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Numerical Modeling of Petroleum Generation and Accumulation in the Sora Basin, Offshore Southern Korea

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Petroleum system modeling calculates and visualizes how and when hydrocarbons generate, migrate, and accumulate in a sedimentary basin. Therefore, it can be used effectively to predict the future prospects of oil and gas based on the understanding of the petroleum system in time and space. The petroleum system modeling was performed on the Sora Basin which is a small Cenozoic basin located offshore southern Korea, also including the offshore area of western Kyushu, Japan.

Oil and gas shows were detected in two wells drilled in the basin, indicating that petroleum systems are present in the basin. Input parameters were selected from the well data as well as previous geological and geophysical studies for the 1-D model, from which thermal parameters such as heat flow and thermal maturity are also calculated and applied to 2-D model.

The 2-D modeling was performed on an E-W seismic section across the basin from western margin in the Korea Block to eastern margin in Japanese Block. The PetroMod software was employed in the 2-D modeling, and stratigraphy, including lithology and organic content, was obtained from the wells and previous geological studies. 2-D modeling shows that hydrocarbons were expelled from the pod of the Eocene source rock in the Miocene time. The hydrocarbons migrate vertically along faults to the upper Oligocene sandstone formation, rather than the updip migrations along the sandstone bed, and hence form small-sized accumulations in the upper part of the sandstone formation.

3-D model was also performed based on depth maps of each formation in the Sora basin. Hydrocarbons are generated and expelled from the pod of the source rock of Eocene formation from 32Ma. In addition, the 3-D model shows that the hydrocarbon migrates northwestward and eastward in the carrier bed of sandstone.

The petroleum models indicate that only a small amount of hydrocarbons are accumulated in the reservoir formation, probably due to small size of the basin and low degree of maturity and burial. The model also shows that faults play a critical role for the migration and accumulation of hydrocarbons.