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Possible Causes of Double-BSRs on the Hikurangi Margin, New Zealand

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Bottom Simulating Reflections (BSRs) mark the base of gas hydrate stability (BGHS), which are thought to originate from the contrast existing at the interface separating high velocity partially hydrate-saturated sediments above low velocity sediments containing free gas. BSRs occur at the thermobaric conditions for the phase boundary of gas hydrate, which depends on gas composition, ionic strength of the water, the abundancy of gas, and many other factors. Therefore, BSRs should be sub-parallel to the seafloor. However, recent seismic profiling of the Hikurangi margin east of New Zealand indicates the presence of double BSRs. Both BSRs are clearly separated on the seismic section, and display negative polarity compared to sea floor. The shallower BSR (BSR1) is found to be at similar depths as BSRs regionally, but the deeper BSR (BSR2) is found at an anomalous depth. From the velocity analysis of the newly acquired seismic data, we suggest two hypotheses: 1. BSR2 could be the result of the presence of hydrates containing higher-order with a second base of gas hydrate stability as mixture of gases tend to form more stable hydrates. This means that BSR2 may form at a level of the BGHS for a more stable gas mix; residual gases may migrate further until they reach the phase boundary for less stable hydrates at BSR1. 2. BSR2 stayed immobile during an uplift while BSR1 was formed at the new BGHS. We, here, present results that let us favor the second hypothesis.