

THE RESERVOIR POTENTIAL OF CARBONATE HORIZONS OF KIRTHAR FORMATION, EASTERN SULAIMAN RANGE, CENTRAL INDUS BASIN, PAKISTAN

Dr. Riaz A. Sheikh¹, M. Athar Jamil², Dr. Ghulam Abbas³, and M. I. Saqi⁴

¹*Institute of Geology, Punjab University, Lahore; Pakistan; dras51@yahoo.com*

²*Tullow Pakistan Developments (Limited), Islamabad; athar@tullow.com.pk*

³*Calgary, Canada; abbasisb@hotmail.com*

⁴*Pakistan Petroleum Limited, Karachi; m_saqi@ppl.com.pk*

Kirthar Formation (Middle to Late Eocene) is conformably underlain by Ghazij Formation/Baska Formation (Early Eocene) and is unconformably overlain by Nari formations (Rakhi-Gaj, Sherani area, near Drazinda) Vehowa (Sheranna Nala, South Waziristan) and Litra Formation (Tochi River Section, Bannu – Miran Shah Road, North Waziristan) from south to north in Sulaiman sub-basin (Sulaiman Depression) of Pakistan. It is comprised of four lithologic units: Habib Rahi Limestone member, Sirki member, Pirkoh Limestone and Marl member, Drazinda member. These units are persistently present with variable thickness upto Gomal Zam (South Waziristan) beyond that four fold division of Kirthar Formation is lost. These four lithologic units are end results of relative sea-level fluctuations in combination of tectonic events.

Nine major microfacies are recognized in >200m core and 245 outcrop samples from eleven (11) limestone horizons recorded in the Kirthar Formation which have been grouped into five depositional facies. Thick alabaster in the upper part (Baska Formation) represents Late Early Eocene regressive cycle resulting in restricted, evaporitic basin. A thin, about 1m thick Assilina bed marks transgression before Habib Rahi Limestone. The Habib Rahi Limestone member can be divided into lower, progradational and upper, retrogradational parasequences. The Habib Rahi Limestone member and Pirkoh Limestone and Marl member were deposited in ‘start-up’, ‘catch-up’ to ‘keep-up’ patterns. The lower part of the Habib Rahi Limestone member has reservoir potential; while middle part may be a significant source rock. A part of the Pirkoh Limestone and Marl member also exhibits transgressive system tract (TST), in fact maximum deepening marked by a large number of planktons. The limestone members experienced shallow to deep burial diagenetic environments. The post burial dissolution has generally preserved secondary porosity. However, the microvuggy matrix and solution enlarged secondary intraparticle porosities are common to abundant in the southern and northern part. These porosities are generally fabric selective and facies related.

Field and laboratory studies revealed that the reservoir characteristics of lower part of the Habib Rahi Limestone member should be well developed in the southern part (Qadirpur, Kandhkot, and Mari Gas Field) of the Sulaiman sub-basin, where potential facies for porosity development (platform edge/shoal/lagoonal in the lower part of Habib Rahi Limestone member) are deposited on paleohighs. Same is the case with Pirkoh Limestone and Marl member which has good reservoir potential in south western and southern parts of the study area. The source rock potential facies in Habib Rahi Limestone member (deep, open marine shelf basinal) are thickly deposited in the central part of the basin, where the environments were more suitable for deposition of organic rich oil shale horizons. The pattern of isopachs of the Habib Rahi Limestone member and Pirkoh Limestone and Marl member suggest that both pinch out in the northern part of the Sulaiman sub-basin, however, eastward termination of these carbonates might have developed stratigraphic traps.