CHAPTER ONE

INTRODUCTION AND SCOPE OF WORK

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1. Introduction:

Evaporites have been received renewed attention through the last century concerning origin and bio-saline roles on mineral solubility. The last decades witnesses rising interest initiated particularly by sedimentologists (e.g. Shearman, 1963; Haride and Eugster, 1971; Schreiber *et al*, 1976), who recognized that evaporites can not only be treated as chemical deposits and/or precipitates, but can also be interpreted as sediments with facies assemblages characteristerizing a certain environment of deposition. Understanding precipitation of evaporites (manner and rates) was greatly developed by the study of modern evaporitic depositional settings such as sabkhas (e.g. Shearman, 1963; Purser, 1985; Wali *et al*, 1995 and others). The contnential salt lakes of Western America and Eastern Africa (Eugster and Haride 1978) and Western Desert of Egypt (Wali *et al*, 1989), the gypsum lakes of southern Australia (Warren, 1989) and modern marine salinas allover the world (e.g. Javor, 1989 and others). The combined work of sedimentologists and biologists on the modern salt setting emphasizes and indicates relationship between the evaporative media and its organic content (e.g. Orti Cabo *et al* 1984; Cornee, 1988, 1984; Gerds and Krumbein, 1987; Evans and Kirkland, 1988; Javor, 1989 and others). The recent studies concluded that evaporite depositional environment are contrary to common believes as not barren but rather are teaming with life and supersede even the most productive ocean releams with respect to primary bioproductivity. This had led petroleum geologist to propose evaporites as a source rock for hydrocarbons (e.g. Friedman, 1980; Evans and Kirkland, 1988; Kerkland and Evans, 1981; Eugster, 1985; Warren, 1986 and Benali *et al* 1995).

Evidences that Evaporites as a source rock for hydrocarbons have been contributed to some of the world's major oil reserves (e.g. Hunt, 1967; Palacas, 1984 and others) based on the unusual composition and habitat of the organic content of many evaporite deposits (e.g. Connan *et al* 1988, 1986; ten Haven *et al* 1988,1985; Sinnighe Damste *et al* 1988,1986; Mello *et al* 1988; Benali and Schriber1995) leading to continual intensive efforts to improve and to strengthen the belief that evaporites are capable to act as a source rock.

Recently, hypersaline recent models have been studied extensively by large number of authors, among them the comprehensive work of Evan and Kirkland, 1988 and many others. The results indicate that the contributed biomass of evaporite environment decrease with increasing salinities. The overall productivity of hypersaline pans remains high and even exceeds the bio-productivity of the most fertile zones of the ocean.

The thick ancient evaporite sequences in the Gulf of Suez (Miocene evaporites) and Mediterranean Sea with its recent analogs e.g. supratidal coastal sabkha at Ras Shukeir were chosen for the present study; hence both Gulf of Suez and Mediterranean Sea basins were of closed type during their development explaining their high evaporite thickness deposits.

Mostafa, 1985; Chowdhary and Taha, 1987; El Zarka and Mostafa 1988; Mostafa *et al*, 1990 and Essam, 1995; suggested that the most strata of Gulf of Suez characterized by kerogen types mostly belongs to type I and type II, which are believed to be derived from algal and planktonic biomass together with microbial residues which are accumulated under saline to hypersaline and moderately to highly reducing conditions. However kerogen type III and II/III is also present, that mostly is believed to be mainly the result of oxidation influence during the time of deposition.

The chosen localities for the present dissertation will focus on studying comparative analogs (older and recent). The chosen areas are:

1- Ras Shukeir Recent Coastal Sabkha lies on the western side of Gulf of Suez (Figs. 1 and 2). This sabkha is located between Latitudes 28° 6` and 28° 20` N and Longitudes 33° 6` and 33° 15` E.

2- Ras Gemsa Field is located 110 Km south Ras Gharib The field center located between 27° 39` N latitude and 33° 35` longitude (Figs. 1 and 2).

South East Zeit Field lays is located on the east side of Zeit range. The field coordinates are 27° 50` N latitude and 33° 35` longitude (Figs. 1 and 2).

3- Ras Dib Field is located on the west of Gulf of Suez. The field coordinates are 33° 25` longitude and 28° 02` N latitude (Figs. 1 and 2).

4- Shagar Field lies is located 28 Km south of Ras Gharib. Shagar lies at 28° 20` W latitude and 33° 10` longitude in Wadi Garf (Fig. 1).

5- Gubal Island Field is located 20Km off shore east of Ras Gemsa. The center of Gubal Kedir is located at longitude 33° 48` and latitude 27° 28`. The maximum length of island is about 5 Km and Maximum width 2.5Km (Figs. 1 and 2).

2. Scope of the Present Work:

The scope of the present work aims to study the following points, targeting collecting the proofs as to answer whether evaporites could act as a source for hydrocarbon potentialities in Egypt or not, these are:

1. Study superatidal, coastal sabkha sediments and their hydrochemical characteristics of the hypersaline pools at Ras Shukeir (as a recent analog) to categorize their capabilities as to offer favorable condition for accumulation and preservation of organic matter and to estimate quantity (ies) and type(s) of organic material enriched the sediments.

2. Study subsurface cores intervals of Miocene evaporites (tentatively) from wells located at Ras Gemsa, Ras Dib, South East Zeit, Shagar and Gubal island fields, Gulf of Suez area; in additional core intervals from wells at Esh Mallah (Red Sea) and N. Sinai, Mediterranean Sea to widening the correlations based on characterization of organic matter (source rock evaluation) and hydrocarbon potentialities of these older evaporite deposits.
3. Examining and studying the encountered fluid inclusions in old evaporite from the subsurface cores and their significance to prove the relationships between evaporite and hydrocarbons.

3. Statement of the Problem:

During the last decades, there are many attempts have been done to study and identify the source rock in Gulf of Suez and Mediterranean Sea, among of them: Azim, 1970; Boddit and Gallagher, 1978; Rohrback, 1980 and192; Barakat, 1982; Shahin and Shehab, 1984; Shahin, 1988; Mostafa and Ganz, 1990 and Shahin *et al*, 1994 and Essam, 1995.

Petroleum exploration in Gulf of Suez is very difficult due to many uncertainties (Essam *et al*, 1995) hence it was closed basin during its development as the same as the Mediterranean Sea. Seismic data are often limited since large volume of evaporites deposited and overlay the sequence in many cases (Essam *et al*, 1995). Another problem is that nearly all-organic rich horizons in Gulf are depleted in humic macerals and particularly vitrinite is always absent. Even if vitrinitic particles are found, their reflectances are lowered in the presence of high amounts of liptinite-rich algal kerogen (Hutton *et al*, 1980). Also Rock Eval pyrolysis is not reliable in these lithologies (Tissot *et al* 1987). Therefore up to the present few maturation data have been published on the Gulf strata and the real source rock is not yet known, although the Miocene sediments (e.g. Globigerina marls) are sometimes believed to be the main source rock.

Evaporites as a saline environment enclose different species belonging to botanic and animal kingdoms. These species capable to flourished and produce tremendous populations at different salinity levels urging for considering them as capable source to generate hydrocarbons. However, different cases allover the worlds were proved that the evaporites are the source rock, none of the published source rock data in Gulf and Mediterranean sea emphasize or reefer that evaporites could be the source rock but the evolved knowledge indicated that the characteristic kerogen were derived algal and accumulated under hypersaline conditions. So, the present study will cover comparative study including recent sites of sabkhas to prove their capabilities to offer the required conditions as to prevent their biomasses from exposing to aerobic condition with tentative available cores from old evaporite sections in order tie-up their products with the recent and prove that the evaporite could act as source rock in Egypt.