EARTHSCOPE SEMINAR
DISCUSSION SUMMARY
MARCH 26, 2007
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Paper Title: An inverted continental Moho and serpentinization of the forearc mantle
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This paper proposed a theory to explain the observed "inverted Moho" in the Cascadia subduction zone. The authors used data from 31 different earthquakes collected at 69 different sites to plot S-wave velocity perturbations. They also used finite element modeling along with observed characteristics, such as surface heat flow, to create a thermal model of the subduction zone. The authors theorized that the cool temperature of the forearc of the mantle wedge and the amount of hydration from the subducting slab can create and environment in which serpentinite is stable. Since serpentinite has a much lower S-wave velocity, even than that of the crust, this may cause the observed "inverted Moho" region in the forearc of the mantle wedge.

Many classmates had questions of how certain the proposed geometry of the subducting slab is in the velocity perturbations model. For instance in depth of around 80 to 120 km the impedance contrast seems to flatten while the proposed slab remains diagonal. However, these plots have great horizontal coverage, but there is not great vertical refinement. Also, there are visible reverberations in the plot and very little resolution below around 80 km depth; therefore, very little can be said for certain about the lower portion of the velocity perturbation plot.

Another point of contention with the velocity plot was that there is very little difference between where the top of the eclogitic crust is proposed to be and the mantle wedge. The class brought up the point that after a basaltic crust becomes eclogitic crust the S-wave velocity through this area increases due to an increase in density and this may mask the impedance contrast along the top of the crust.

The group came up with several different alternatives to this model or ways it may be improved. For instance, most people agreed that the temperature model is too simple. The crustal boundary could have been changed to accommodate flexes and changes in the plate near the point of subduction. There were also questions about the interaction of the mantle lithosphere and how or if it was incorporated at all in the model. A thermal signature to the active volcanic arc was also missing from the temperature plot and may have affected the temperature profile of the mantle wedge. Another possible explanation for a very low velocity zone in the forearc may be a large volume of melt right above the basaltic crust; however it would require a large amount of melt and a much higher temperature than proposed.

Overall this is a very good approximation for determining where the Moho is underneath subduction zones although it is agreed upon that the model is slightly too simple for what may be needed to determine if the lower velocity perturbation is caused by serpentinite in the mantle.