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Along-Arc Variations in Attenuation in the Nicaragua-Costa Rica Mantle Wedge

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The goal of this study is to image attenuation structure in the Central American subduction zone using local event waveforms recorded by the TUCAN Broadband Seismometer Experiment. Geochemical observations from this region manifest strong along-arc variations and the constraints on thermal structure, fluid content and melt provided by attenuation will aid in understanding the source of this geochemical signal. The preliminary dataset presented here represents approximately the initial 7 months of the 20 month long deployment (July, 2004 until March, 2006) of the 48 seismometer TUCAN array that spanned the fore-arc, arc, and back-arc regions of Nicaragua and Costa Rica. To calculate attenuation structure we invert P and S waveforms separately for the corner frequency and moment of each event and for the t* value of each event-station pair, assuming attenuation is slightly frequency dependent (α=0.27). We then perform a tomographic inversion for both P and S wave attenuation structure in the mantle wedge, the upper plate, and the down going slab assuming a priori Q values (inverse attenuation) of 600 in the crust and mantle and 50 in the uppermost 500 m. We find that resulting P and S wave attenuation models are generally consistent, and here we describe S wave attenuation, focusing on features that are robust in both the P and S wave tomography. As is typical in subduction zone attenuation studies, we detect the difference between a less attenuating slab and a more attenuating mantle wedge. Additionally, we observe first order differences between the mantle wedges of Nicaragua and Costa Rica. The mantle wedge beneath Nicaragua is characterized by a large zone of high attenuation (Q_s<100) located roughly beneath the arc and extending to depths of approximately 100 km. The region of highest attenuation in Costa Rica is also located beneath the arc but is confined to a smaller volume at depths of ~75-100 km. The observed

attenuation structure is strongly correlated with along-arc trends in geochemical data. Geochemical indicators are consistent with greater depth of melting, degree of melting, and flux of fluids from the slab in Nicaragua than in Costa Rica. The stronger and more extensive zones of high attenuation we observe in Nicaragua suggest a combination of higher wedge temperatures, greater hydration, and possibly more melt than is present in the Costa Rican wedge. Once our data analysis is completed and further resolution testing is accomplished, the attenuation models will be used to quantitatively bound thermal structure in the mantle wedge, allowing the identification of anomalous regions that require the presence of volatiles and/or partial melting.

7203 Body waves
7208 Mantle (1212, 1213, 8124)
7270 Tomography (6982, 8180)
8124 Earth's interior: composition and state (1212, 7207, 7208, 8105)
8170 Subduction zone processes (1031, 3060, 3613, 8413)

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