Two types of upper crust seismic velocity structure in the Izu-Bonin-Mariana back-arc basin

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We focus on the seismic velocity structure in the Izu-Bonin-Mariana (IBM) back arc basin, and investigate spatial variation of P-wave velocity structure of the upper crust. The seismic velocity of oceanic crust is composed of 3-6 km/s with large velocity gradient (layer 2), and 6-7 km/s with less velocity gradient (layer 3). The thickness of the layer 2 formed at fast spreading mid-ocean ridges is about 1~2 km (e.g., Kearey *et al.*, 2009). The upper crust P-wave velocity structures of the back-arc basins are divided into two groups by the thickness and velocity gradient of layer 2 (Sato *et al.*, 2015); 1) The same structure to the crust created at fast spreading mid-ocean ridges (We call this "standard structure"), 2) The structure which has thicker (~3 km) layer 2 and lower velocity than that of "standard structure" at shallow depth because of smaller velocity gradient (We call this "lower velocity structure"). The lower velocity structure probably due to high porosities of the crust, which corresponds to rock samples and low gravity anomaly (Dunn and Martinez, 2011). They suggest that when near the volcanic arc, back-arc spreading centers preferentially advect hydrous, low-viscosity mantle, possibly augmented by dynamic buoyant upwelling, as inferred for the arc itself. The upper oceanic crust velocity structures in the Southern Mariana Trough and the Lau back arc basin shows "lower velocity structure" where subduetion influence would exist (Jacobs *et al.*, 2007; Dunn and Martinez, 2011; Sato *et al.*, 2015).
We investigate spatial variation of the upper crust velocity structure in the IBM back-arc basin using 2-D velocity structures (Takahashi *et al.*, 2015) to identify two types of structure. The 2-D velocity structures were obtained along eight survey lines across Izu-Bonin arc and one survey line across the Mariana arc. These lines lie in W-E direction and extend near old spreading center in N-S direction. We make graphs of veloscity structure against depth below sediment. The boundary point of two groups is set at 1.5 km depth and 5 km/s velocity because the difference of two groups become clear at this point based on Sato *et al.* (2015). We define the middle structure of two groups as "middle structure".
The velocity structures of all lines vary in order of lower velocity structure, middle structure, and standard structure from east to west. The width of each structure is different from each line. We name each survey line as line 1-9 from north to south. In line 1,2 and 8, there are lower velocity structure of 15~40 km, middle structure of 30~80 km, and standard structure in the rest western area. In line 3, there is only standard structure. In line 4,5,6 and 9, there are lower velocity structure of 30~70 km and middle structure in the rest western area. In line 7, there are middle structure of 30~80 km, and standard structure in the rest western area, but no lower velocity structure. Only line 9 cross Mariana trough. There are middle structures of 40 km in the eastern end and 55 km in the western end of the trough, and standard structure of about 100 km in the rest area near the spreading center.
Our analysis reveals that lower velocity structure and middle structure exist in the IBM back-arc basin, suggesting that the upper crust influenced by subduction was formed. All areas of lower velocity structures and middle structures are influenced by subduction with older crust in these arcs. This indicates that the influenced crust was made in early stage of back arc formation when the spreading center was near the subduction zone. The subduction influences vary along the spreading center, because width of each lower velocity structure and middle structure structure is different. Especially, there is no standard structure in the middle of Shikoku basin and Parece Vela basin, suggesting the subduction influences would be significant there.

