

Large gas reservoir in continental back-arc basin, revealed by automatic seismic velocity analysis in the Okinawa Trough

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P-wave velocity acquired from seismic reflection data allows us to quantify submarine geological structures. In the Iheya North Knoll of the Okinawa Trough, intense hydrothermal activity occurs due to continental rifting. The hydrothermal system in the Iheya North Knoll has been explored by geophysical surveys, geochemical measurements and drilling campaign. Based on these surveys, gas reservoir could be considered to exist around the Iheya North Knoll. However, gas reservoir around the Iheya North Knoll has not been identified in previous studies. Here we show P-wave velocity structure derived from automatic velocity analysis of multi-channel seismic reflection data. P-wave velocity is sensitive to free gas in sediments. Therefore, P-wave velocity is key information to quantify gas distribution in sediments. Automatic velocity analysis estimated P-wave velocity structure with remarkable high spatial and temporal resolution. The P-wave velocity structure revealed gas reservoirs around the Iheya North Knoll. Although many gas components can be generated by magmatic activity, hydrothermal alteration of organic-rich sediments and biogenic processes, CH₄ and CO₂ could be major gas components which is derived by hydrothermal system in marine sediment. Therefore, main gas components could be CH₄ or CO₂. The strong amplitude reflector above the gas reservoir could be the interface between CH₄ hydrate and gas, because the depth of strong amplitude reflector is well consistent with pressure-temperature conditions of the phase transition. If the main gas component is CH₄, the gas reservoir could be important as resource. Whereas, if the gas reservoir includes CO₂, the gas distribution could be important to consider carbon flux between earth and ocean. Furthermore, widely distributed gas reservoir may influence on the chemical components of hydrothermal fluids in the Iheya North Knoll.

Keywords: Seismic reflection data, Okinawa Trough, Gas reservoir