
GEOCHEMISTRY A TOOL FOR IDENTIFICATION OF COMPARTMENTALIZATION FOR PAB SANDSTONE (SUI GAS FIELD) PAKISTAN

Fareed I. Siddiqui, Asif A. Syed, Hamid Hussain, S. Rashid .H. Gilani, M. Faisal

Pakistan Petroleum Limited, Karachi

ABSTRACT

Sui gas Field, located in the Sulaiman sub-basin of the Indus Basin (Pakistan), was discovered in 1952 and to date 93 wells have been drilled in it. Structurally, the field is located in the first set of folds emerging from the Indus flat planes, west of Indus River. The major axis of the structure at surface is about 55km long and is in the east west direction. The surface dips are gentle and range from 1° to 4°. It is an almost dome shaped structure, exposing surface rocks down to lower Siwaliks that are marked by the rocky outcrop forming low hills and cliffs all around. Gas has been discovered in three reservoirs up till now with two reservoirs from Ypresian age and one Maastrichtian age. Further hydrocarbon potential, possibly tight gas, exists in the deeper formations.

The two Ypresian reservoirs, Sui Upper Limestone (SUL) and Sui Main Limestone (SML) were discovered in 1952 and contain major portion of the reserves with 1.28 Tcf in SUL and 12.5Tcf in SML reservoir. The SUL and SML reservoirs are laterally continuous and are interlain by laterally continuous Ghazij Shale. The third discovery in the field was made in 1999 in Maastrichtian aged Pab Sandstone reservoir by Sui-87(P) which tested 40m of gross sand above the gas water contact (GWC). Since then, Pab reservoir has been tested in five wells out of which three wells Sui-90(P), Sui-91(P) and Sui-92(U) were drilled inside the GWC identified in the discovery well. Unexpectedly Sui-90(P) ended into a possible graben while Sui-92(U) ended in a zone with shallower GWC indicating possible compartmentalization of the reservoir. The fourth appraisal well, was deepening of existing well Sui-52(U/M) was located beyond the identified GWC and was dry.

2D seismic data with an average line density of 1500 to 4000m is available which is not enough to identify either structural or stratigraphic compartments in the reservoir. In the absence of detailed support from the seismic we have used geochemical data from the wells supported by the drilling, logging and production data to confirm the existence of compartments in the Pab reservoir. Gas and water samples from the producing wells Sui-87(P), Sui-91(P) and the downhole gas and water samples collected from the formation tester run in Sui-92(U), suspected to be in different compartment, were sent for detailed geochemical analysis to ascertain compartmentalization of Pab reservoir. Gas samples were analyzed for $\delta^{13}\text{C}$ and hydrogen isotope while strontium isotope analysis was performed on water samples.

The results show that gas samples from Sui 87(P) and Sui 91(P) have similar isotope values which are significantly different than Sui 92(U). This strongly suggests that Sui 87(P) and Sui 91(P) lie in one compartment different from Sui 92(U) which is further corroborated by formation evaluation data. The isotope results will be used in combination with the 3D seismic data to reduce the risk in appraisal and development of Pab reservoir at Sui Field.