2006 Fall Meeting

Cite abstracts as **Author(s) (2006), Title, *Eos Trans. AGU, 87*(52), Fall Meet. Suppl., Abstract xxxxx-xx**

T22C-05

Shear-wave Splitting Tomography in the Central American Subduction Zone: Implications for Flow and Melt in the Mantle Wedge

*** Abt, D L** *David_Abt@brown.edu*
Department of Geological Sciences, Brown University, Providence, RI 02912 United States
Fischer, K M *Karen_Fischer@brown.edu*
Department of Geological Sciences, Brown University, Providence, RI 02912 United States
Martin, L *laura.jane.martin@gmail.com*
Department of Geological Sciences, Brown University, Providence, RI 02912 United States
Abers, G A *abers@bu.edu*
Department of Earth Sciences, Boston University, Boston, MA 02215 United States
Protti, J M
OVSICORI, Universidad Nacional, Heredia, 86-300 Costa Rica
Gonzalez, V *vgonzale@una.ac.cr*
OVSICORI, Universidad Nacional, Heredia, 86-300 Costa Rica
Strauch, W
Geophysics, INETER, Managua, 2110 Nicaragua

Resolving the geometry of flow in subduction zones is essential in understanding mantle wedge thermal structure, slab dehydration, melting and melt transport in the wedge, and subduction zone dynamics. In this study we use shear-wave splitting measurements made in the Nicaragua-Costa Rica subduction zone to constrain anisotropy and possible flow directions, taking into consideration that the relationship between deformation (i.e., direction of shear) and the lattice preferred orientation (LPO) of olivine is dependent on pressure, temperature, stress, volatiles, and melt. Our dataset includes >825 local-S splits collected by the 48 station TUCAN Broadband Seismometer Experiment, as well as three permanent stations, between July 2004 and March 2006. In general, arc-normal fast directions are prominent in the fore-arc, where waves sample the shallow wedge corner, while arc-parallel fast directions dominate beneath the arc and most of the back- arc. Using an iterative, linearized, damped, least-squares inversion to solve for crystallographic orientation and fabric strength, we find a best-fitting 3-D model of LPO that reveals relatively weak alignment of arc-normal olivine a-axes across much of the wedge corner, stronger arc-parallel a-axis alignment beneath the arc and back-arc, and an area of strongly aligned ~arc-normal a-axes just beyond the arc in Nicaragua. Although we solve for the orientation of all three crystallographic axes, horizontal fast-azimuth is the best-resolved parameter, with large trade-offs existing between the dip of the a- and c-axes. >60 teleseismic SKS splits, not incorporated in the inversion, display a more coherent pattern of arc-parallel fast directions and much larger splitting times, indicating significant arc-parallel anisotropy is present both deeper in the mantle wedge and/or beneath the subducting plate. The predominance of anisotropy with an arc-parallel fast direction in the mantle wedge beneath the arc and back-arc cannot be explained by simple 2-D arc-normal corner flow, even allowing for the presence of B-type olivine LPO in the shallow wedge corner. Thus, Nicaragua-Costa Rica joins Tonga, Kamchatka, and Alaska among the subduction zones where it appears observed anisotropy is not consistent with 2-D corner flow. One potential

model that accounts for the anisotropy in Nicaragua-Costa Rica is arc-parallel flow in the mantle wedge, possibly driven by flow around the slab edge beneath SE Costa Rica, steepening of the slab to the northwest beneath Nicaragua, and slightly oblique subduction of the Cocos Plate. Along-arc flow from the SE is consistent with geochemical data that may indicate an OIB-type mantle source similar to the Galapagos hot spot. B-type fabric development in combination with arc-parallel flow could explain the observed arc-normal fast directions in the fore-arc mantle wedge, while the arc-normal anomaly in the Nicaraguan back-arc may be caused by complex 3-D flow and/or the effects of melt.

http://www.geo.brown.edu/People/Grads/abt/CASWS/CAgeneral.htm

3902 Creep and deformation

7240 Subduction zones (1207, 1219, 1240)

7270 Tomography (6982, 8180)

8121 Dynamics: convection currents, and mantle plumes

8170 Subduction zone processes (1031, 3060, 3613, 8413)

Tectonophysics [T]

2006 Fall Meeting