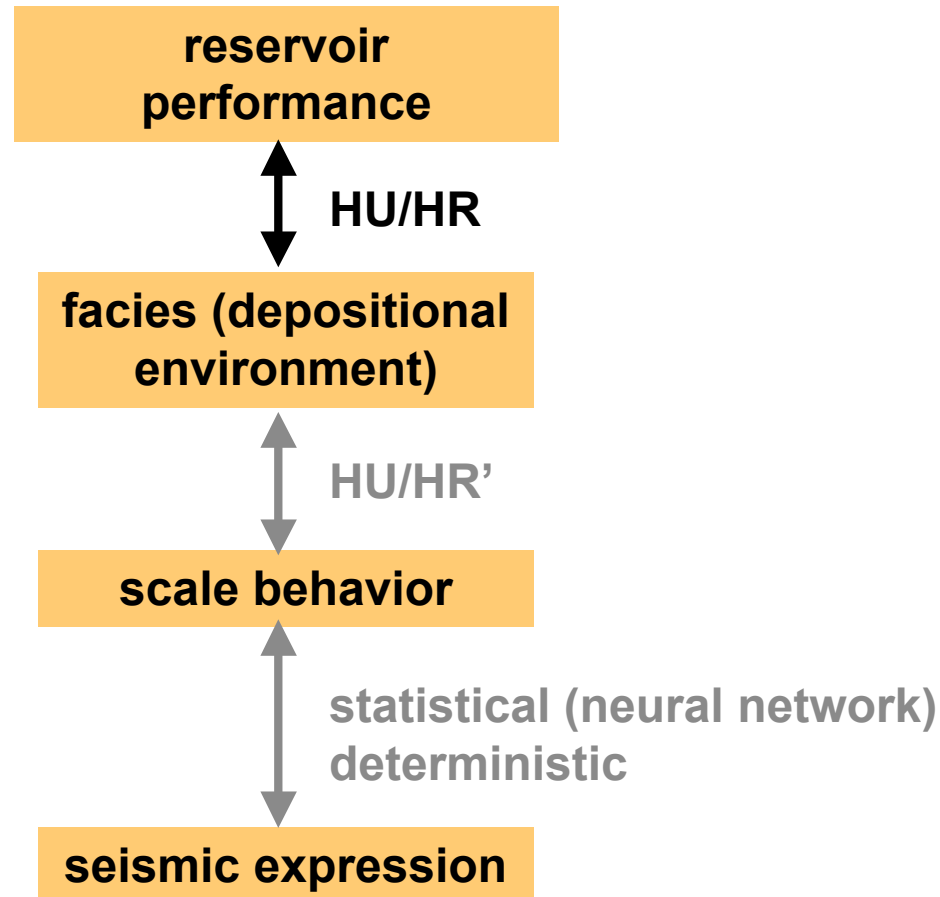




Amplitude Variation with Frequency

Michael Glinsky and Mark Barton
Shell E&P Technology Co.

A critical geophysical link needs to be made

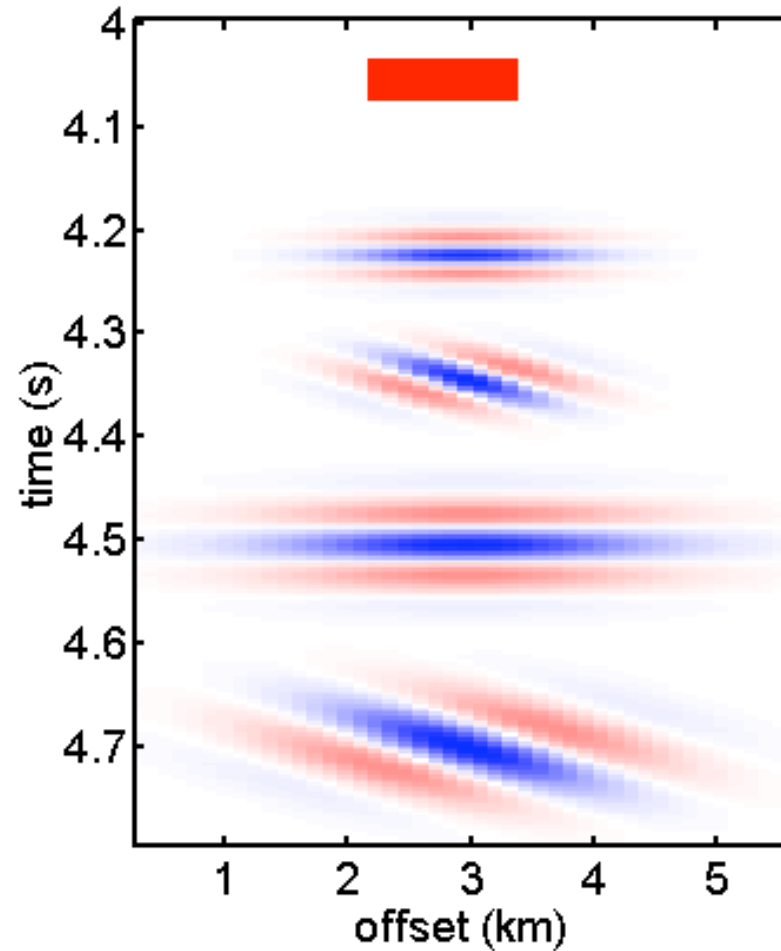


There has been a confluence of theoretical advances to enable this link

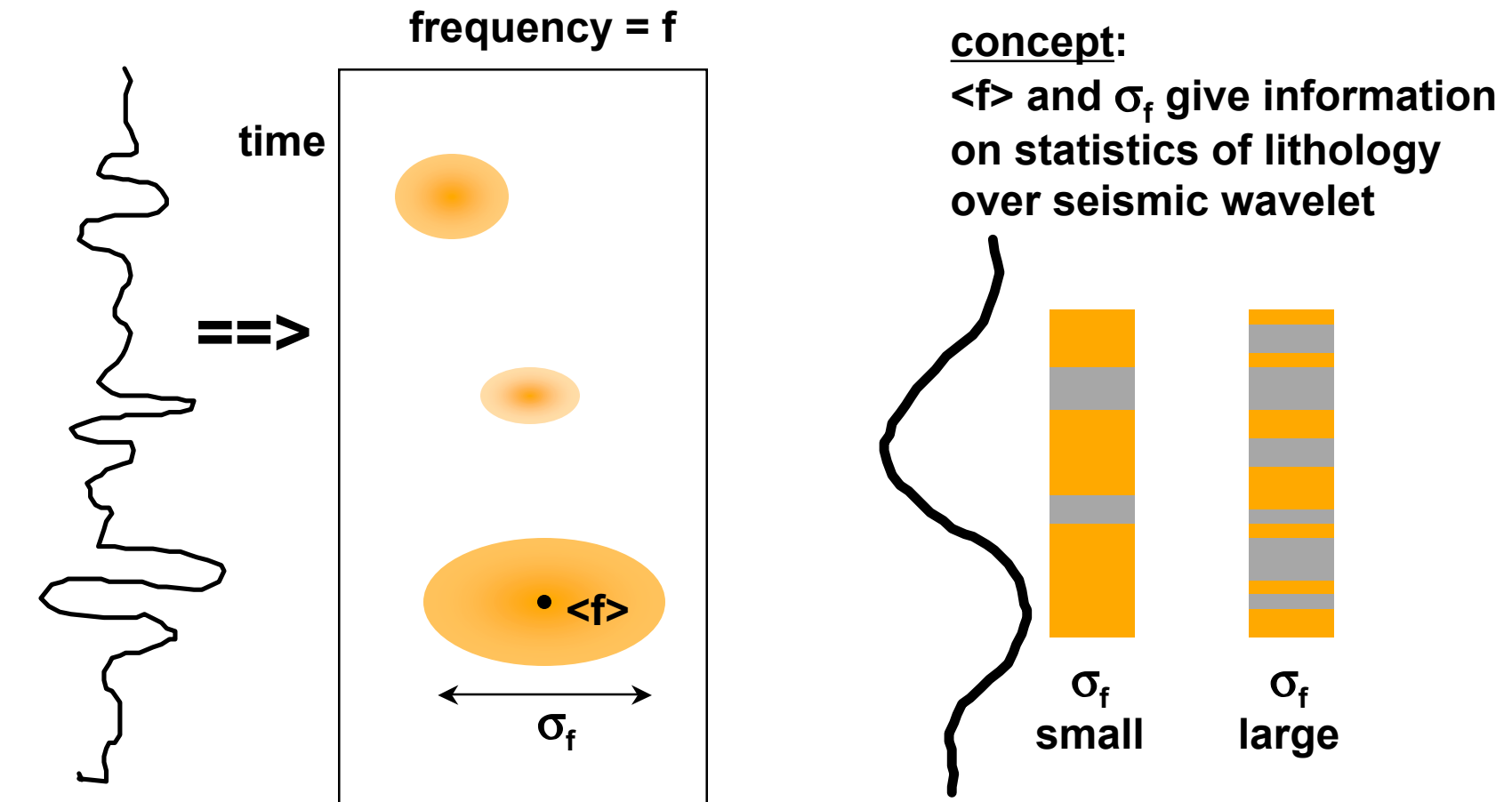


- **recognition of multi-fractal nature of earth structure**
 - vertical
 - horizontal
- **wavelet decompositions**
 - 1D (vertical)
 - 2D and 3D (horizontal)
- **singularity analysis**
 - link multi-fractal nature to wavelet decomposition
- **theory of wave propagation in multi-fractal medium**
 - plasma turbulence theory (P. Diamond, UCSD)

What is a wavelet?



Amplitude Variation with Frequency (AVF)



O'Doherty and Anstey, Geo. Prosp. 19, 430 (1971)
Shapiro and Hubral, Geophysics 61, 1282 (1996)
S. Devi, SEPTCo, lithology estimation
DELPHI consortium

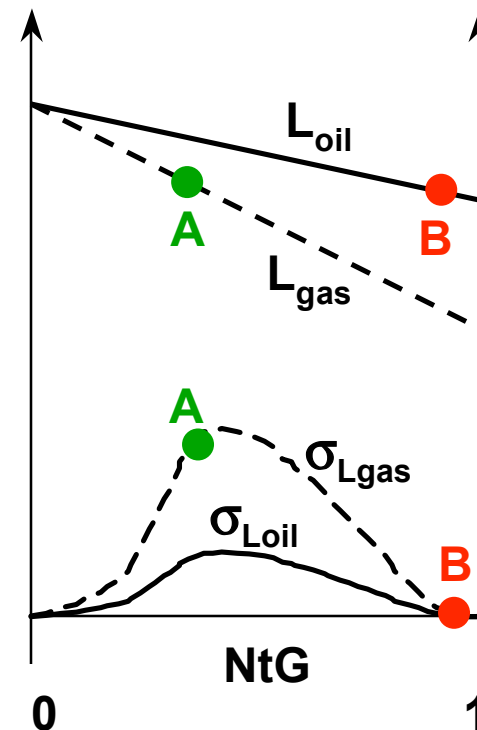
Example of utility of AVF



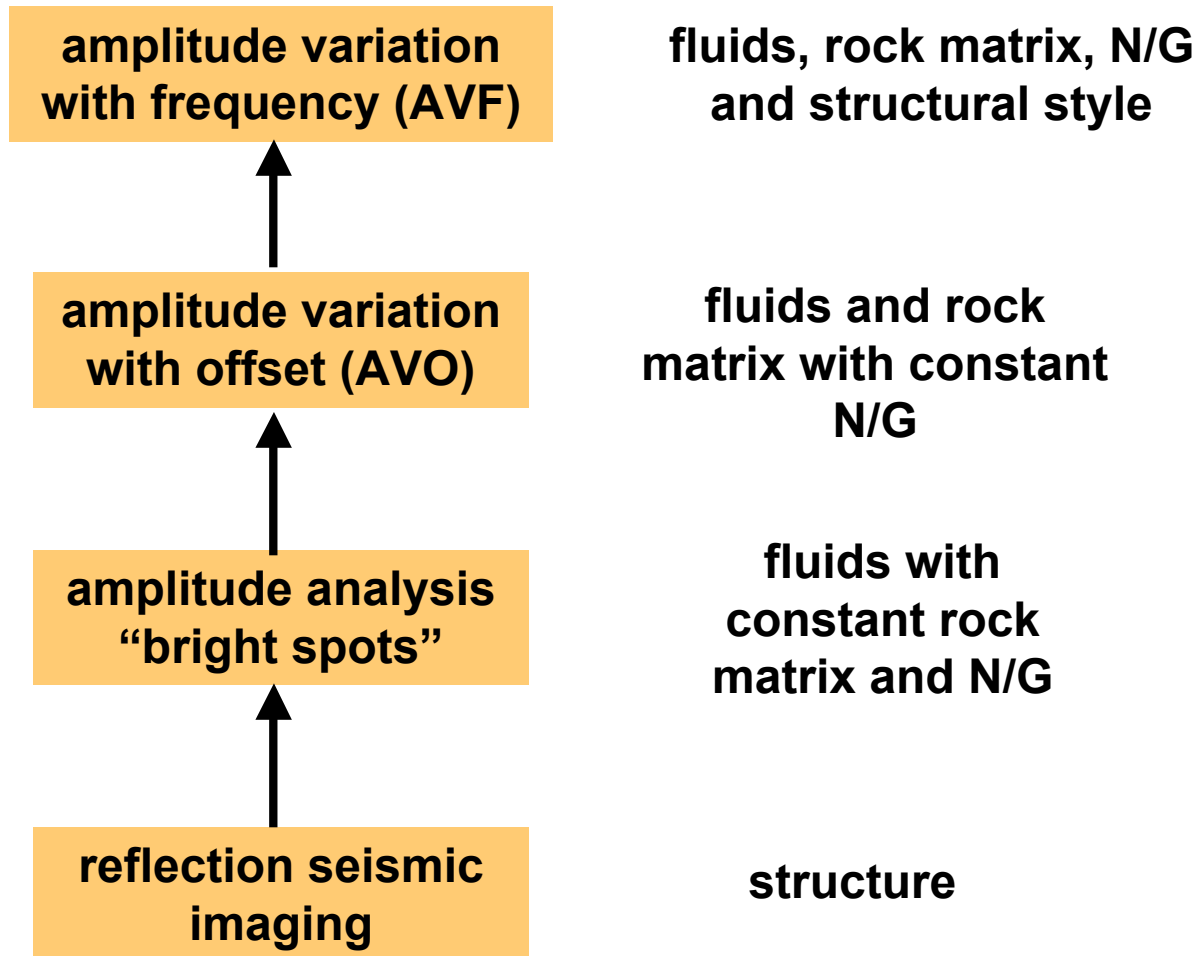
tell the difference between:

A. low NtG gas sand

B. high NtG oil sand



AVF inversion could be the next seismic game changer

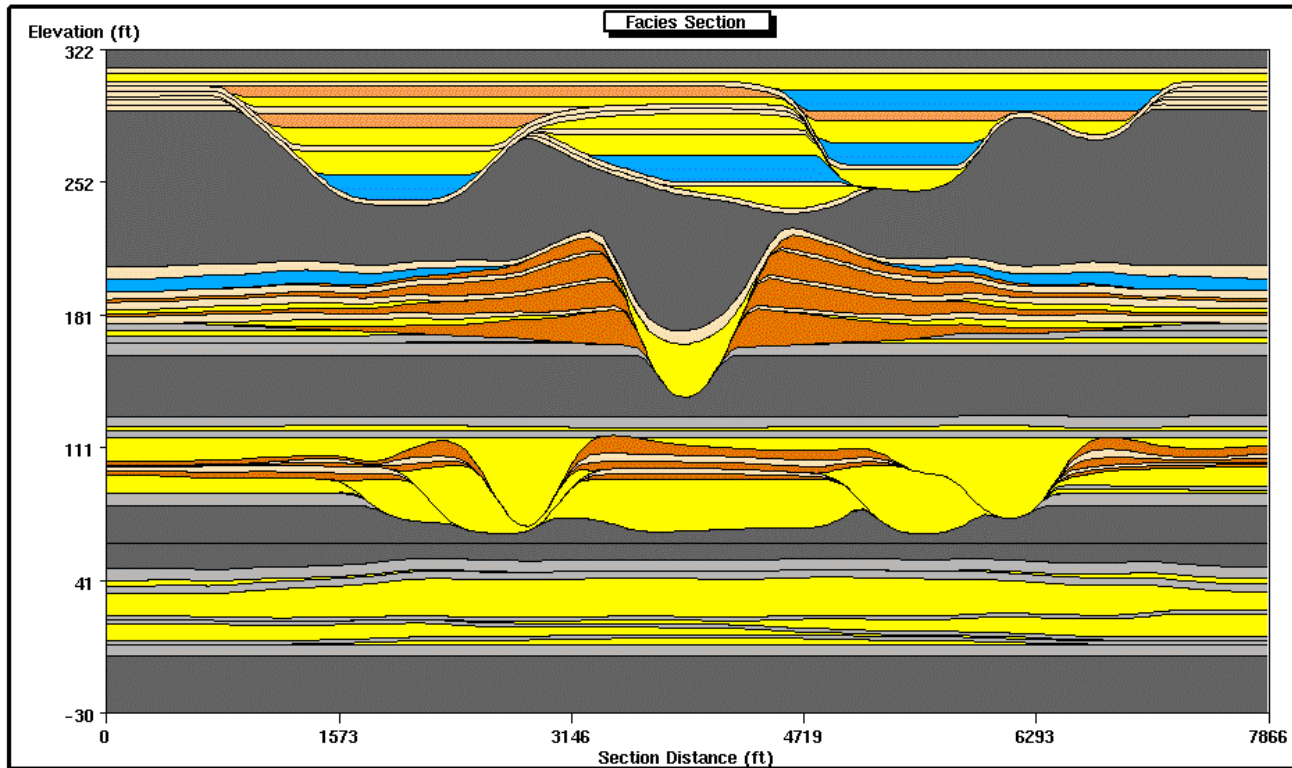


DepSim model of typical 4th order cycle has been put together to test the AVF concept



- **based on west Texas turbidite outcrops**
 - unconfined
 - aeolian sourced
- **one 4th order cycle, four 5th order cycles, basin to slope architectures (bottom to top), up to 7th order detail**
 - submarine canyon fill, aggradational channel-levee, nested channel-overbank, compensating lobes/sheets
- **seven facies**
 - sand, overbank silt, thin beds, overbank mud, shale, organic rich shale, debris flow
- **typical GOM rock and fluid properties**
 - taken from Glider in Green Canyon
 - three models constructed, same geometries, different fluids (oil, gas, brine)

Facies cross-section of DepSim model



submarine
canyon fill

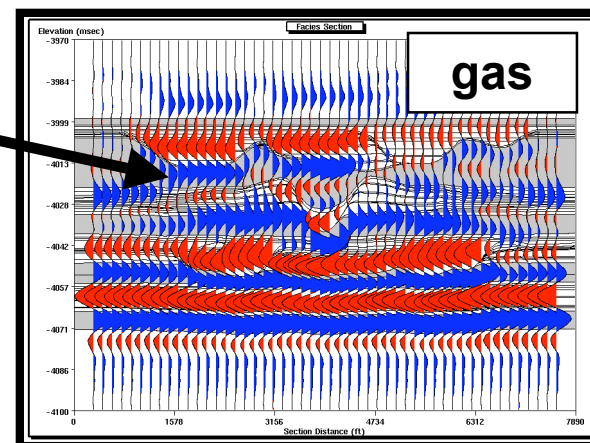
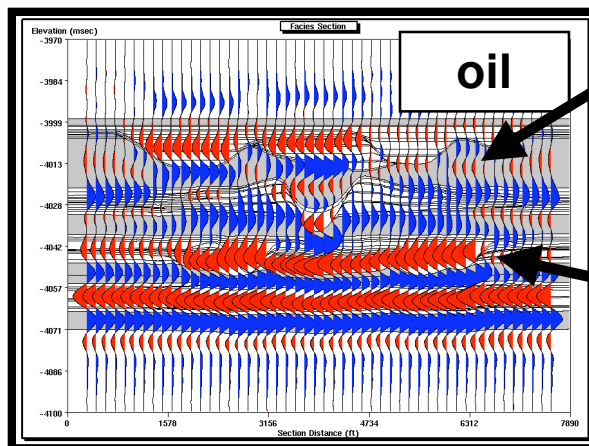
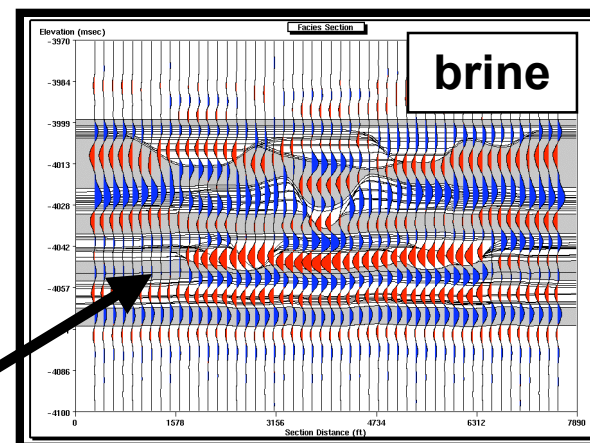
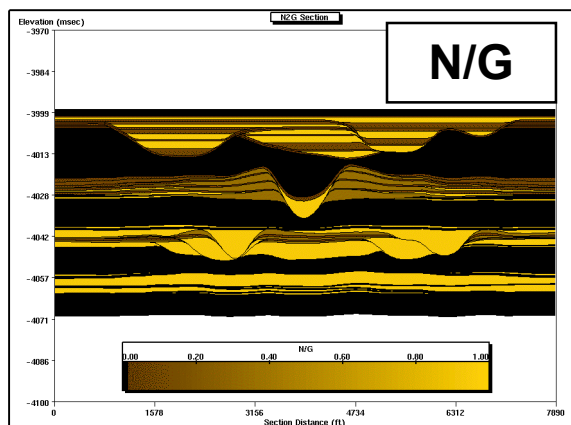
aggradational
channel-levee

nested channel-
overbank

compensating
lobes/sheets

Shale	OBMud	OrgShale	
Sand	Debris	ThBed	OBSilt

Synthetics of model show similar amplitude but different frequency and spacial response



Fast analytic forward model needed to enable AVF inversion

