New knowledge on formation of island arc crust and growth of continental crust: Recent fruits of deep seismic studies in Japan

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Recent advance of deep seismic reflection/refraction studies makes it possible for us to discuss the formation of island arc crust and the nucleation/growth of continental crust based on new knowledge.

1. Formation of island arc crust

(1)It was newly found in Northeast Japan(Sato et al., 1998; Yokokura et al., 1998)and Hidaka (Ito et al., 1998) that the lower crust of island arc also has seismic laminations which occur commonly in continental crust. This fact must provide essential information on both material and structure of island arc lower crust.

(2)Structural cross sections of Southwest Japan were presented by the deep seismic experiments in collaboration with JAMSTEC in east Shikoku (Onishi et al., 2000, 2002; Kurashimo et al., 2002) and Shitara (Sato et al., 2001). The sections indicate the following two characteristics: First, there is no lower crust about 220 km wide (in east Shikoku) and 150 km wide (in Shitara) from the Nankai trough. Vast area of the accretionary wedge does not have lower crust. Second, the lower crust and the Moho tilt about several degrees southward (seaward). Although we have no idea about the cause of the tilting, it might give us important information on shortening and thickening process of island arc crust.

2.Nucleation and growth of continental crust

A series of deep seismic reflection studies in the Hidaka Collision Zone(Arita et al., 1998;Tsumura et al, 1999; Ito, 2000) has provided a new model, delamination-wedge-subuduction model, to explain nucleation and growth of continental crust from island arc crust in arc-arc collision. This model presents the following process of nucleation and growth of continental crust: (1) split the lower portion of island arc lower crust with more mafic component from the main body of island arc crust and transport the lower portion into mantle, and (2) combine two island arc crusts to form a thick merger which is more felsic than prior to the collision.