Sinking hot anomaly and exothermic phase change: A possible origin of hot anomaly beneath the ocean side of Honshu subduction zone

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Recently, Obayashi et al. (2006) confirmed the existence of slow velocity anomaly under the ocean side of the Honshu subduction zone and they interpreted as hot anomaly over 100 degrees. Since such a high temperature appears to contradict our conventional view of convection, it is interesting to think about its origin. Here we consider a scenario in which a hot anomaly, whose origin might be a part of remains of hot plume(s), is dragged down by the slab and it interacts with the exothermic phase change near 410 km. The presence of exothermic phase change retards the downward movement of hot anomaly. Thus, the hot anomaly may stay near the 410 km for a while. To analyze this hypothesis, we have constructed a simple numerical model.

We found that the hottest part is located above the 410 km discontinuity and stays there for a while. This may explain the slow velocity distribution which appears to closely correlate with the 410 km discontinuity. The time for the hot plume to stay near the 410 km discontinuity depends on many factors, such as the intensity of thermal anomalies and the viscosity. The plume whose size is of the order of a few thousands km (horizontal) X 100 km (vertical) may stay there up to ˜100 million years. This may suggest that it might be related to the Cretaceous superplume activity in the Pacific Ocean.