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Sedimentation and Development of a Slope Basin Offshore Southwestern Taiwan from 3D Seismic Volume Analyses

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A 3D seismic survey was conducted recently over a slope basin in the upper slope domain of the accretionary wedge offshore southwestern Taiwan for the purposes of mapping detailed structures and sedimentary sequences of this basin where clear BSRs are observed. Morphologically, this basin is bounded by two diapiric ridges at its eastern and western sides, and the survey area is also the merging location of two submarine canyons. Thick orogenic sediments derived from the Taiwan mountain belt have been deposited in the slope basin and filled up the canyons. To investigate the relations of different geological features in this basin, we collected 104 E-W trending 2D seismic reflection profiles with a line space of 50 m and a CDP distance of 12.5 m, and built a 3D seismic image cube using 3D seismic data processing approach. The 3D seismic cube constructed for this study covers an area of 65 km2, and interpretation of the 3D cube was carried out with the Kingdom Suite software package.
Even within this small area, complex structures and deposition patterns are observed. A double anticline with thrust faults bounding its western flank has developed in the western part of this slope basin. This fold and fault structure merges into the large anticlinal ridge at the western edge of the basin further north. Southward, it connects to a small diapiric ridge developed in the central part of the basin. The small diapiric ridge which appeared near the southern edge of the 3D cube actually pierces above the sea floor further south, as revealed by bathymetry data. Most of the sediments deposited above the small anticline show little or no compressional characters, suggesting that the active convergence is no longer active in this region. The small diapiric ridge formed in the axial part of the slope basin could be formed by differential loading process. Sedimentary sequence analyses and 3D time slice images also reveal the canyon infilling processes, and suggest that the submarine canyon which flowed along the axis of the slope basin is no longer active, while another submarine canyon (the Fangliao Canyon) joins this slope basin from east at a later stage and is now still active. This study demonstrates the value of 3D seismic data in revealing details of the slope basin development.