Spatial and temporal evolution of arc volcanisms in the NE Honshu and Izu-Bonin arcs and small-scale convection

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Small-scale (less than around 100km) along-arc variations as revealed by tomography and volcanisms may suggest that the plate-scale phenomena, that is, mantle convection, may not be directly related to these. However, since the viscosity of the mantle wedge, whose typical scale is around 100 km, may be lowered by the water dehydrated from the subducting slab, mantle convection may still play an important role. We have tested this hypothesis using a series of numerical models. Based on these models studies, we suggest that the temporal and spatial evolution of arc- volcanisms in the NE Honshu and Izu-Bonin arcs may be explained, at least, qualitatively by our hypothesis.

In the NE Honshu arc, recent distribution of volcanisms, which well correlate with the tomographic results, shows a several & #34;fingers& #34; elongated almost perpendicular to the arc and a possible migration of volcanisms from the back-arc to the volcanic front side, at least, during last 5 Myrs. Besides, the pattern of fingers appears to have flip-flopped around 5 Ma. In the Izu-Bonin arc, there is a several across-arc seamount chains, where volcanic activities existed from about 17 Ma to about 3Ma. In contrast, the recent active rifting is occurring almost parallel to the arc.

Our models show the existence of small-scale convection within the assumed low viscosity wedge. Its pattern is a series of rolls whose axes are almost perpendicular to the strike of trench axis, even when the subduction is oblique. This roll-pattern sometimes flip-flops by the migration of cold-plumes initiated at the back-arc end of the low viscosity wedge. These results may explain the geologic features described above, at least, qualitatively.

We also have a several inferences from our modeling studies. In the NE Honshu arc, the geometry of subduction from the old time (say about 10 Ma) to the present remained similar. Meanwhile, in the Izu-Bonin arc, the angle of dip of

subducting plate may have increased. This may explain the disappearance of volcanisms along the seamount chains of the Izu-Bonin arcs at present, which is also confirmed by our models. We also suggest that the trend of seamount chains, which is oblique to the arc, may be a result of the lateral movement of the back-arc region after their formation.