NRIAG Journal of Astronomy and Geophysics (2015) 4, 222–235

National Research Institute of Astronomy and Geophysics

NRIAG Journal of Astronomy and Geophysics

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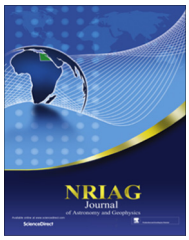

REVIEW ARTICLE

Prospect evaluation of BED 3 and Sitra oilfields, Abu Gharadig Basin, North Western Desert, Egypt

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Received 5 May 2015; revised 4 September 2015; accepted 14 September 2015
Available online 16 October 2015

KEYWORDS

BED 3 and Sitra oilfields;
Abu Gharadig Basin;
Prospect evaluation;
Egypt

Abstract The occurrence of hydrocarbons is closely linked to the elements of petroleum system history of the BED 3 and Sitra 8 oilfields, which has created multiple reservoir and seal combinations. BED 3 Field and Sitra concessions occupy the northwestern part of the Abu Gharadig Basin and extends between latitudes 29°45′ and 30°05′N and longitudes 27°30′ and 28°10′E. The comprehensive integration of the geo-related data and the interpretation of the well logging, geochemical, seismic data in time domain and depth and sealing mechanisms explain the occurrence of hydrocarbons in some certain reservoirs during cretaceous age and other reservoirs in the same fields don't have any hydrocarbon accumulation. Detailed seismic data interpretation was performed for the target units of BED 3 and Sitra 8 oilfields in time domain and converted to depth domain. Sitra 8 Field is a three-way dip closure bounded by NW–SE faults while BED 3 field is represented by a WNW–ESE trending horst dipping to the east.

The Albian–Cenomanian Kharita Formation has a high energy shallow marine shelf environment and considered as the main pay zone in the BED 3 oilfield. On the other hand, Kharita sands are dry in the Sitra 8 Field. Also, the shallow marine shale, sandstone, limestone and dolomite interbeds of the Abu Roash G Member are another hydrocarbon bearing reservoir in the Sitra 8 Field.

Sealing mechanisms were applied to explain why certain reservoirs have hydrocarbon and others don't. Allan's juxtaposition diagram for the main faults in the study area shows that Kharita sands in BED 3 area have excellent juxtaposition as Kharita juxtapose to upper Bahariya and intra Bahariya, which consist of shale and limestone. Abu Roash G sands in BED 3 area have bad juxtaposition as the Abu Roash G juxtapose to Abu Roash C sand (sand juxtaposed sand). Allan's diagram shows that the Abu Roash G reservoir (main target) in Sitra 8 is juxtaposing Abu Roash D which is

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Peer review under responsibility of National Research Institute of Astronomy and Geophysics.

ELSEVIER Production and hosting by Elsevier

http://dx.doi.org/10.1016/j.nrjag.2015.09.002

composed of limestone and shale, which acts as very good seal rock, while the Kharita reservoir is juxtaposing Abu Roash G sand (sand juxtaposed sand) from the crest position which can explain the bad juxtaposition.

Contents

1. Introduction

The study area occupies the northwestern part of the Abu Gharadig Basin and covers Badr El Din specially BED 3 and Sitra concessions (Fig. 1). It extends between latitudes 29°45′ and 30°05′N, and longitudes 27°30′ and 28°10′E.

The Abu Gharadig Basin is ENE–WSW oriented basin. It extends for about 300 km long and 60 km wide and represents 3.6% of the Western Desert district, with an age ranges from Late Jurassic to Early Cretaceous (EGPC, 1992). The major Abu Gharadig Basin extends between the Qattara Depression to the west and the Kattaniya horst to the east (Meshref et al., 1980). The Abu Gharadig Basin is bounded by two basement uplifts to the north and south (Meshref et al., 1988): the northern uplift (Sharib–Sheiba–Rabat platform), and the southern bounding structure (Cairo–Bahariya uplift).

The Badr El Din Petroleum Company was started a Joint Venture between EGPC 50% and Shell 50%. The Sitra development lease is located in the Western Desert and it was awarded to Shell in December 1985 following the hydrocarbon discoveries in Sitra 1-1 at (1982), Sitra 3-1 at (1983) and Sitra 5-1 at (1985) in the Abu Roash reservoirs. The BED 3 field is located in the Egyptian Western Desert some 300 km west of Cairo. It was discovered in 1983 when the BED 3-1 well tested gas and condensate from the Cretaceous Kharita sandstone reservoir at 3500 m depth. The most important reservoirs in the study are Abu Roash G, and the good quality sands with great thickness of Kharita reservoir in Sitra 8 and BED 3 oilfields.

2. Geological framework

2.1. General stratigraphic framework for Western Desert

The greater part of the north Western Desert formed a platform which was characterized by comparatively mild subsidence and situated near actively subsiding basins or depocenters. During the Paleozoic, most of the area were located in the east of the active Paleozoic basin and occupying the Siwa-Kufra, Libya area (the Kufra Basin). During the Jurassic substantial tilting shifted the center of the basin to northeastern Egypt leaving part of the Western Desert in the form of a platform. With the onset of the Early Cretaceous and up to the Recent, the active part of the basin shifted to the north occupying the present Mediterranean offshore area parallel to the present shore line. During these times, the north Western Desert formed a platform which was located in the south of the offshore basin to the north. During different periods, however, local depocenters of limited dimensions developed in different places over this platform. The narrow pullapart basins that straddle latitude 30°N are Betty, Abu Gharadig and Gindi (Faiyum) basins. These basins were particularly active during Late Cretaceous–Early Tertiary times.

Recent active exploration of oil exploration work including, seismic, geological studies, drilling, aeromagnetic and gravity measurements has explored the presence of a thick subsurface stratigraphic column, which ranges in age from Paleozoic to Recent. The sediments occur in a number of basins with varying degrees of subsidence (Said, 1990) (Fig. 2).

The whole thickness, stratifies some anomalies, increases gradually to the north–northeast from about 1829 m in the south up to an estimated 7620 m of section over the coastal area.

There are five cycles composed the stratigraphic section of alternating deposition between clastics and carbonate rocks.

1. Clastics Sedimentation prevails the oldest sedimentary rocks including Paleozoic and Lower Jurassic formations.
2. Upper and Middle Jurassic rocks composed of carbonates.
3. Lower Cretaceous up to Early Cenomanian contains mainly clastics cycle.