Reservoir Rock Quality of the Lakadong Member in the Eastern Part of Upper Assam Basin, India*

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Abstract

The Upper Assam basin is the earliest explored petroliferous basin of India. It represents the northeastern extremity of the Indian subcontinent encompassing an area of about 57,000 km^2 and forms the northeastern part of Assam-Arakan geological province (Figure 1). Tectonically the Upper Assam Basin represents a structurally wrapped foreland basin between two convergent plate margins and came into existence during Early Cretaceous time. The generalized stratigraphy of the Upper Assam Shelf in the study area is given in Table 1.The Lakadong Member (Upper Palaeocene - Lower Eocene) of the Sylhet Formation in Upper Assam is of interest because it contains sandstone reservoirs, which are prolific producers of oil and gas. The thickness of this member in the area varies from 60 to 150m. The sandstone beds range in thickness from less than a meter to about 13m. In spite of having lower thickness the productivity from these classic reservoirs are very high. Diagenesis has played a major role in controlling reservoir quality of these reservoir sandstones.

Samples of conventional and sidewall cores along with drill-cuttings and wireline logs of Upper Palaeocene-Lower Eocene age recovered from wells located in different parts of the area have been studied with respect to petrography, diagenesis and lithofacies characteristics. The study of reservoir rocks includes general mineralogy, primary and secondary porosities and the important diagenetic features that control the reservoir quality as seen in Figure 2 and Figure 3.

The Upper Palaeocene – Lower Eocene sandstones are quartz arenites to sublitharenite and less commonly of lithic wacke type. The general mineralogy of the sandstones includes mainly subrounded to subangular quartz particles (although angular and rounded

particle are present), along with feldspar, glauconite, calcite, clay minerals such as kaolinite, chlorite, illite and minor smectite, and heavy minerals. These reservoir sandstones contain generally large secondary pores, which are numerous in certain producing horizons. These have developed mainly due to the activity of interstitial solutions. Fracturing and dissolution of quartz, feldspar, rock fragments and the cementing materials are some of the important diagenetic changes that make the reservoir to be highly productive. Moreover, the sorting of the minerals and the presence of micro fractures within the framework grains enhance the porosity and permeability in these sandstones. On the other hand, development of authigenic minerals as well as the overgrowths and presence of clay minerals in the pore spaces, as revealed from scanning electron microscope studies, affects the reservoir quality. Data generated from conventional core and drill-cutting analyses together with wireline log information indicate the presence of three sets of lithofacies within the member. These lithofacies have developed because of changing palaeoenviroment conditions.

Reference

Handique, G.K., and R.K. Mallick, 1989, Neogene sediments of upper Assam intermontane basin and their hydrocarbon potential, *in* T. Thanasuthipitak, and P. Ounchanum, (eds.), Proceedings of the international symposium on Intermontane basins; geology and resources: Chiang Mai University, Chiang Mai, Thailand, p. 13-28.

Epoch	Lithostratigraphic Units: Group	Formation		Thickness (m)	Major Lithological Types
Recent	-	Alluvium			
Pliestocene	Dihing	Dhekiajuli		1300- 2000	Unconsolidated sands with clay and lignitic sands.
Unconformity					
Pliocene Miocene	Dupitila	Namsang Beds		0-1000	Poorly consolidated sandstone with clay and lignitic sands
Unconformity					
Miocene	Tipam	Girujan Clays		100-2300	Mottled clay with sandstone lenses.
		Tipam Sandstones	{Upper	300-500	Essentially arenaceous sequence
			{Middle	100-200	Sand/shale alteration sequence
			{Lower	100-200	Arenaceous sequence
	? Surmas	Not subdivided			Sandstone with shale and grit bands
Unconformity					
Oligocene	Barail	Not subdivided		500-1200	{ Upper Part: Mudstone/sale with sandstone beds and coal bands (Argillaceous sequence) { Lower Part: Sandstone with shale bands (Arenaceous sequence)
Eocene	Jaintia	Kopili alterations		280-500	Splintery shale with sandstone and fine-grained sand-stone with coal bands.
		Sylhet Limestone	{Prang {Nurpuh {Lakadong	350-450	Splintery shale with sandstone and limestone bands
	Therria			60-170	Sandstone, calcareous sandstone and limestone
Unconformity					
Precambrian granitic basement					

Table 1. Tertiary Succession of Upper Assam Shelf sediments (modified after, Handique et. al., 1989).

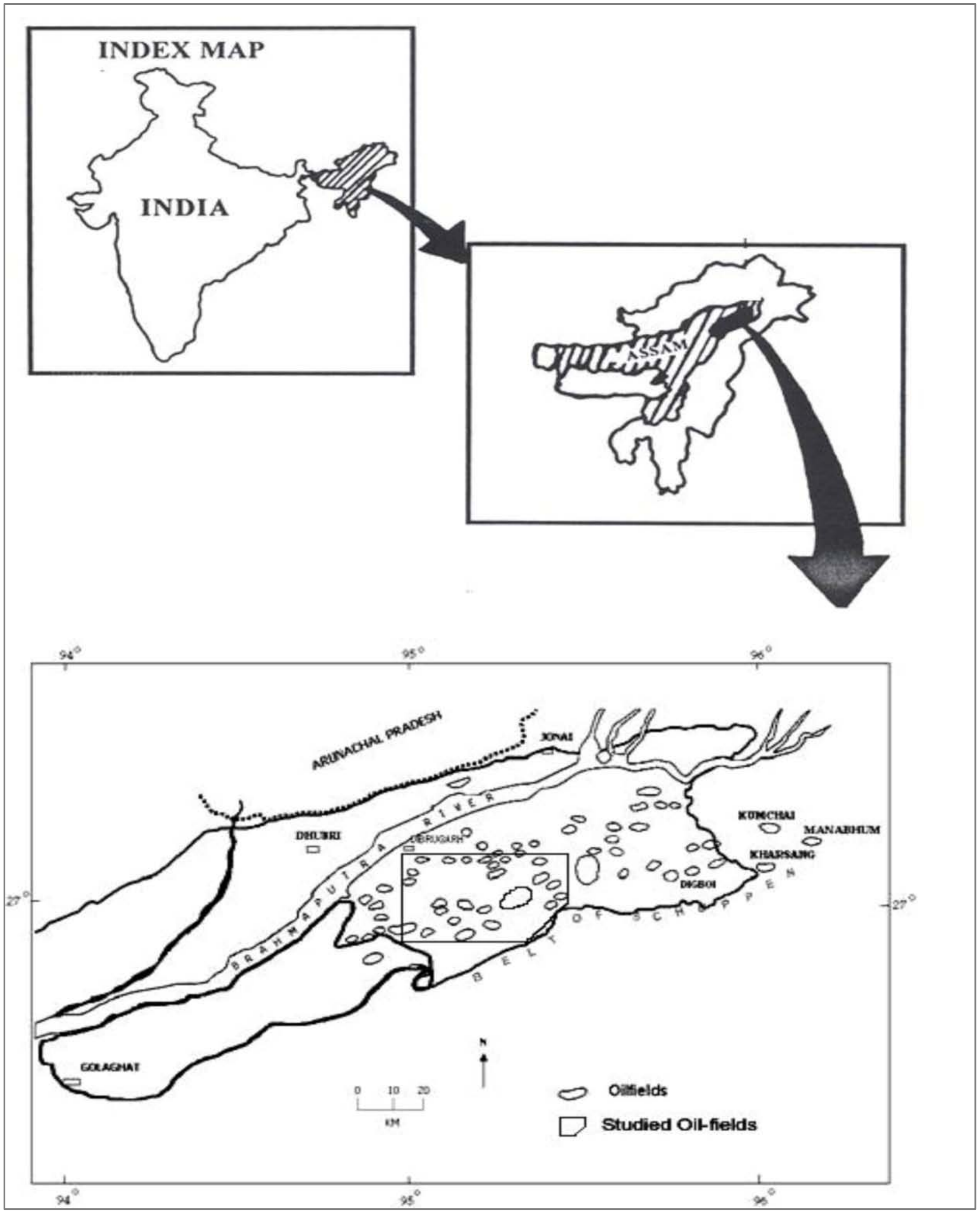

Figure 1: Location map of the study area.

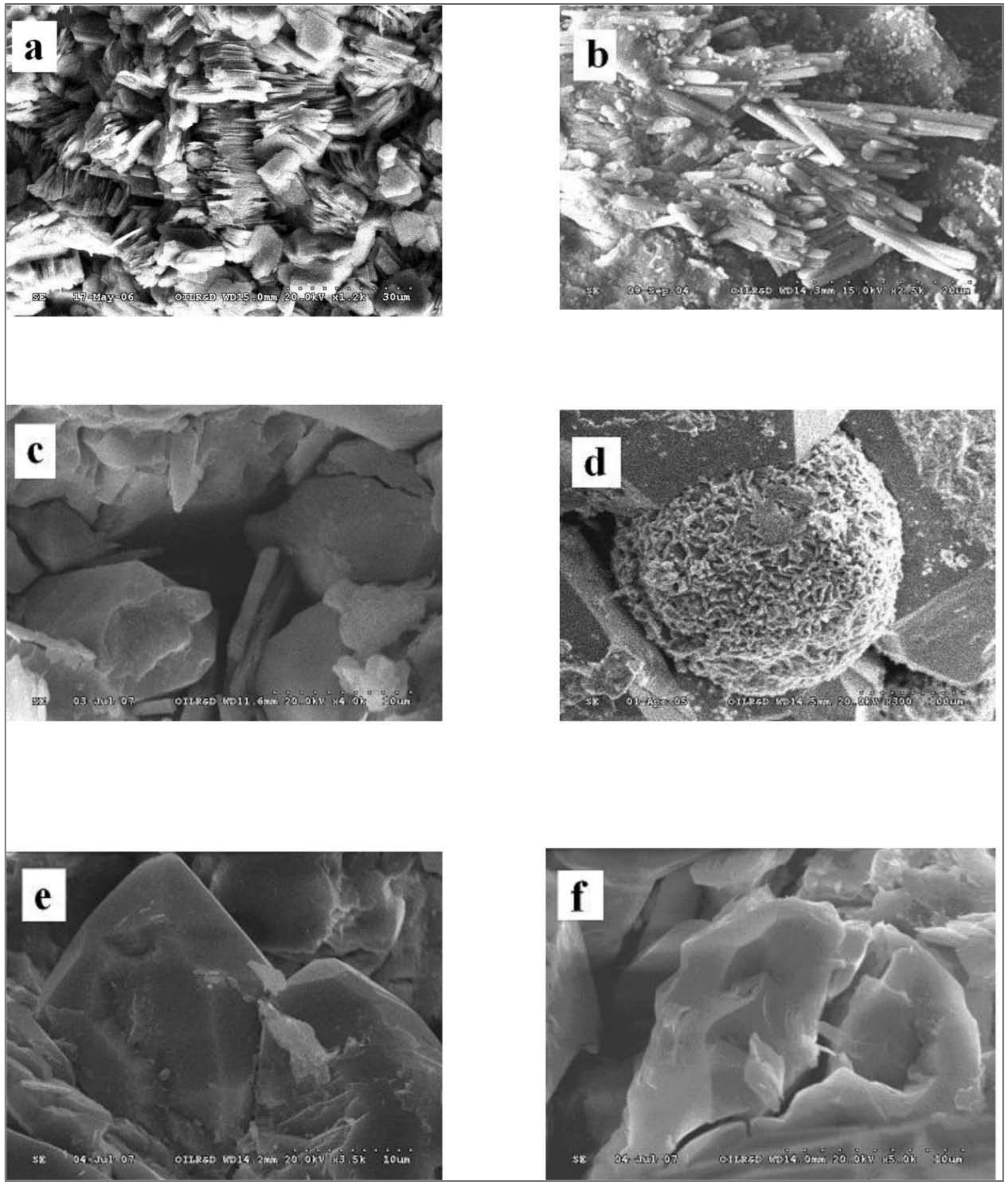

Figure 2. SEM photomicrographs of Lakadong reservoir sandstones: a) kaolinite books, b) gypsum crystals, c) intergranular pore, d) glauconite developed in pore space, e) quartz overgrowth, f) microfracture in framework quartz.

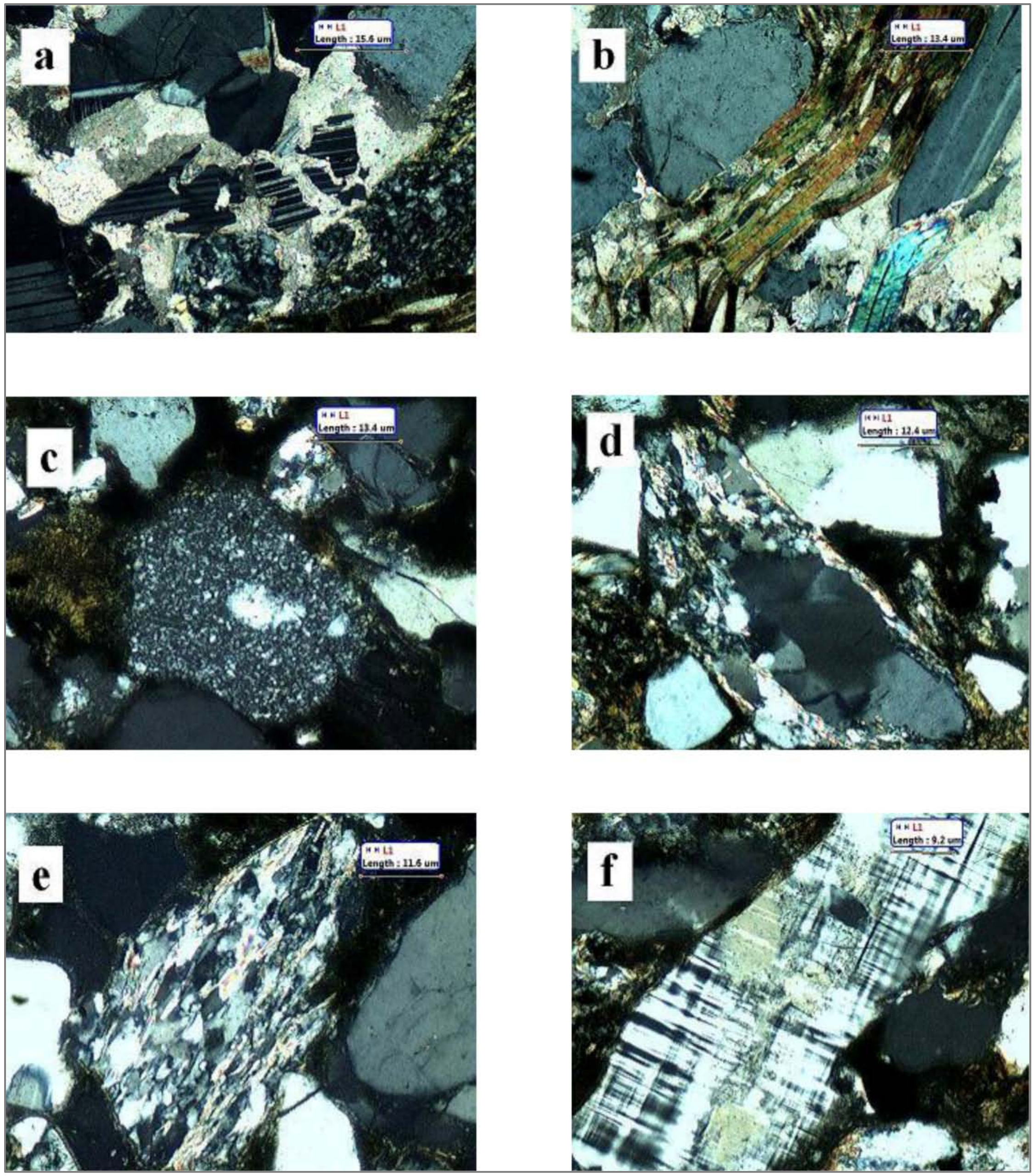

Figure 3. Photomicrographs of Lakadong reservoir sandstones: a) dissolution of quartz and feldspar grains (100x), b) dissolution and kink bend of mica flakes (100x), c) authigenic chert (100x), d) rock fragment (100x), e) metamorphic rock fragment (100x), f) surface corrosion on microcline grains by cementing material (100x).