Marine and Petroleum Geology 112 (2020) 104093

Contents lists available at ScienceDirect

Marine and Petroleum Geology

journal homepage: www.elsevier.com/locate/marpetgeo

Research paper

The role of Late Cretaceous wrench tectonics in hydrocarbon endowment in El-Gindi Basin, northern Western Desert, Egypt

M. Naguib El Ghamry[a], Maher El Amawy[b], Wael Hagag[b,*]

[a] Merlon El-Fayium Petroleum Company, El-Fayium, Egypt
[b] Department of Geology, Faculty of Science, Benha University, Benha, Egypt

ARTICLE INFO

Keywords:
Wrench tectonics
Basin inversion
El-Gindi basin
Hydrocarbon maturity and trapping

ABSTRACT

Detailed subsurface mapping and structural analysis of El-Gindi basin indicate the hydrocarbon potentiality of the Cretaceous reservoirs. El-Gindi basin is a Late Cretaceous-Eocene basin located at El-Fayium district, northeastern Western Desert of Egypt. The overwhelming impact of the Late Cretaceous wrench tectonics was evident during the inversion of the Jurassic-Early Cretaceous rift-related basins along the North Western Desert of Egypt and subsequent deposition of a thick succession of Eocene sediments (~6000 ft Apollonia Formation) within El-Gindi Basin. These tectonic events were developing the oil maturity and trapping through the Late Cretaceous reservoir sequences, Upper Bahariya Formation (Cenomanian) and the Abu Roash "G" Member (Turonian). The Gindi Fault, however, is a NW-trending basement feature breaching El-Gindi basin and bounding several deeper half grabens in the western half of El-Fayium district. It has been reactivated during the Cretaceous, Eocene and probably Oligocene-Early Miocene times, where extended northwestward to the Qarun Field at the footslopes of the Kattaniya inverted basin forming several oil traps along its strike. The Late Cretaceous dextral wrenching developed a regional system of ENE-oriented structural ridges such as Kattaniya and Silah (bounded El-Gindi basin to the north and south, respectively), associated with a series of NE-to ENE-oriented right-lateral strike-slip faults enclosing some structural closures in between. The development of such ridges causing regional subsidence and subsequent deposition of the Apollonia Formation creating several structural hydrocarbon traps. In addition, the structural closures formed between the ends of right-lateral strike-slip faults at Silah High became potential sites for hydrocarbon accumulation. The thermal maturity model of El-Gindi basin suggests a phase of hydrocarbon expulsion occurred during or immediately after deposition of the Apollonia Formation, where the Lower and Upper Cretaceous sediments passing the oil window. According to the analysis of well cores, E-logs and seismic data, shallow marine to deltaic environments have been assigned for the Cenomanian-Turonian reservoir sediments. Moreover, the deposition within channels, point-bars and estuarine environments for the hydrocarbon bearing sandstone reservoirs within El-Gindi Basin was identified.

1. Introduction

The North Western Desert of Egypt comprises a chain of NE-to ENE-oriented rift-related basins. Such basins include among others El-Gindi, Abu Gharadig, Shushan, Matruh, Ghazalat, Misawag and Siwa. The regional tectonostratigraphy, structural setting and tectonic evolution of many of these prolific sedimentary basins was identified through the deep drilling processes associated with oil and gas exploration, as well as the gravity, magnetic and seismic data analyses (e.g. El Awady et al., 1985; Hanter, 1990; Hermina, 1990; Sestini, 1995; Abd El-Aziz et al., 1998; Dolson et al., 2001, 2002; Moustafa, 2008; Aboud et al., 2008; Fairhead et al., 2013; El Awady et al., 2016; Alrefaee and Abd El-Aal, 2017; Sarhan, 2017a,b; Sarhan et al., 2017a,b. Sarhan and Collier, 2018). Such basins have been originated in the Late Jurassic-Early Cretaceous, during the building of the passive continental margin of the East Mediterranean region (Moustafa et al., 1998). Seismic and borehole data indicate that the Jurassic and Lower Cretaceous sediments were deposited in rift-related basins forming half graben geometry, bounded by a major normal fault on its down-dip direction. At the extreme up-dip direction the strata have gently-dipping to flat-topped areas referred to as platforms such as Sitra, Wadi El-Rayan and Silah (Moustafa, 1988, 2008). After the deposition of the Cenomanian, Turonian and Lower Senonian rocks, folding and reverse faulting (basin inversion) affected the Upper Cretaceous and older formations and controlled the deposition of younger Paleocene, Eocene and slightly Oligocene sediments (Syrian Arc deformation: Morgan, 1990; Moustafa

* Corresponding author.
E-mail address: waelhagag78@yahoo.com (W. Hagag).

https://doi.org/10.1016/j.marpetgeo.2019.104093
Received 11 May 2019; Received in revised form 5 October 2019; Accepted 14 October 2019
Available online 18 October 2019