Egyptian Journal of Petroleum (2016) 25, 45–51

HOSTED BY

Egyptian Petroleum Research Institute

Egyptian Journal of Petroleum

www.elsevier.com/locate/egyjp
www.sciencedirect.com

FULL LENGTH ARTICLE

Use of spectral decomposition technique for delineation of channels at Solar gas discovery, offshore West Nile Delta, Egypt

Adel A.A. Othman [a], **M. Fathy** [a], **Ali Maher** [b,*]

[a] *Geophysics Department, Faculty of Science, Azhar University, 1 El-Mokhayam El-Daem Street, Nasr City, 11884 Cairo, Egypt*
[b] *Rashid Petroleum Company (RASHPETCO), Building 18 Road 293, New Maadi 1073, Cairo, Egypt*

Received 20 January 2015; revised 1 March 2015; accepted 3 March 2015
Available online 7 December 2015

KEYWORDS

Spectral decomposition;
WDDM concession;
Offshore West Nile Delta;
Solar gas discovery

Abstract This paper presents a case study of spectral decomposition of seismic data and how it aids in seismic data interpretation. It is also known as time–frequency analysis where non-stationary signals in time/space are from time/space domain to time/space vs. frequency domain. The frequency domain representation illustrates many important features that are not apparent in time domain representation. Spectral decomposition is a non-unique process for which various techniques exist and newer modified techniques are being discovered. Over the years, spectral decomposition of seismic data has progressed from being a tool for stratigraphic analysis to helping as a Direct Hydrocarbon Indicator (DHI); a potential weapon for reducing dry well drilling. In the coming years, it is expected that spectral decomposition may be able to play a significant role in analyzing time lapse seismic data.

In this paper, spectral decomposition technique is applied to the imaging and mapping of bed thickness, geologic discontinuities and channel delineation at Solar discovery. From the study, two distinctively different channels (gas bearing "Red channel" and water bearing "Yellow channel") were delineated in the area, and are proven by the drilled well, and some stratigraphic features are identified.

1. Introduction

Seismic data, being non-stationary in nature, have varying frequency content in time. Time–frequency decomposition (also called spectral decomposition) of a seismic signal aims to characterize the time-dependent frequency response of subsurface rocks and reservoirs. Spectral decomposition unravels the seismic signal into its constituent frequencies. This allows the interpreter to see amplitude and phase tuned to specific wavelengths, just as a radio can pick out a single station or a prism a single color. Since the stratigraphy resonates at wavelengths dependent on the bedding thickness, the interpreter can image not only subtle thickness variations and discontinuities,

* Corresponding author.
E-mail address: Ali.Maher@Rashpetco.com (A. Maher).

Peer review under responsibility of Egyptian Petroleum Research Institute.

http://dx.doi.org/10.1016/j.ejpe.2015.03.005
1110-0621

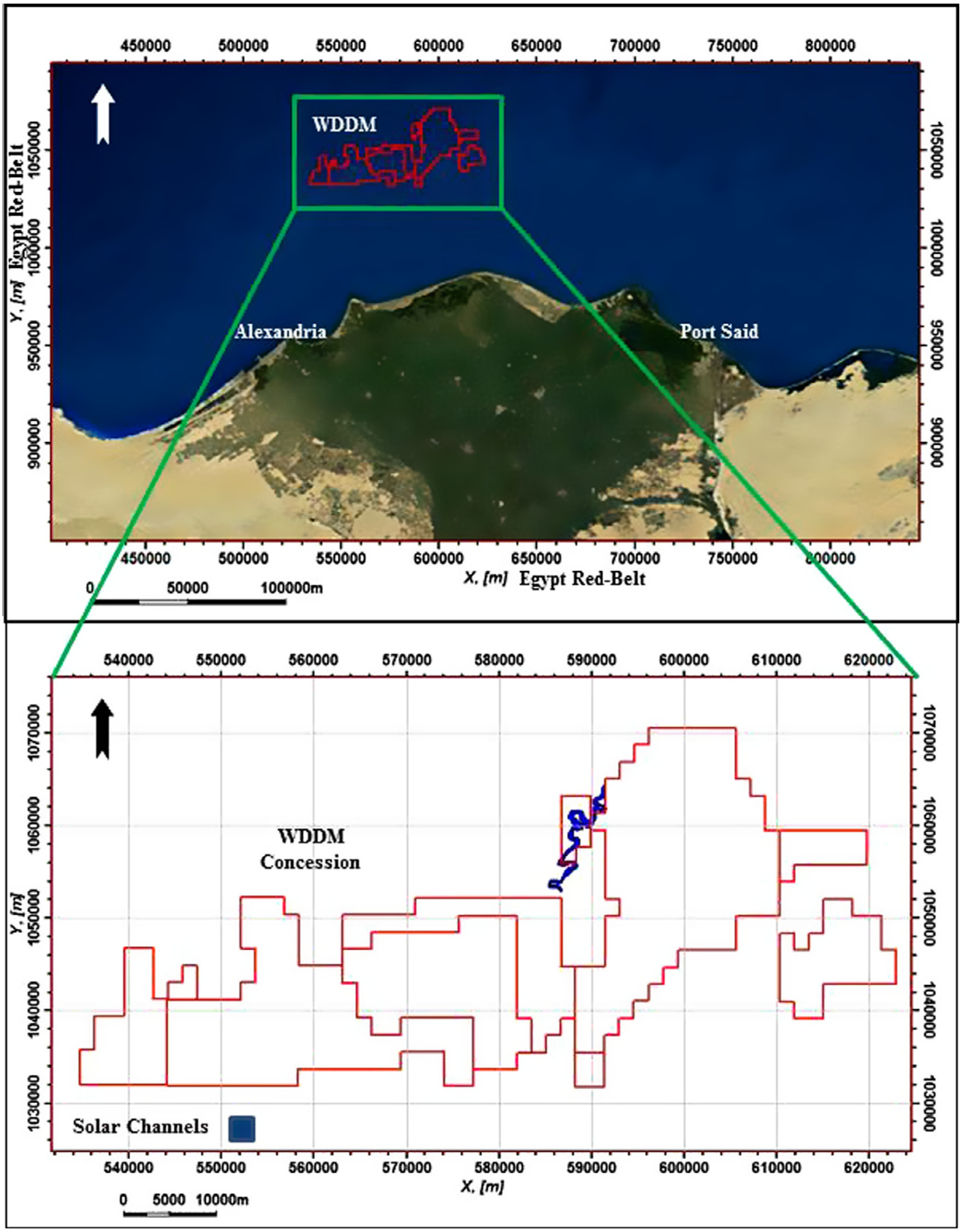

Figure 1 Satellite image showing the location of West Delta Deep Marine (WDDM) concession, offshore Egypt (upper) and an index map showing Solar channel location (lower).

but also accurately predict bedding thickness quantitatively [7]. In addition, since the high-frequency response of a reflector can be attenuated by the presence of compressible fluids, spectral decomposition can also assist in the direct detection of hydrocarbons [1]. These approaches, applied alone to a seismic dataset, can be very enlightening but the results can also be somewhat cryptic. Seismic modeling gives the interpreter a critical insight into tuned attribute maps, and also allows him or her to predicting what a particular bed geometry or thickness trend will look like. Volume visualization and interpretation can enhance the interpretation further still, significantly reducing exploration risk.

2. General geological setting

Egypt is divided into three main petroleum provinces which are Gulf of Suez, Nile Delta and Western Desert. The Nile Delta province is rapidly emerging as a major gas province, highly prolific, with significant Yet To Find (YTF) estimates [3,5,9].