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Pseudo 3-D analysis of seismic data at seep locations in the Wairarapa area offshore New Zealand

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Gas hydrates constitute a large reservoir for hydrocarbon gases, forming at continental slopes at high pressures and low temperatures. They may play a role in slope stability although the influence of changes in the hydrate stability conditions on slope failures are not yet fully explored. During the cruise SO 191-1 on RV Sonne, a number of multichannel seismic profiles have been recorded together with wide-angle observations to analyze gas and gas hydrate deposits in the area of Wairarapa, south-east of the Northern Island of New Zealand.

This area is dominated by a compressional/transpressional tectonic setting related to the subduction of the Pacific Plate under the Australian Plate. Bottom simulating reflections (BSR) have been observed along the entire margin and also on our profiles. Where the base of gas hydrate stability (BGHSZ) follows the stratigraphy, a bundle of high-amplitude reflections appears instead of the BSR. Considerable signal attenuation beneath the BGHSZ reduces the signal penetration from up to 1.5 s TWT beneath the seafloor to 0.5s TWT. Several slumps and apparent sediment wave formations are found where the slope steepens.

While the present seafloor bathymetry shows an elongated high, the seismic sections reveal a second anticlinal structure in the subsurface and a depression in between indicating a change of tectonic regime presumably in the past 1 or 2 million years. This corresponds to a rotation of the Hikurangi forearc of 50˚ from WNW in early Miocene to ENE today. The stratigraphy above the BSR seems to be dominated by relatively

rapid deposition from mass wasting processes such as turbidites and channelized sediment transport deposits. Other than some minor fault displacements and fractures the structural deformation imprints appear to have ceased in the upper stratigraphic record. The position of a paleo-canyon can be clearly traced in deeper strata in between the structural highs.

Heat flow values estimated from the depth of the BSR are very constant in the working area except beneath the slumps. This indicates that the BSR has not yet adapted to the new seafloor level, which shows i.e. the slumping has happened within the last few thousand years