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Gas hydrate occurrences from seismic analysis Offshore Chile Vargas-Cordero, I.¹, Tinivella, U.², Villar-Muñoz, L.^{1,3} and Toledo-Rubilar, P.¹

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Natural gas hydrates are deposits of water and gas in an ice-like form occurring on continental margins below seafloor and in permafrost. They are stable under relative low temperature and high pressure. Studies of natural gas hydrates normally deal with mining, their spatial distribution, geohazards and climate change. In the last decades, gas hydrate occurrence along the Chilean continental margin has been well documented. Until now, however, few studies have been done to better define the seismic character of the hydrate bearing sediments. To fill this knowledge gap, we performed a detailed velocity analysis by using the pre-stack depth migration methodology on part of multichannel reflection seismic line SO161–40 located offshore Valdivia.

Results from the velocity model show a hydrate bearing layer above the BSR, with high velocity (1800 to 2500 m/s), a maximum thickness of 500 m and a free gas bearing layer below the BSR, characterized by low velocity (1600 m/s). A weak reflector at about 100 m below the BSR marks the base of the free gas layer. Particular attention is devoted in analysing the base of the free gas layer. In order to better underline this reflector, we performed a pre-stack time migration that improved the stacked image. Moreover, from Amplitude versus Offset theoretical curves, we know that the reflection amplitude increases for a large offset, as confirmed when comparing the stacked section with near, medium and far offsets.

By knowing the BSR depth, the sea floor depth, and the sea bottom temperature from direct measurements, the geothermal gradient was estimated. The resulting geothermal gradient varies from 25 to 45 °C/km. In order to quantify the amount of gas phase, the velocity model was converted into a gas-phase concentration model by using a theoretical approach. The results indicate a range of 5 to 10% of the total volume of gas hydrate concentration, while low concentrations of free gas are detected (0.1 to 0.5% of the total volume). Average concentrations are equal to 8% and 0.4% of the total volume for gas hydrate and free gas respectively, confirming that this area is very interesting from a gas hydrate point of view.

