MINISTRY OF SCIENTIFIC RESEARCH
NATIONAL RESEARCH INSTITUTE OF ASTRONOMY
AND GEOPHYSICS (NRIAG)
HELWAN, CAIRO, EGYPT

وزارة البحث العلمي
المعهد القومي للبحوث الفلكية والجيوفيزيقية
حلوان – القاهرة – جمهورية مصر العربية

Professor Sultan Awad Sultan Araffa

Examiner's report of the PhD thesis "Identification of promising oil and gas bearing objects based on the petroleum system modelling in the central eastern part of the Gulf of Suez (Egypt) " by Tarshan Ahmed Ramadan Mohamed For the PhD Degree of candidate of geological and mineralogical sciences of St. Petersburg State University

It is a pleasure to write my recommendation letter for acceptance of the degree of candidate of geological and mineralogical sciences submitted by Tarshan Ahmed Ramadan Mohamed. In the first, the thesis is very good for the written, contents and representation where it contains valuable data and results for the important part in Egypt, where the Gulf of Suez represent the principle area for oil production in Egypt. The thesis consists of four chapters include 66 figures and 13 tables of total 149 pages. The main objective of the study is to predict hydrocarbon accumulation zones in the study area using several geophysical data by constructing a petroleum system model, as well as comparing the proven and undiscovered hydrocarbon accumulations. The thesis started with the introduction part where the author (Tarshan) gives a brief description for the content of the thesis and objectives of thesis which includes four objectives such as:1) Acquisition, processing and interpretation of airborne magnetic data, and constructing a 3D depth model of the basement layer of the study area. 2) Creating a depth-based structural model of the study area using seismic data and well data. 3) Constructing 3D petroleum system model of the study area. 4) Identification of oil and gas-bearing objects based on the results of the petroleum system model. The author ended his thesis before references with a part for the conclusion and main results for the thesis, where he concluded that the depth of basement rocks ranging from 400-5000 m.

The following is a brief description of the four chapters of the thesis

Chapter I Tectonic setting and geological history

This chapter include geologic, structural, and stratigraphic setting for the Gulf of Suez and the surrounding eastern area. The chapter concentrates on the origin of the Red Sea and

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Gulf of Suez rift where the rift formed through four stages, stage 1) Late Oligocene–Earliest Miocene, stage 2) Earliest Miocene, stage 3) Mid-Miocene–Late Miocene, and stage 4) Pliocene–Recent. Also, this chapter indicates that the petroleum system in the Gulf of Suez, where the Gulf of Suez is the main oil province in Egypt with production ranking seventh among the world's petroliferous rift basins. The Gulf of Suez indicates the different formations for source rock, reservoir rocks, and cap rocks (seals). The author indicates in this chapter that the study area consists of different field oil and traps such as Ras Budran, Abu Rudeis, October, Feiran, and Belayim oil fields.

The data and figures in this chapter are sufficient where it includes different information which necessary to complete the picture for oil provinces to produce and extract the oil from the Gulf of Suez.

Chapter II Airborne magnetic data analysis (Construction of the basement layer of the 3D model)

This chapter contains all information about the Airborne magnetic data such as magnetic data acquisition, data correction, data processing, and magnetic data interpretation. The Airborne magnetic data were acquired along primary lines spaced at 1000 m and along control lines spaced at 10,000, (normal to the primary lines. Nominal flying elevation was about 100 m above the ground surface (terrain clearance). The orientation of the survey was 125°-305° azimuth degrees for primary lines and 35°-215° azimuth degrees for control lines. Also, different magnetic corrections are carried out on measured data such as diurnal correction, heading correction, Parallax / Lag correction, and International Geomagnetic Reference Field (IGRF) correction. The author applied different processing on corrected total intensity data such as RTP to be ready for magnetic interpretation. The thesis includes different tools for estimating the depth of basement rocks such as analytical signal "AS", source parameter imaging "SPI" and 3D Euler deconvolution. The results of the depths to the basement of the AS and SPI methods range from 100 m to more than 5500 m. Trashan

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My recommendation about this chapter, I suggest adding high and low pass filters and adding figure for the rose diagram for structural trend which derived from regional (low pass) and residual (high pass). Some references are necessary for magnetic susceptibility which is used in magnetic modelling.

Chapter III 3D petroleum system model

This chapter concern to the oil modelling system for detecting the main reservoir in the study area. The researcher used seismic data to delineate the reservoir parameters. The seismic sections and well data were collected and used for construction the depth-structure map for all formations in the study area using Petrel software. The 3-D modelling indicates that there are five locations within the study area that are considered to be basins, where the depth to the basement ranges from 3000 to 4500 m. Lithology, depositional environment and age were determined for each layer. The petroleum system element is defined for each layer as source rock, reservoir rock and seal rocks. Two main boundary conditions were defined in basin modelling: Heat flow and Sediment Water Interface Temperature (SWIT). Then, after determining the ages and properties of all layers, the simulation was run forward, starting with sedimentation of the oldest layer and progressing to the present.

This chapter is well represented and contains valuable information but contour values in figures no.3.10, 3.11 and 3.12 are not readable and need to redraw.

Chapter IV Identification of oil and gas bearings objects based on the results of the 3D petroleum system model (Model results)

This chapter contains different information about the source rocks, and different reservoirs, where the results indicate that the Gulf of Suez has multi-reservoir characters. The modelled accumulations of oil and gas in these reservoirs show that the total mass of oil and total volume of gas accumulations is equal to 23.6 MMbbls and 31815.9 Mm^3 in Nubia B reservoir, 49.85 MMbbls and 23411.42 Mm^3 in Nubia A-P3 reservoir, 235.13

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MMbbls and 27605.9 Mm^3 in Nubia A-P2 reservoir, and 141.61 MMbbls and 11175.14 Mm^3 in Nubia A-P1 reservoir.

This chapter is more excellent and represents calculated modelled accumulations of oil and gas, all figures are good quality and good representation.

The thesis in total is good and contains valuable information about the different reservoirs in Gulf of Suez. The results of thesis can be indicator for petroleum sector in Egypt to increase the productivity of extract oil and gas of an important part of Egypt.

The dissertation research "Identification of promising oil and gas bearing objects based on the petroleum system modelling in the central eastern part of the Gulf of Suez (Egypt)" by Tarshan Ahmed Ramadan Mohamed presented for the degree of candidate of geological and mineralogical sciences of St. Petersburg State University meets the requirements for candidate dissertations on specialty 25.00.10 - Geophysics, geophysical methods of mineral prospecting ".

With best regards,

16/9/2020

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