AAPG Datapages/Search and Discovery Article #90238 © 2015 Latin America & Caribbean Region, 20th Caribbean Geological Conference, A Collision of Ideas to Uplift our Understanding, May 17-22, 2015, Port-of-Spain, Trinidad & Tobago, West Indies

Applying Full-Tensor Gravity Gradiometry (FTG) to Exploration in Southern Trinidad

Jamie A. Warner[1]

[1]*ARKeX Ltd. Newton House, Cambridge Business Park, Cambridge CB4 0WZ, UK*

Abstract

Trinidad is situated in the southeast corner of the Caribbean Plate, within the prolific Eastern Venezuelan Basin (Pindell & Kennan, 2007; Persad, 2008; Persad & Ritson, 2014). The country has a long and successful history of petroleum exploitation dating back to its first commercial oil production in 1908 (Trinidad Ministry of Energy and Energy Affairs, 2015). Since then, with hugely successful gas production from the mid-1990's from the southeastern offshore Columbus Basin, and northern offshore Patao high (Fig.1), Trinidad has become the largest gas producer in the Caribbean, largest exporter of LNG to the U.S., and has seen oil production peak at ~180,000bbl/d in 2006 (US Energy Information Administration, 2014).

Despite this abundance of natural resources, oil production from the southern part of the Country has since seen a steady decline, by almost a third, between 2006 and 2013 (Fig. 1; US Energy Information Administration, 2014). This underlies a larger decline in production since the 1980's (Fig.1), and is a consequence of a combination of maturing fields, increasing costs and industry volatility, and simply a lack of recent drilling and development in the past few years (Khan, 2014).

In line with a recent rise in exploration and production activity, helped along by a series of government measures aimed at arresting oil decline, a multi-client Full Tensor Gravity Gradiometry (FTG) survey, covering ~5,300 km2 over both the onshore and near-offshore parts of southern Trinidad (Fig. 2), was acquired between January-February 2015.

Gravity Gradiometry is the measurement of variations in acceleration due to gravity, and is therefore a 3D measurement of Earth's gravity field (Fig. 3). These variations are caused by lateral density contrasts in the subsurface, which relate to variations in the underlying local geology (either changes in rock properties or geological structures, e.g. faults or intrusions). It is a higher resolution measurement than conventional gravity systems (Li, 2001; Barnes et al, 2011), and is also an ideal technology for rapid airborne deployment.

ARKeX have successfully applied FTG technology for multi-client use in several geological settings around the world, for example onshore U.S.A, offshore Gabon, offshore NE Greenland and the SE Barents Sea (Fig. 4). In all of these cases, the methodology for using FTG data has been the same, although the geology and exploration rationale may have been different. The fundamental concept is integration: combing as many exploration datasets as possible and using the merits of each to produce a consistent interpretation of the subsurface that allows explorers to be predictive away from seismic control and put any existing discoveries in context.

It is hoped that interpretation of the FTG data, in combination with existing seismic, will allow a re-appraisal of the main tectonic elements, infilling gaps in existing seismic coverage and therefore contributing to a greater understanding of any additional or deeper exploration potential. Another use of the FTG data will be to produce 2/2.5D models along as many seismic lines as possible, in order to help to reduce risk in areas where seismic imaging or interpretation is a challenge.