

12. Quantitative Interpretation and 4D

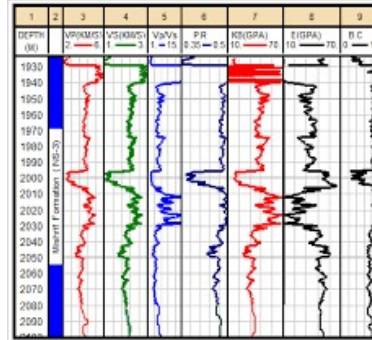
M. Ravasi

ERSE 210 Seismology

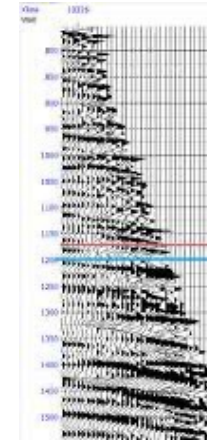
From Rock properties to Seismic



Rock definition (Facies)
and properties (porosity,
shale content, grain size, fluid
content)



Elastic properties (VP, VS, RHO)



Seismic response (post-stack or
pre-stack AVO gathers)

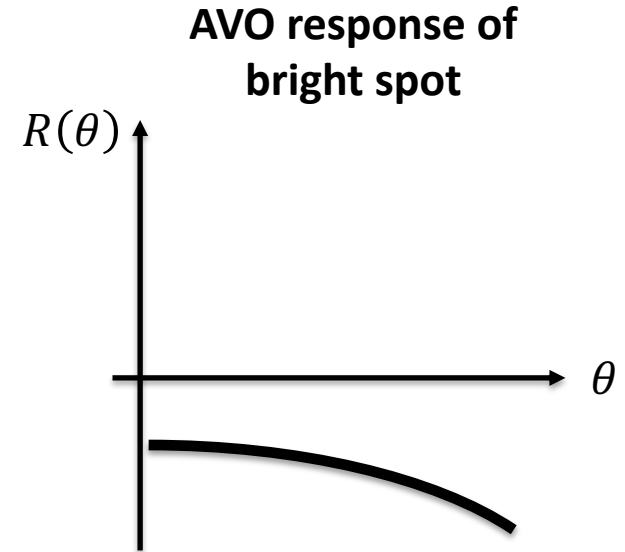
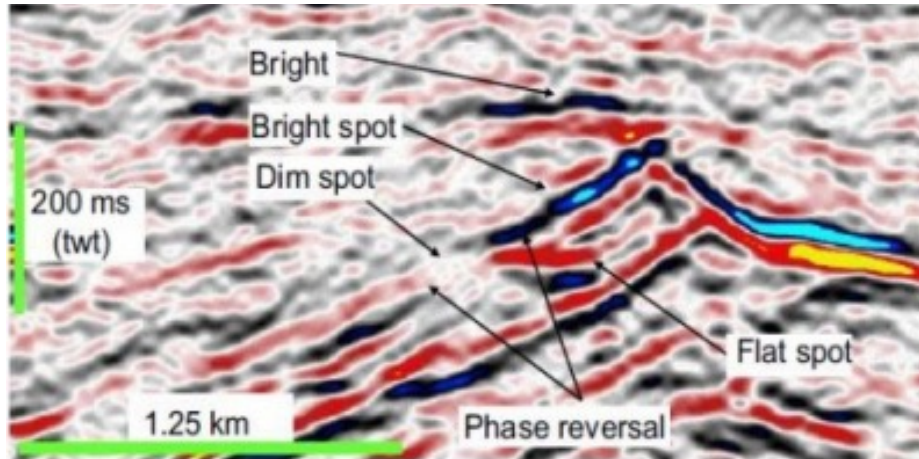
FORWARD



INVERSE



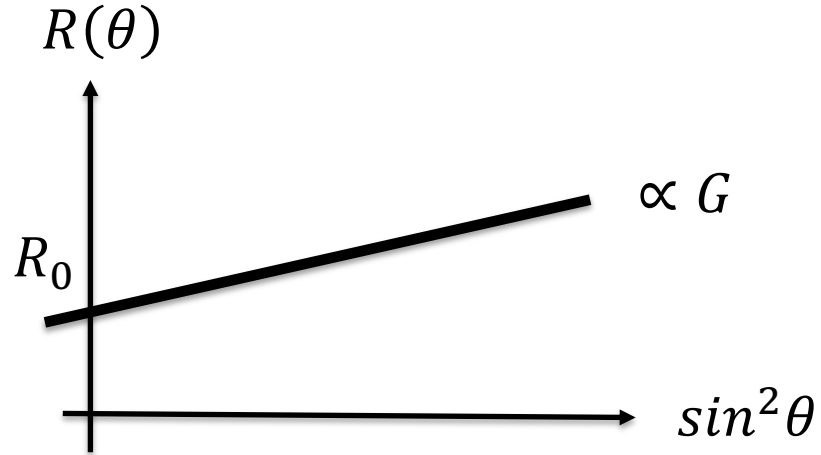
Bright spot and AVO



DHI (Direct Hydrocarbon Indicator):

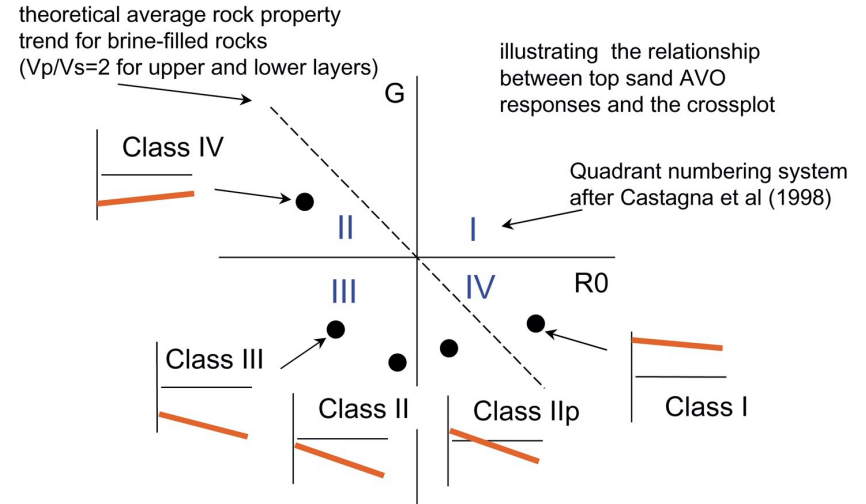
- Bright spot (gas filled soft sand)
- Dim spot (brine filled hard sand)
- Flat spot (oil-water contact or gas-oil contact)

2-terms AVO



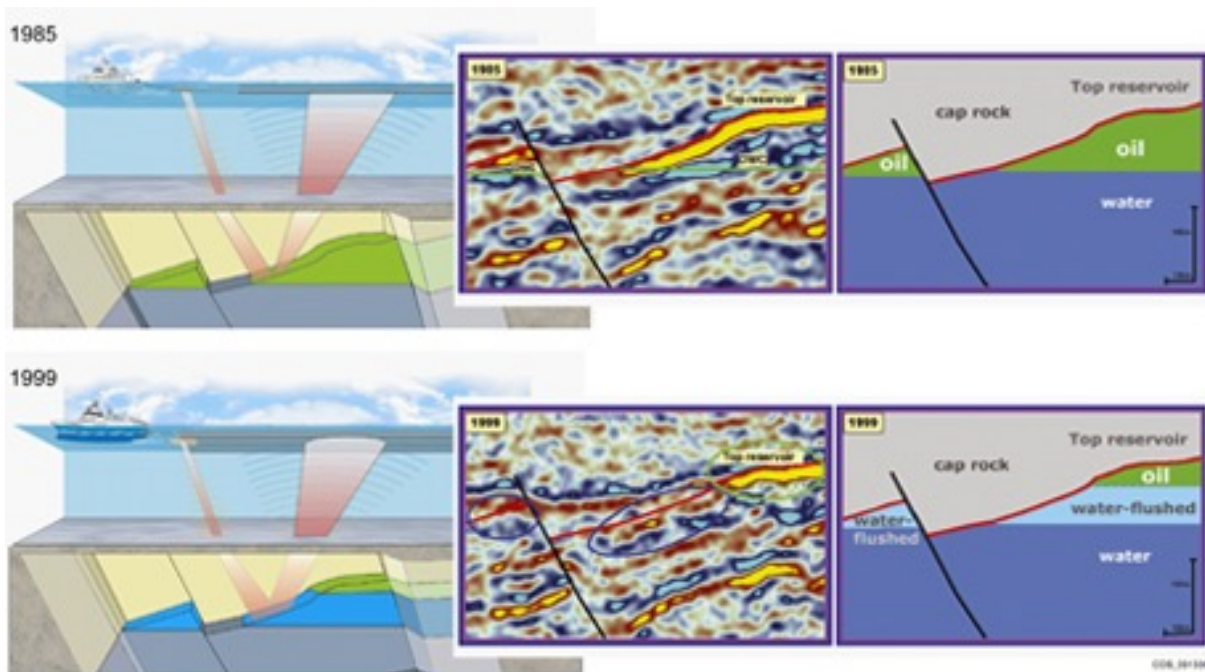
$$R(\theta) \approx R_0 + G \sin^2 \theta$$

AVO Classes



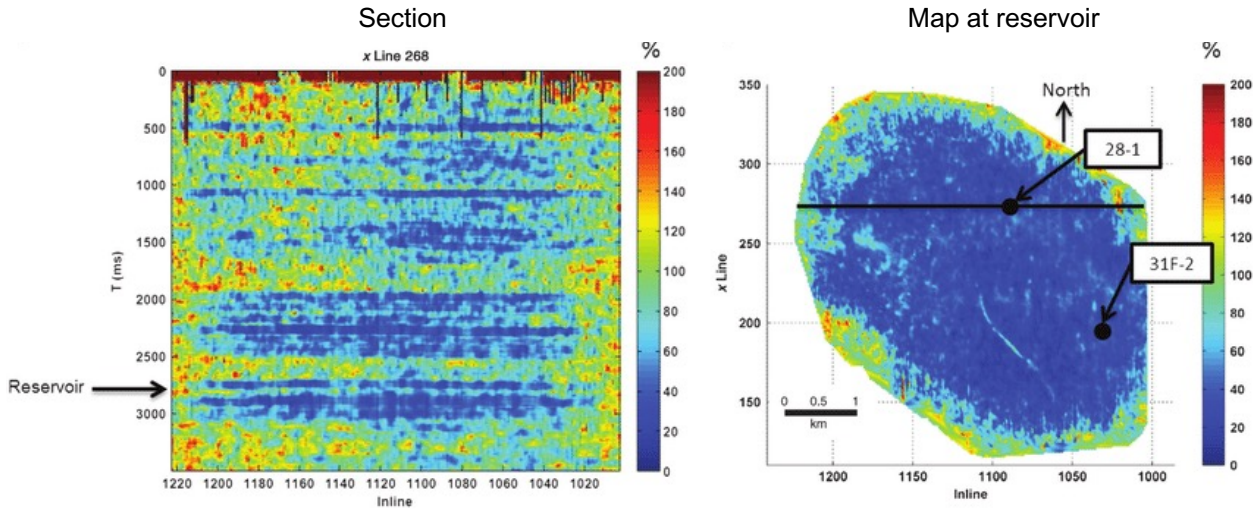
http://www.rock-physics.com/papers_downloads/RPA_simm_et_al_2000.pdf

4D Seismic



<https://www.geoexpro.com/articles/2009/05/4d-geophysical-data>

NRMS



From: Time lapse seismic response (4D) related to industrial-scale CO₂ injection at an EOR and CCS site, Cranfield, MS

$$NRMS = \frac{200 * RMS(base - moni)}{RMS(base) + RMS(mon)}$$