shasta in western US and the subduction of Amlia fracture zone beneath the Aleutians Island arc. In this study we develop time-dependent numerical experiments to explore how serpentinized fracture zones influence the mantle wedge dynamics and the amount of fluids released. We find that as the facture zone enters the subduction system two phenomena take place: the amount of water released during subduction is much greater than in the case of normal subduction, and hydrous cold-plume formation at depths greater than 100 km. The release of high amounts of water by the subduction of serpentinized fracture zones are potentially responsible for the occurrence of adakitic volcanism. Such particular and localized type of volcanism has been related to highly hydrous mafic melts, as is the case for the Nevado de Longavi volcano in southern Chile, where the Mocha fracture zone is located.