New Constraints on the Subduction of the Orozco Fracture Zone, Mexico

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Subduction of fracture zones has been shown to have a pronounced effect on the distribution and geochemistry of arc volcanism [1, 2, 3, 4]. In the case of the Mexican Volcanic Belt, geochemical and petrologic data from volcanism in the region indicates that the Tziztio Gap (TG), a prominent ~100 km indentation in the front of the volcanic belt, and anomalous compositions of young volcanism behind the TG, are caused by subduction of the Orozco Fracture Zone (OFZ) beneath the North American Plate at the Middle America Trench [1]. Several recent studies support this conclusion and allow for a multidisciplinary approach to understanding fracture zone subduction.

Investigation of coastal deformation in the region shows that Pleistocene and Holocene tectonic uplift rates are significantly higher across the OFZ than in the rest of the Mexican subduction zone [5], consistent with surface roughness or buoyancy due to hydration of the oceanic lithosphere in proximity to the OFZ. Detailed studies of the seismic structure and anisotropy of the Mexican subduction zone show that there is an ultra-slow velocity layer at the top of the subducting Cocos Plate [6], which ends at the western margin of the of the projected OFZ, consistent with the interpretation of a tear in the Cocos Plate [7] that separates a North Cocos Plate from a South Cocos Plate, analogous to the 10 Ma Rivera-Cocos tear. Reconstruction of the volcanic history of the Tacámbaro-Puruarán region directly west of the TG documents anomalously high eruption rates of basaltic andesite to andesite magma in the Holocene [8], which could be explained by a tear in the slab at the OFZ and influx of asthenospheric mantle into the source region. This new geologic and geophysical data, combined with our geochemical data and model [1] provide a well-constrained example of on-going fracture zone subduction.

[1] Blatter & Hammersley (2010) *J. Volcanol Geoth Res* **197**, 67-84 [2] Singer *et al* (1996) *AGU Geophysical Monograph Subduction: Top to Bottom,* 285-291 [3] Jicha *et al* (2004) *J Petrol* **45**, 1845-1875 [4] Grove *et al* (2002) *Contrib Mineral Petrol* **142**, 375-396 [5] Ramírez-Herrera *et al* (2011) *Pure Appl. Geophys*, **168**, 1415-1433 [6] Dougherty *et al* (2012) *J. Geophys Res* **117**, B09316 [7] Stubailo *et al*. (2012) *JGR* **117**, B05303 [8] Guilbaud *et al* (2012) *Bull Volcanol*, **74**, 1187-1211