

Distribution of the Bottom-Simulating Reflector in the Offshore Taiwan Collision Zone

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ABSTRACT

A bottom-simulating reflector (BSR) has been identified in the offshore Taiwan accretionary prism using both migrated 6-channel and 120-channel reflection profiles. The BSR is marked by a reversed polarity reflector that increases in sub-bottom depth with increasing water depth, suggesting that the BSR marks the base of the methane hydrate stability field. The BSR is located in offscraped sediments derived from the Taiwan orogen and the Chinese continental margin, which may contain high amounts of organic carbon, thereby providing a source for the methane. Gas seepage found on land north of this region also supports the presence of methane in these strata. The BSR is typically located in the crests of anticlines and mud volcanoes, implying the migration and entrapment of methane gas. Recent uplift of the seafloor in anticlines may reduce pore pressure, thereby decomposing the hydrate phase into free gas, which may enhance the acoustic impedance contrast across the BSR. BSRs are conspicuously absent beneath submarine canyons in the region. A "flat spot" was found under the BSR within an anticline, suggesting that the hydrate-filled pore-space may result in lower sediment permeability, therefore enhancing the entrapment of free gas. We document the areal extent and sub-bottom depth of the BSR over a 77000 km²-wide region around southern Taiwan. In particular at least 30% of the seafloor, to as much as 60%, along the trenchward slope of the accretionary prism is underlain by the BSR. The BSR is located at shallower sub-bottom depths on the trenchward (western) side of the accretionary prism than on the arcward (eastern) side, even though water depths are similar, implying enhanced fluid flow from depth, resulting in a higher geothermal gradient as sediments are accreted and dewatered along the Manila trench.

(Key words: Methane hydrates, Bottom-simulating reflectors, Convergent boundary, Multi-channel seismic reflection data)

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