# Seismic Attenuation Tomography in the Mariana Subduction System

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We analyse seismic attenuation (1/Q) across the western Pacific Mariana subduction system using data from the 2003-2004 Mariana Subduction Factory Imaging Experiment to investigate the anelastic structure of the subduction zone, which can place first-order constraints on temperature and volatile content. We use a path-averaged method [after Stachnik et al., 2004]* to compute the amplitude spectra for P and S arrivals at 78 seismic stations for a given local earthquake and simultaneously invert for the path-averaged attenuation parameter, t*, for each waveform and the earthquake source parameters for each event. Tomographic inversion of nearly 3000 t* estimates for 2-D $1/Q_P$ and $Q_P/Q_S$ structure and the subsequent calculation of $1/Q_S$shows:

- a columnar-shaped high $1/Q_P$ anomaly beneath the spreading center that extends to ~100-125 km depth and into the far backarc in a broad swath ~50-100 km thick, which provides significant insight into slow-spreading ridge system dynamics.
- a narrow (<~50 km) high attenuation region that appears to connect the slab to the anomaly beneath the spreading center at ~75-100 km depth;
- at shallow depths (< ~50 km), the backarc column anomaly is distinctly separate from the high attenuation island arc anomaly, which extends to nearly ~100 km depth and abruptly truncates near the slab-wedge interface;
- low attenuation persists in the subducting Pacific plate at depths greater than 100 km;
- a high attenuation anomaly beneath the forearc serpentinite seamounts persists for both P and S structures to depths of ~50 km. We interpret the arc and wedge core anomalies mainly as regions of high temperature, the forearc anomalies as indicative of increased volatile content and/or large-scale serpentinization, and the columnar-shaped high $1/Q_P$ anomaly directly beneath the backarc spreading center as possibly indicative of increased melt content and/or dynamic upwelling beneath the slow-spreading ridge axis.

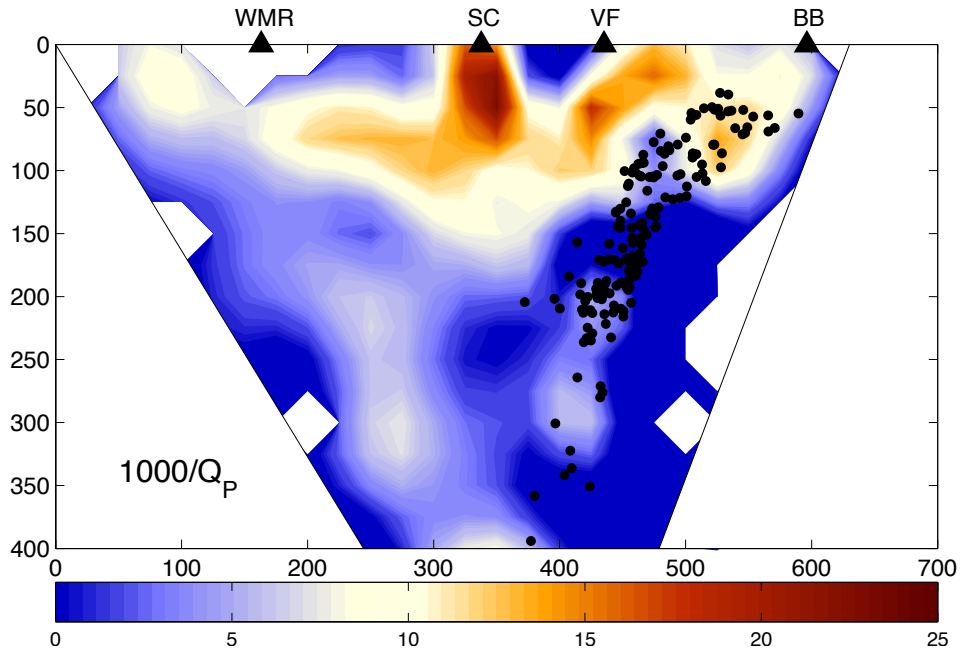


*Figure: $1000/Q_p$ structure from SVD inversion [Pozgay et al.]. Cross section is at ~18° N. Circles are earthquakes delineating the slab and triangles across the top from left to right correspond to the West Mariana Ridge (WMR), Spreading Center (SC), Volcanic Front (VF), and Big Blue Seamount (BB). Note that only model parameters with large model resolution matrix diagonals are shown.*

Pozgay, S. H., D. A. Wiens, H. Shiobara, and H. Sugioka (submitted to G-cubed), Seismic Attenuation Tomography in the Marianas: Implications for Thermal Structure, Volatile Distribution, and Dynamics of the Arc-Backarc System, subm to G^3 issue The Izu-Bonin-Mariana Subduction System: A Comprehensive Overview.

*References listed in appendix A.