Paper Number: 1322

Clay mineralogy in parts of the subsurface of Tapti – Daman block, western offshore basin, India: a lead to reservoir characterisation

Sarkar Ashish

School of Petroleum Technology, PDPU, Gandhinagar 382007, Gujarat, India; e-mail: ashish29s@yahoo.co.in

---

Reservoirs are one of the important components of the petroleum systems, the characterization of which is necessary during the exploratory stage in order to understand the hydrocarbon potential of the basin. Appraisal of the petrophysical property during the exploration is a part of the reservoir characterization, which enables to understand the ease/difficulty of flow of petroleum to the well during the exploitation stage. Presence of clay minerals in the reservoir has been found to be detrimental to the permeability, which reduces the flow to the wellbore significantly by damaging the reservoir. During petroleum production, while kaolinite may get dislodged and clog the pore-throats in the clastic reservoirs, smectite being water sensitive would swell with fresh water [1], both causing decrease in permeability of the reservoir. In addition, by coating the grains, smectite reduces the dimension of the pore-throats. Chlorite reacts with acid during the acid treatment, the precipitates of which damages the permeability. Illite is equally detrimental, which bridges the gaps between the grains and severely deteriorates the permeability [2].

Western offshore basin as a whole is a prospective petroliferous basin, of which the giant oil fields of Bombay offshore are producing since seventies of the last millennium. During the exploratory stage in the last decade in the Tapti – Daman block in the western offshore basin, the finding of encouraging ‘source rocks’ with oil window coupled with favourable ‘structure’ in parts of the basin necessitated the ‘reservoir’ appraisal in the area (Well – B), which has been attempted in the present work. Megascopically the lithology in the studied section is mainly moderate to poorly sorted sandstone – at times calcareous, shale along with siltstone, claystone and argillaceous limestone. While presence of carbonaceous matter in the shale is suggestive of its continental origin, the presence of siderite in the sandstone, claystone and siltstone is indicative of near surface oxidizing condition in the studied section.

In view of the above, to identify the clay minerals present at different levels, X-Ray Diffraction analyses (both oriented and glycolated) of five selected core samples within an interval of six meters from conventional core of Well-B have been carried out on the separated clay [3, 4]. Semi quantitative estimates for the abundances of the clay minerals present in the samples were done with the help of Energy-Dispersive X-Ray Spectroscopy (EDS) analyses. While Illite has been found to be absent in all the samples, at the the bottom most samples do not contain any chlorite (7% montmorillonite and 93% kaolinite). The rest top four samples contain only chlorite (between 6% and 16%) and kaolinite (between 84% and 94%). The absence/paucity of montmorillonite, illite, and chlorite in all the samples in the studied 'fractured' section indicates a better reservoir property in terms of permeability, which has been corroborated with the help of Scanning Electron Microscope (SEM) photomicrographs.

References:

[1] Selley RC (1988) *Applied Sedimentology*, pp. 8, 51, 55, 64.

[2] Almon WR & Davies DK (1981) Formation damage and crystal chemistry of clays. In: Longstaffe FJ (ed) *Short courses in clays and the Resource Geologist*, Miner Assoc Canada, 7, pp. 81–102.

[3] Carroll D (1983) *Clay minerals: A guide to their X-ray identification*, pp.1,14, 26,58.

[4] Saikia HC (1991) Mineral identification using X-ray diffraction, chap.8, *Standard laboratory techniques and procedures in Geology*, Unpublished Report, WOB, ONGC, Mumbai, p.141.