

Fluid Migration

"Proprietary analysis workflows in OpendTect that significantly reduce risks in both our development and exploration well programs"

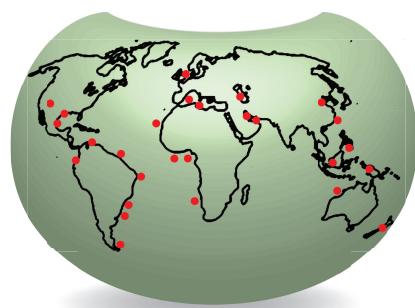
Donald Burch - Aspect Abundant Shale, LP

The ChimneyCube: Following the Migration Trail...

When fluids migrate upwards from deep thermally mature source rocks, connate gas stays behind and generates vertical noise trails – known as chimneys. Such trails reveal hydrocarbon migration paths and vital information about the petroleum system. dGB's OpendTect tracks fluid migrations from source rocks to the surface, providing essential information on your petroleum system. The result? Highly accurate prospect ranking, and the very best in fault- and top-seal analysis. Fluid migration, fault seal analysis and seismic object detection play a vital role in locating Hydrocarbons today.

dGB Earth Sciences – Ranking Prospects and Fault Seal Analysis

dGB Earth Sciences leads the way in tracking fluid migration. Since starting working with Statoil in 1998, we have created hundreds of chimney cubes that follow the fluid migration paths from source rock into the trap and upwards to the surface.



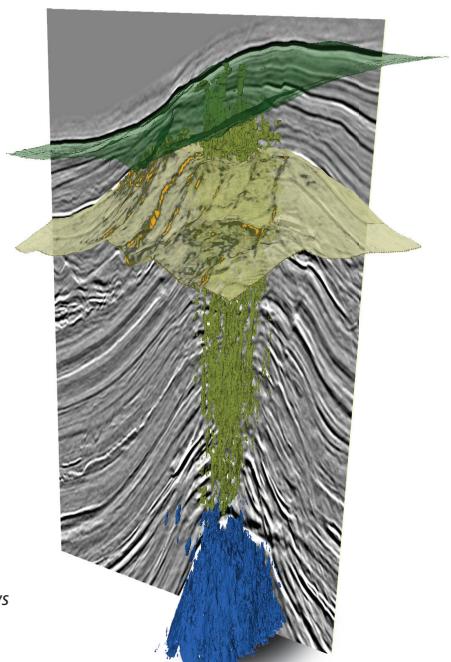
- Fluid Migration Studies

Enhanced Prospect Ranking and Fault Seal Analysis

Our OpendTect seismic interpretation software and Neural Networks & Dip-Steering plugins provide enhanced prospect ranking and fault analysis.

Prospect ranking is based on classifying chimneys on appearance and spatial relationships and calibrated against our database of analogs. Fault seal analysis is through the comparing of chimney cubes with faults (similarity cubes) and generating a qualitative measure of fault leakage.

Prospect risking using HC-Chimneys



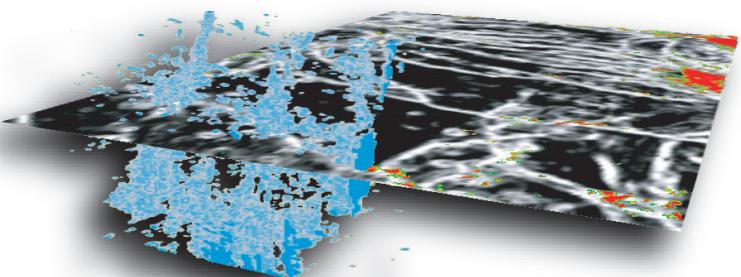
Fluid Migration

Many Tertiary, Mesozoic, and Paleozoic petroleum systems are dominated by vertical hydrocarbon migration from deep thermally mature source rocks. On seismic data the vertical migration paths are generally recognized as vertically aligned zones of chaotic often low amplitude reflectivity, described variously as gas chimneys, seepage pipes, blowout pipes, or gas clouds. The paths are often associated with other seismic seepage-related features such as mud volcanoes, fault related pock marks, and hydrocarbon related diagenetic zones (HRDZ's).

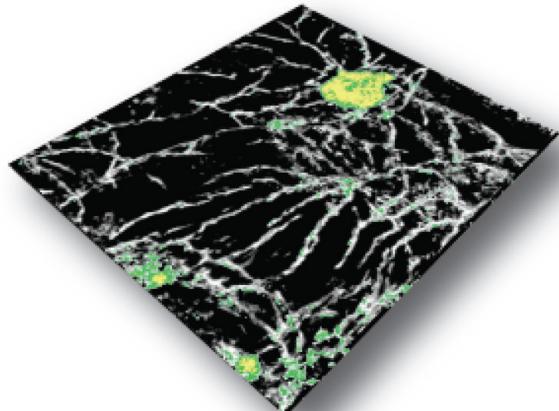
We use chimney examples identified by a human interpreter to create a learning set for a neural network. The output of the network is a chimney probability cube (or 2D line set) which we then use to interpret fluid migration paths. Among others the following questions are addressed:

- Are there DHI's associated with the chimneys?
- Do the chimneys link to indications of hydrocarbon seepage?
- Are the locations of the chimneys supported by basin modeling?
- Do the chimneys originate in deep thermally mature sediments?
- Do the chimneys exhibit circular pockmark morphology on time slices?

In prospect ranking we compare the observations against our data base of analogs, and try to classify the prospect into one of 7 commonly observed chimney classes. We distinguish 3 fault-seal traps, 3 top-seal traps and one charge-risk trap. Each class features certain risk factors for charge and leakage, the two main risk factors associated with dry holes.



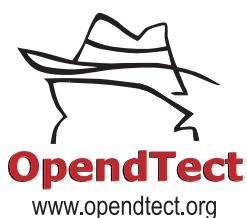
3D visualization of fluid migration paths through a fault zone. Note the columnar fluid flow, lining up with pockmarks on the seabed, indicating diapiric fluid flow through fault zones.



Combining FaultCube (grey) and ChimneyCube (yellow) for fault seal analysis. Yellow spots are related to high fluid flux zones and mud volcanoes. Note conducting and sealing faults and fluid migration at fault intersections.

The OpendTect Geophysics Attributes & Filters Package includes:

Dip Steering, Neural Networks, Fluid Contact Finder, Seismic Spectral Blueing, Seismic Feature Enhancement, PDF-3D, Workstation Access



Earth Sciences

Creators of OpendTect

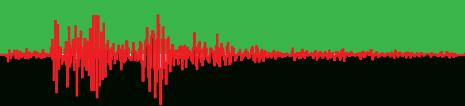
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**For accurate prospect ranking and fault seal analysis,
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