

Mathematical and Numerical Modeling of Ultrasound Vibro-Acoustography

Alison Malcolm – MIT

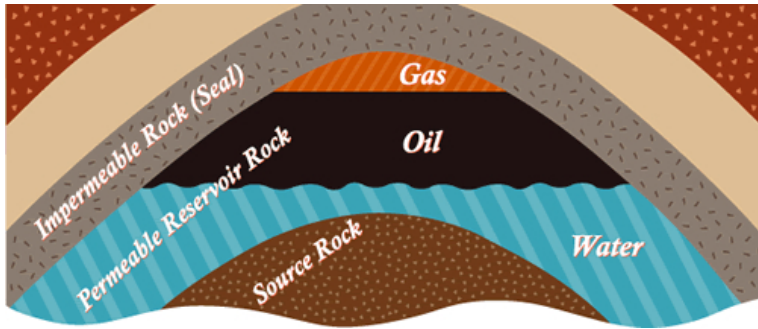
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Oil Exploration



From <http://www.pgesafetyeducation.com>. Image courtesy of Pacific Gas and Electric Company.

Oil Exploration

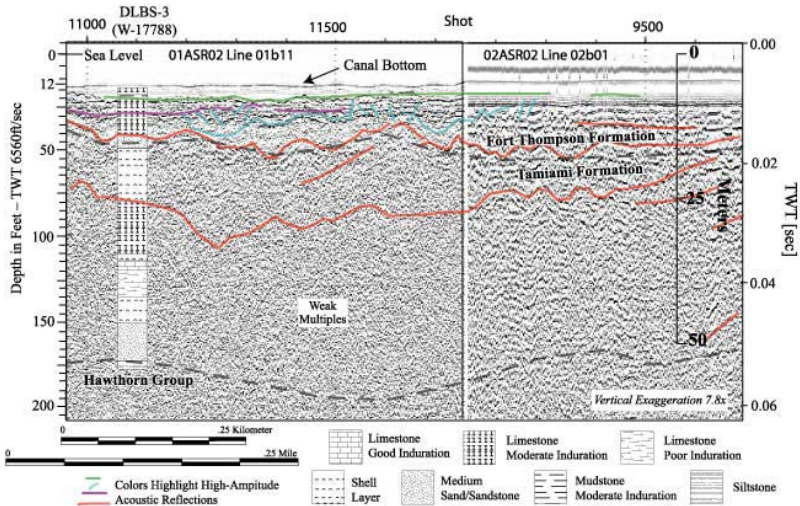


Image courtesy of USGS.

Summary so far

We use waves for:

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- **CO₂ monitoring**

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We use waves for:

- **CO₂ monitoring**
- **Geothermal energy**
- **Determining deep Earth structure**
- **Finding (and producing) oil**

Cube

Typical wave imaging

Radon Transform

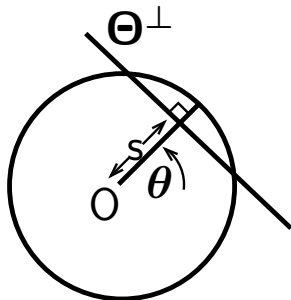


[http://en.wikipedia.org/wiki/](http://en.wikipedia.org/wiki/File:64_slice_scanner.JPG)

[File:64_slice_scanner.JPG](#)

f - absorption of material

Rf - data



$$Rf(\theta, s) = \int_{\theta^\perp} f(x+s\theta)dx$$

Image difference in absorbance

Typical wave imaging

Radon Transform



Shepp-Logan Phantom

Projection-Slice Theorem

$$\widehat{Rf}(\sigma) = (2\pi)^{(n-1)/2} \widehat{f}(\sigma\theta)$$

back-project data
along lines

Image difference in absorbance

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