

2016 MIDDLE EAST AND AFRICA HONORARY LECTURER

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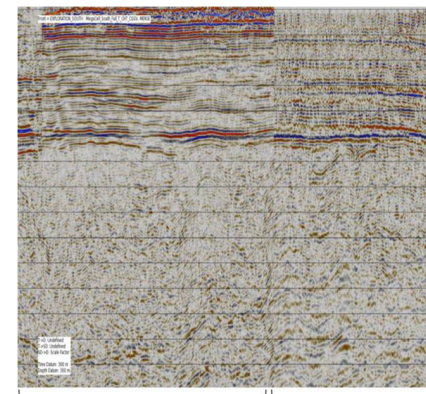


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Land seismic acquisition - the highs and lows of very high data rates and very low frequencies

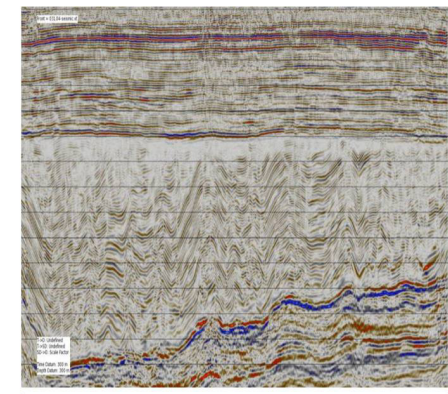


Presented by Said Mahrooqi
Petroleum Development Oman LLC



■ Narrow azimuth 300 fold
■ Narrow azimuth 16 fold

Figure 1: Legacy Data



■ Broadband, Wide azimuth 19,200 fold

Figure 2: Image with latest WAZ, broadband data



Land seismic acquisition - the highs and lows of very high data rates and very low frequencies

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Abstract

As requirements to develop more complex reservoirs and subtle traps evolve, the demand for a high-fidelity image becomes increasingly important. Technology advancements now provide us with the opportunity to provide very high density broadband seismic data at realistic cost. In this discussion, we illustrate the opportunities and the deliverables, and we touch on potential future developments.

Land seismic data suffers from near-surface phenomena including ground roll with varying frequencies and velocities, back scatter, multiple generators, also complex subsurface geology. Ambient noise both transient and persistent has become increasingly challenging as the activity footprint of the seismic crews becomes larger.

The emission and recording of high density, wide azimuth, broadband land seismic data has provided greater potential for imaging the entire geologic subsurface. Evolution of receiver geometry, together with sources, has escalated in recent years. Channel count has increased more than tenfold over this period. Vibrator count also has increased, together with higher output units, with improved low-frequency capability.

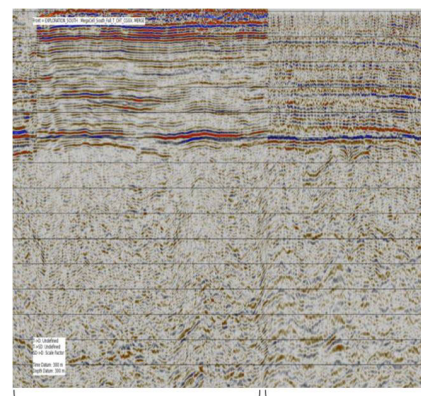
To support the investment required for these recording techniques, enablers must be deployed in order to optimize production efficiency. This has included 24/7 operations in all environments, short sweeps, slip sweep, dynamic fleeting, and various simultaneous acquisition techniques.

Looking ahead, there are many highs, and the current environment has accelerated what already was a race to lower seismic channel costs. Exciting developments include advanced architecture seismic systems, lighter and more robust nodes, automated deployment projects, and new low-frequency vibrators. Acquisition techniques now being tried and implemented include inter-, intra- and independent vibrator cluster simultaneous acquisition together with specialist low-frequency vibrators. We then will potentially be able to better sample the full wavefield.

The final “low” or “high” to be mentioned is perhaps the significant challenge now being posed to our data- processing teams, by these vast volumes of continuous “blended” daily data.

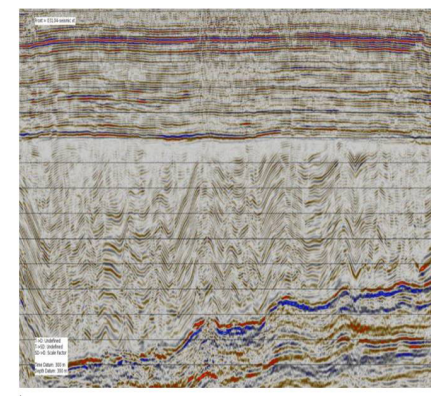
Biography

Said Mahrooqi, head of Geophysical Operations at Petroleum Development Oman LLC (PDO), obtained a BSc in geological science, emphasis geophysics, from San Diego State University in 1992, and an MSc in exploration geophysics from Leeds University in 1996. Said’s work experience includes land and marine seismic acquisition, VSP, microseismic, and nonseismic techniques. Since 2008, Said has been instrumental in the testing, introduction, and implementation of high channel count, 24/7 operations, together with short sweep, slip sweep, dynamic fleeting, simultaneous recording, and low-frequency land seismic acquisition. Said is a member of EAGE, GSO, SEG, and SPE. Said also is a member of the SEG Middle East North Africa Advisory Committee and a director of the SEG Global, Inc. Board of Directors.



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Figure 2: Image with latest WAZ, broadband data