Elastic Properties of Subduction Zone Materials in the Large Shallow Slip Environment for the Tohoku 2011 Earthquake: Implications of a Compliant Wedge on Earthquake Rupture and Tsunamigenesis

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1. Introduction

The 11 March 2011 Tohoku-Oki earthquake ruptured through the subduction zone, producing tsunami waves at the surface and a devastating tsunami in Japan. We report laboratory ultrasonic velocity measurements performed on drill core samples from the Japan Trench during IODP Exp. 343. These measurements were performed on drill core samples from the Japan Trench during IODP Exp. 343. These measurements were performed on drill core samples from the Japan Trench during IODP Exp. 343.

2. Methods

Ultrasonic velocity experiments were carried out on five core samples from IODP Exp. 343, since samples were chosen from the subducting forearc accretionary wedge. Core plugs were placed into a triaxial pressure vessel with independent control of axial, confining, and pore-fluid pressures. Axial and confining pressures were varied to test the effects of effective pressure on the velocity measurements. For all measurements, a faster ultrasonic transducer was used to measure the velocity of seismic waves in the sample.

3. Results

Velocities for both P- and S-waves were measured for samples from the Japan Trench at various effective pressures. The results show that for samples from the Japan Trench, the velocity decreases with increasing effective pressure. This behavior is consistent with the behavior of most other subduction zone materials.

4. Conclusions

At an estimated in situ pressure of 5 MPa, the velocity of seismic waves in the Japan Trench is significantly lower than the velocities commonly assumed in earthquake rupture models.

5. Future Work

We will continue to study the effects of effective pressure on the velocity of seismic waves in the Japan Trench. We will also study the effects of effective pressure on the velocity of seismic waves in other subduction zones.

References


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