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Seismic reflectivity and AVO studies of BSRs on the convergent margin in southwestern Taiwan: OBS data analysis

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The result of regional Multi-Channel Seismic reflection profiles suggested that a gas hydrate-related Bottom Simulating Reflectors (BSRs) is identified in the broad southwestern offshore region of Taiwan. To understand the regional distribution of methane hydrate bearing layers and explore concentrated hydrate bearing layers, we conducted a detailed analysis of reflection coefficient and amplitude-versus-offset (AVO) pattern of BSR using ocean bottom seismographs (OBSs) seismic data acquired in the southwestern offshore region of Taiwan. We focus on the analysis and interpretation of airgun-array signals recorded by OBSs during 2004 and 2006. Ten profiles of seismic reflection/refraction with a total length of about 140 km and recorded by 50 recovered OBSs were acquired on the active and passive margins in offshore southwestern Taiwan. The profiles of the 2004 and 2006 profiles are oriented in E-W and N-S direction and the 2005 survey is trending in NW-SE perpendicular to the continental margin. For all the OBS lines, amplitudes of the direct water arrival, the multiple, and the BSR were picked interactively. A quantitative representation of reflector strength is provided by calculation of reflection coefficients. In general, the seafloor reflection coefficients for the active and passive margins are estimated as 0.1-0.25. Maximum of up to 0.47 were observed over the topographic high in the active margin. Those high amplitudes of seafloor reflection could be associated with widespread carbonate pavement observed with TowCam in the active and passive margins, southwest Taiwan. For the BSR the largest reflection coefficients were observed in the passive margin. This area has average values of about 0.12 with localized highs between 0.15 and 0.18, while the active margin area exhibited relatively lower values of about 0.015-0.05. If we assumed that the velocity below the BSR has a constant value. Variations in BSR reflection coefficients are attributed to velocity variations of the gas hydrate above the BSR. Estimates of the hydrate concentration have been made from BSR reflection coefficients obtained in this study. Mean concentration are abut 20$\tilde{2}$5% of the total sediment volume for the passive margin, and are about 5$\tilde{1}$0% for the active margin. In addition, AVO pattern of the observed BSR over the active and passive margins also suggests that the probable velocity distribution across the BSR and infer hydrate/free gas model are different for these two areas. The results of calculated reflection coefficient and AVO pattern of the BSRs in offshore SW Taiwan suggest that inferred hydrate concentration for the passive margin profiles is relatively higher than that for the active margin profiles.