

## **Re-imaging extensive regional offshore seismic survey and data base is stimulating a new offshore exploration cycle in the Middle Eastern Gulf countries.**

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### **Introduction**

Many recent initiatives appear to signal the onset of a new exploration cycle in the offshore waters of the Middle Eastern Gulf countries. These initiatives include:

- In late 2016 and following its West Bukha discovery offshore Oman, DNO approached NIOC for unitised joint development operation of West Bukha with NIOC's 1999 offshore Hengam oil and gas field discovery.
- KOC's 3D seismic acquisition of offshore Kuwait
- In early 2017, BAPCO of Bahrain invited international participation in a "Joint Study Agreement" of the country's offshore
- NIOC has announced the ongoing Iranian round that includes the development of 16 offshore oil and gas fields and 3 offshore exploration concessions
- In April 2017, Qatar Petroleum announced the lifting of its self-imposed 12 years old pause in the development of offshore supergiant North Dome Gas Field.
- In May 2017 NIOC announced that their newly discovered "Sepand" gas field is close to but not part of the giant South Pars offshore gas
- In July 2017, the new Minister of Oil announced the hitherto unexplored offshores of Iraq as exploration block among the new nine exploration blocks of Iraq.
- RAK Gas of Ras Al Khaimah, UAE is committed to organising a new License Round for its currently unlicensed entire offshore and onshore concessions in January 1st 2018.
- Saudi Aramco is committed to a 7,000 tons offshore redevelopment construction of platform, wellheads and pipelines in offshore Saudi Arabia during 2019.

In an area of otherwise patchy and inhomogeneous seismic coverage, one seismic data set is unique in providing a dense and continuous coverage from the mouth of the Euphrates and Tigris through the Strait of Hormuz – the PC-2000.

### **Re-imaging goals**

The PC-2000 seismic data set is one of the largest continuous seismic data sets collected in the entire world. It was collected in 1999-2002 and covers the Iranian part of the Gulf with a 2x2km 2D seismic grid and also provides a regional coverage in the Sea of Oman, comprising around 100,000 line km.

The data set has contributed significantly to the mapping and understanding of the petroleum systems and different proven and possible plays in the basin. Comparing the number of wells drilled with the resources proven, it is clear that this highly prospective basin is still under-explored and that the return to increased focus on offshore exploration is a good strategy in today's market environment.

Re-imaging of the complete data-set is ongoing to take advantage of the last decade's significant advances in processing technology. Major improvements are seen from the application of the most modern broad-band de-ghosting and de-signature techniques as well as advances in multiple-attenuation. The improved imaging proves particularly useful in analysing the stratigraphic and combined stratigraphic/structural plays that may contain large reserves and have so far been targeted by very few wells.

### **Inversion and conditioning for AVO/AVA**

The original data acquisition was carried out in a consistent manner, with uniform quality control procedures applied to both data acquisition and processing. This is a great benefit today, when 15 years of advance in processing technology can be put to work.

Relative inversion has been undertaken on the processed gathers for the well Farur-B. The well was used along the 2D line for wavelet scaling and to QC analyse the inversion results. Angle stacks were created from the processed gathers to be used as the input to the inversion. These stacks were frequency balanced and aligned to each other prior to inversion. Wavelets were extracted from the 3 stacks and scaled to match the stacks. The P-impedance volume shows a good match to the well.

The inversion substantiates the quality of the original data set as well as verifying that the re-imaged data set will meet the requirements for large scale regional quantitative interpretation work across the Gulf and because of its unrivalled regional coverage has relevance for the understanding of the entire Gulf.

### **Interpretation**

The improved seismic imaging is contributing to more reliable reservoir characterisation as well as enabling extrapolation that will benefit the evaluation of identified prospects and new exploration plays.

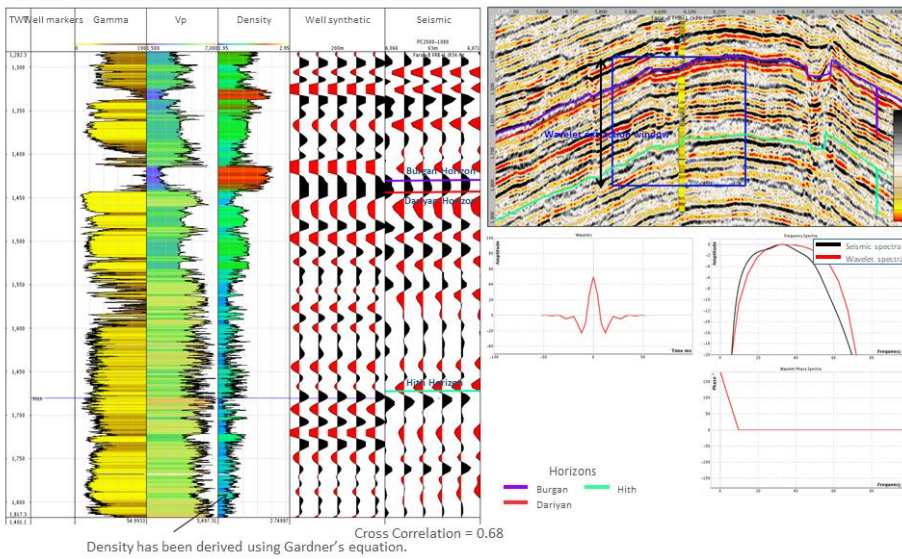
Benefitting from more detailed mapping, the paper will show examples from a number of proven and producing fields and their relevance to structural/stratigraphic exploration plays

### **Conclusion**

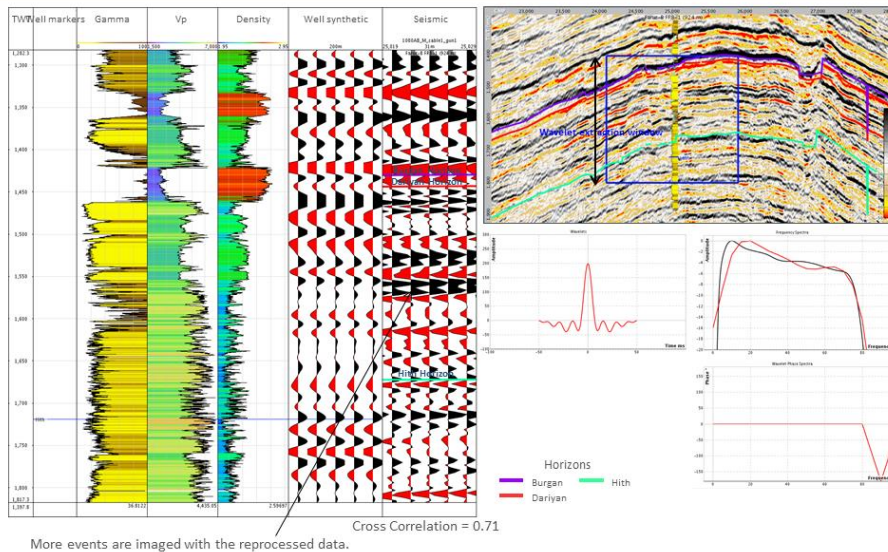
The re-imaging of the unique coverage PC-2000 data set is providing an updated version of a super-regional data set that meets the requirements for quantitative as well as qualitative interpretation. The application of advanced processing techniques will benefit a proper evaluation of the petroleum potential of the Gulf and the definition of core areas for further exploration.



### Well tie – Farur-B: Original volume



### Well tie – Farur-B: DUG processed volume



**Figure 1. Well ties for the Farur B well (well is offset by approximately 1 km from the seismic line). The extent of the PC-2000 data base and the location of the Farur-B (★) well is shown on map.**