Gas Hydrate Volume Estimations in the Western Continental Margin of India

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Summary

Multi-channel seismic data acquired on the Western Continental margin of India show some instances of promising BSR's. There are some localized occurrences, which have been established by the presence of BSR and some AVO studies that were carried out in those regions. The paucity of well-log data inhibits the computation of the volume estimates of these gas hydrate reserves. So the present study uses and alternative approach based on the relationships between the interval velocity and porosity. The interval velocities were derived using the finite difference routines and the porosities were deduced from their relationship with the sub-bottom depth for terrigenous sediments. We computed a baseline model for velocities and porosities of non-gas hydrate bearing sediments in the area based on the velocity jumps observed at the BSR. The volume estimates are computed from the interval velocity configuration of the gas hydrate bearing sediments and the baseline models for non-gas hydrate bearing sediments using the Biot-Gassman Theory.

Introduction

Natural gas hydrates have attracted the attention of the scientific community world wide mainly because of their potential as a alternative energy source and the vast amount of the methane associated with the hydrate. The global volume of methane varies from 10^{15} to 10^{17} m^3, which exceeds all other forms of conventional energy. The presence of hydrates is indicated in the seismic reflection profiles as a bright high amplitude reflection that parallels the seafloor and deepens with the increase in water column. However, the quantitative aspect of the hydrate reserves is not accurate unless there is a well/sonic log drilled in the region. The area considered for the present study is located in the western continental margin of India and does not have any information and this has deterred the computation of the volume estimates for the study area. The presence of gas hydrates in this region has been inferred earlier (Gupta et al, 1998; Rao et al, 2001; Reddi et al, 1998; Veerayya et al, 1998). In the present paper we present a concerted effort to calculate the volume estimates based on the relationship between the velocities and porosities.

Methodology

For the purpose a seismic line from the Western Continental margin of India is considered. We present computations in the case of both hydrated and non – hydrated sediment present in the same profile. The interval velocities are estimated for the both the cases, using a finite difference approach. The porosities are derived from the Hamilton's relationship using the sub-bottom depth for the sediments.

The amount of increase in velocity of the sediments can be treated as directly corresponding to the compaction and thereby, the porosity of the sediments. Qualitatively, we may extend the argument that the mount of velocity increase is proportional to the amount of gas hydrate present in the sediment. Thus, we need to have the information about the porosities and velocities in non-hydrate bearing zones so that we can estimate the amount of the hydrate in sediments from the increment in velocity. This becomes a baseline model for our study. Since we lack the well-log information, we will use the reference velocities for normally compacted sediments (Hamilton, 1979) and the porosities that are derived from the Hamilton relationship (1976), wherein we can relate the porosity and the sub-bottom depth. This becomes the baseline model.

Having the baseline model, we now compute in the interval velocity from the finite difference routines and assume that the velocity variations are partly due to compaction. Having knowledge of these values, we estimate the amount of gas hydrate present in sediment using the Biot-Gassmann theory. The final estimates resulting from this study will be presented at the workshop.

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