Chapter 1

Introduction

The search or economic accumulations of oil and gas starts with the recognition of likely geological provinces, progresses to seismic surveying, and the drilling of one or more wild-cat wells.

If one is lucky, these wells may encounter oil, and if that is the case, measurements made down the hole with wireline tools are used to assess whether sufficient oil is present, and whether it can be produced.

Clearly, the evaluation of sub-surface formations requires the combined efforts of geologists, petrophysicists, drilling engineers and even geophysicists. However, it is the geologist and petrophysicist that has the most influence.

The geologist is interested in the lithology, stratigraphy and depositional environment of the subsurface strata penetrated by the drilling bit.

The exploration geologist uses wireline tool responses in a number of wells to create a large scale image of the sub-surface geology by correlating wireline responses that are characteristic of a given formation or horizon between formations.

This picture is very useful when carrying out initial reservoir modeling and in the decision where to drill new wells.

Later the production geologist carries out much the same process with much more well information, and adds any extra information that has been gathered to produce a detailed geological model of the reservoir and related sub-surface formations.

This model will be the basis of reservoir modelling, and all major reservoir management decisions from primary drainage through to enhanced oil recovery and shut-down.

The petrophysicist’s job is to use all available information to analyze the physical and chemical properties of the rocks in the sub-surface, and their component minerals, with particular emphasis given to the amount and distribution of those fluid minerals that we know of as water, oil, and gas.

The petrophysicist will use extensively wireline log data and data from experiments done on cores extracted from the well, and will occasionally use other sources of information such as engineering and production logs, as well as mud logging data.

Initially, it is the aim of the petrophysicist to differentiate between oil, gas and water bearing formations, estimate the porosity of the formations and the approximate amount of hydrocarbons present in each formation.

Ultimately, the petrophysicist also uses laboratory data to estimate how easy it will be to extract the hydrocarbons in place, and to design reservoir management strategies to optimize long term oil recovery.

There is a large database of information available to both the geologist and the petrophysicist, and as time passes the amount and variety of information increases.

Table(1.1) summarizes a few of the main measurement that a geologist or petrophysicist will have access to, arranged in approximate chronological order.

It is the responsibility of the wellsite geologist or engineer to ensure that all this data is properly collected and recorded. (Glover,2001).

It should be remembered at all times that the main job of the petrophysicist is to evaluate the amount of hydrocarbons in place in the reservoir.

Hence, the evaluation sequence for a straightforward reservoir will be as follows For any given well interval:

1. Distinguish between reservoir and non-reservoir rock (Reservoir rock contains a reasonably high connected porosity).
2. For the reservoir intervals only, distinguish between hydrocarbons and water filling the pores, hence calculate water saturation in reservoir rocks (Hydrocarbons are electrical insulators, while water conducts).
3. For the hydrocarbon fraction, distinguish between oil and gas, hence calculate gas and oil saturations in reservoir rocks (Gas has a much lower density than oil).

Table 1.1 Main sources of data concerning sub-surface rocks.

Source	**Data Type**
Drilling (Mud logging)	Rate of penetration of drill bit (ROP) Analysis of drill cuttings Analysis of drilling mud Shows of gas, oil or water Gains or losses of drilling mud
Wireline Logs	Mechanical logs (e.g., calipers) Electrical logs (e.g., laterologs, induction logs, SP logs) Natural radiation logs (e.g., simple and spectral gamma ray logs) Acoustic logs (e.g., sonic logs) Pressure and temperature logs Artificial radiation logs (e.g., density and neutron logs) Imaging logs (e.g., dipmeter and various other types) Special logs (e.g., NMR logs)
cores	Lithology Hydrocarbon shows Heterogeneity and fracturing Porosity Permeability (Klinkenberg, liquid and relative permeability) Wettability and capillary pressure Grain and pore size distributions
Production Logs	Formation testing (e.g., RFT –Repeat Formation Tester) Drill stem tests Production tests Pressure build-up and spinner tests

1.1. Aims Of Study:

This study deals with the calculation of petrophysical properties from wireline logs (i.e. Gamma ray log , caliper log , resistivity logs , and porosity logs) and Laboratory measurements of porosity , permeability and fluid saturation from core analysis .

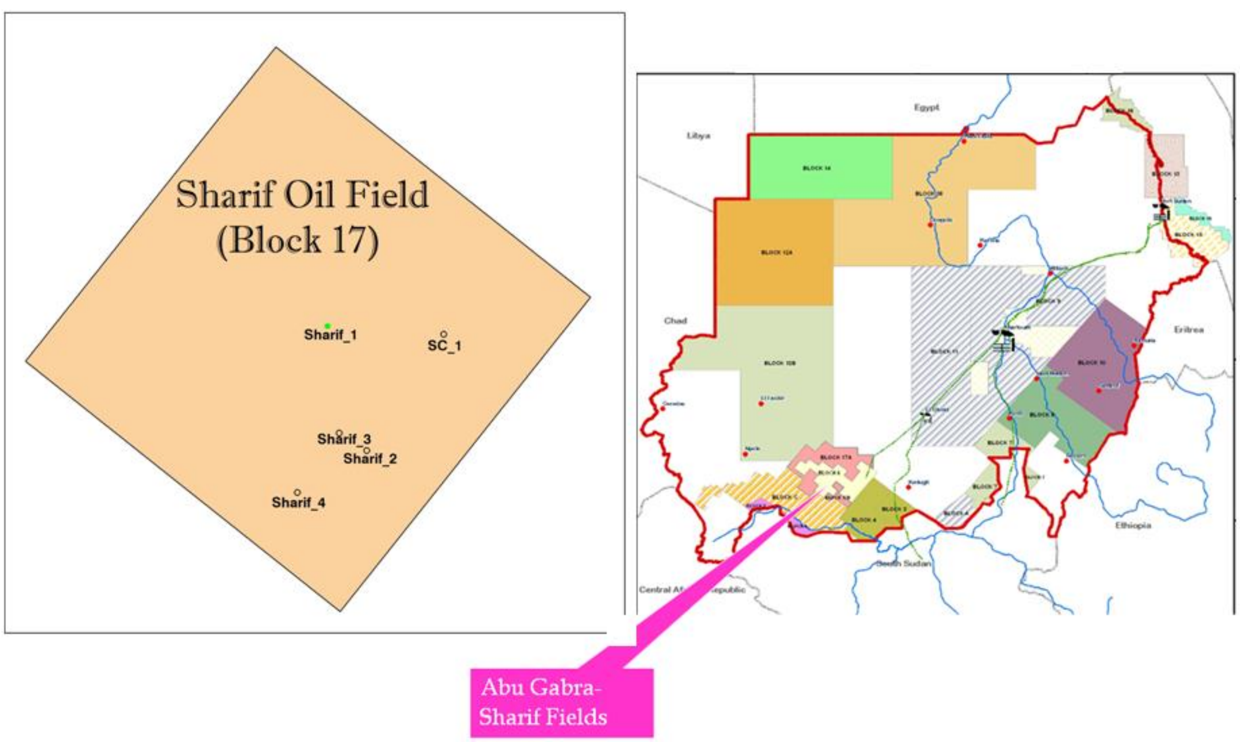
This research concerned with the following points :

- Lithology identification.
- Calculation of reservoir properties (porosity, saturation, shale volume …etc).

1.2. Location of The Study Area:

The Sudan interior basin is part of a trend of cretaceous sedimentary basin of apparent origin which cut across north Centeral Africa from the Benue through in Nigeria , through Chad and the Centeral Africa republic , into Sudan. The Muglad Basin located in Western Darfur State (100km far from Khartoum), near to town of Bentiu.

The sharaf (1) located approximately bounded by latitudes 11° 22' 10.47" N , longitude 27° 05' 59.66" E . Sharaf(2) located approximately bounded by latitudes 11° 21' 40.02" , longitude 27° 06' 09.47".



Figure(1.1): illustrates sharaf oil field.

Sharaf (1) was twelfth exploratory was drilled in chevron's interior Sudan concession. it is located on the northwest segment of Abu Gabra trend . Sharaf(1) is located approximately 37 miles northwest of Abu Gabra(1) and 10 miles north of Adila(1). Sharaf(2) is located 0.93km to the south of sharaf(1).

1.3. Data Include:

we have two wells data which include the following items :

- Well logs data.
- Drilling fluid.
- Formations test report.

1.4. Methodology:

The data analyzed with Interactive Petrophysics(IP) software. Schlumberger conducted the wireline logging. An important step in well log interpretation is the estimation of shale parameters such as: gamma ray reading in shale (GRsh), shale resistivtiy (Rsh), shale density (ρsh) and shale neutron porosity (ØNsh), which have determined either statistically using the frequency crossplots or directly from the well logs.