Layered anisotropic structure of the Huatung Basin oceanic lithosphere offshore eastern Taiwan

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We analyze ambient noise of continuous seismic waveform data recorded by ocean-bottom seismometers (OBS) deployed in the Huatung Basin and adjacent regions off the east coast of Taiwan. Taiwan is a young and active orogenic belt resulting from the oblique subduction and collision between the Eurasian Plate and the Philippine Sea Plate. Sitting on the westernmost edge of the Philippine Sea Plate, the Huatung Basin is directly involved in the subduction-collision processes. The structural characteristics of the lithosphere provide important constraints not only on its own history but the tectonic evolution in this complex region. We integrate data from OBS with those from land stations along the east coast of Taiwan to derive Rayleigh wave Green’ s functions from cross-correlation between all available station pairs, covering the majority of the Huatung Basin. We measure phase velocity dispersion at periods from 4 to 20 sec, and invert for 2-D anisotropic phase velocity maps based on a wavelet-based multi-scale inversion scheme. Our results reveal a distinct period-dependent variation in anisotropy. At periods of 4-8 s, the anisotropy is generally weak and the fast direction is aligned in N-S direction. In contrast, at periods of 12-20 s, stronger anisotropy is observed with fast direction in NW-SE. The N-S anisotropic pattern reflects characteristics at crustal depths, and is consistent with magnetic lineation suggesting past basin spreading direction. Therefore, what we observe is likely the fossil anisotropic fabric created during the development of the ocean basin. On the other hand, the mantle lithosphere is dominated by NW-SE anisotropy, a direction sub-parallel to that of the convergence between the Philippine Sea Pate and the Eurasian Plate. The coincidence implies that the Huatung Basin’ s mantle lithosphere is under the influence of asthenospheric flow induced by the plate motion of the Philippine Sea Plate.

Keywords: seismic anisotropy, ambient noise, ocean-bottom seismometer, Huatung Basin, Philippine Sea Plate, Multi-scale wavelet inversion

