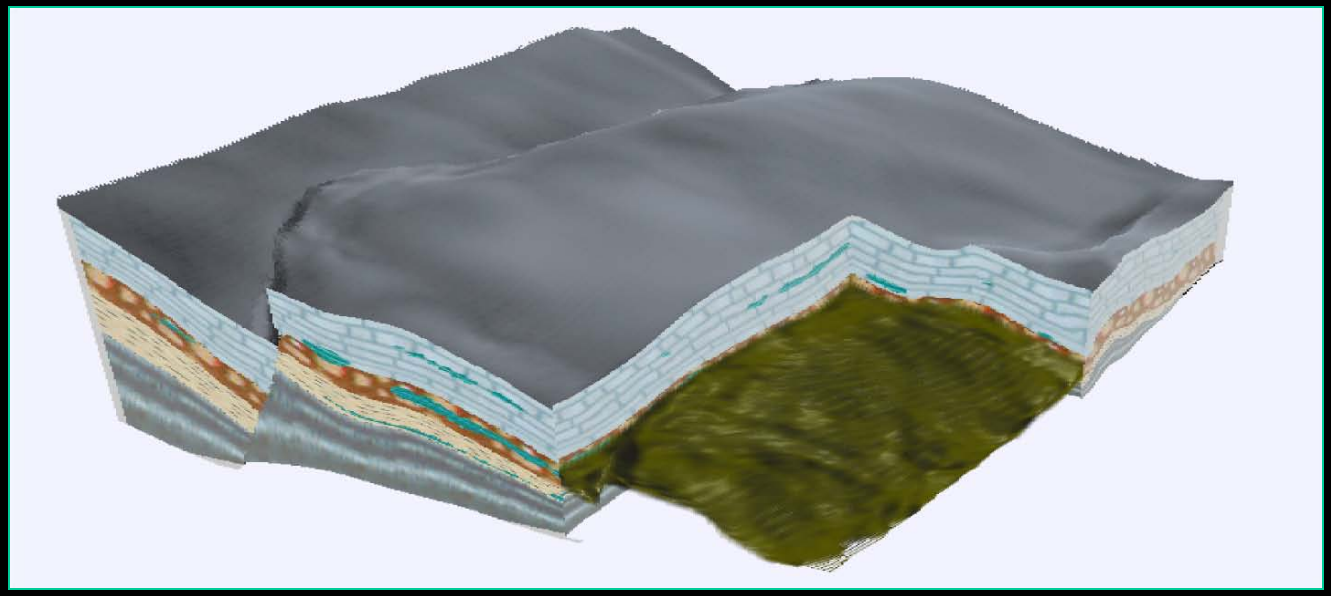
Illustrative Visualization for Rapid Interpretation in Geosciences



cmr

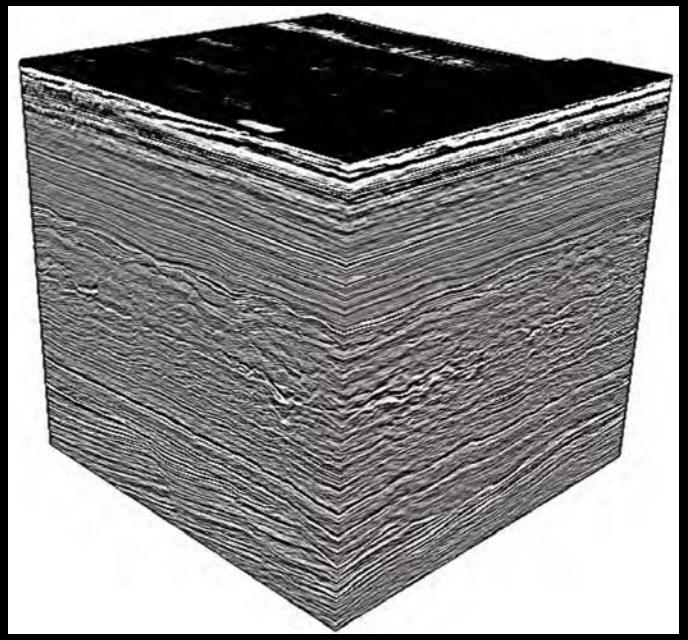
UNIVERSITAS BERGENSIS

StatoilHydro

TU WIEN Technische Universität Wien Vienna University of Technology

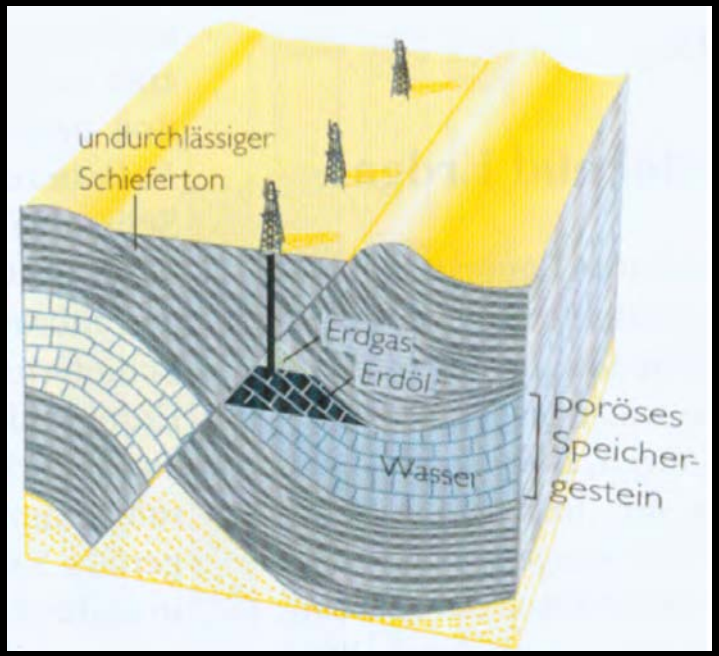
The essence of scientific illustrations

Data



- Raw data
- Visual overload

Illustration

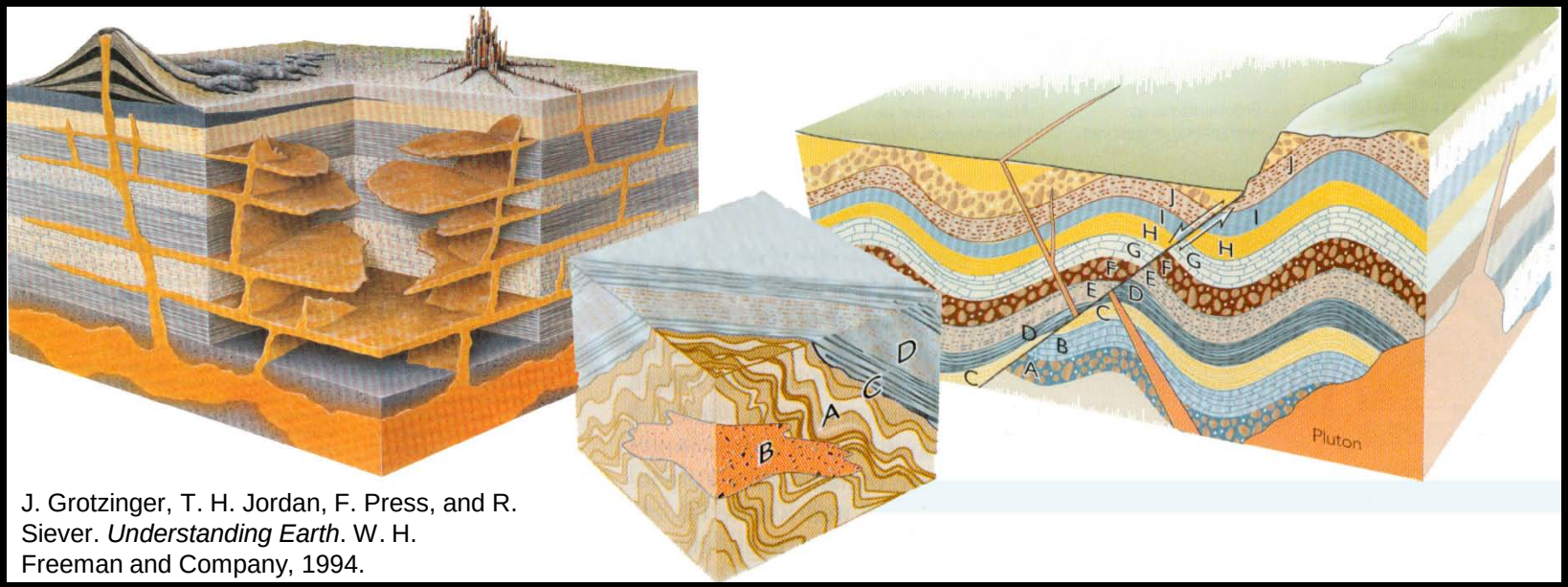


- Abstracted
- Shows essential aspects

Techniques in geoscientific illustrations

- Textures on planar surfaces to emphasize layers and faults
  - Textures bent along layers
  - Discontinuities over faults

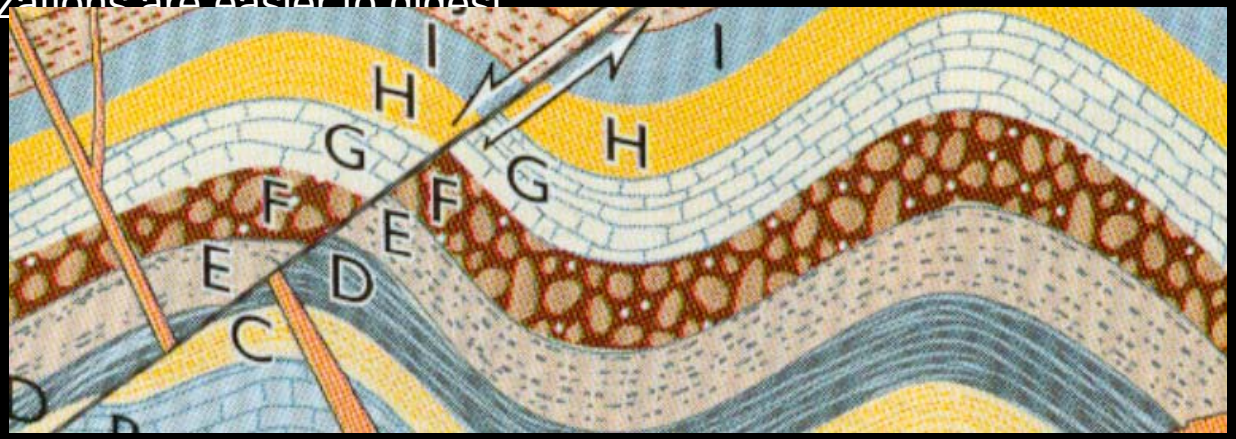
- Opaque cubes with textured surfaces for 3D context
  - Axis-aligned cut outs
  - Extruding features



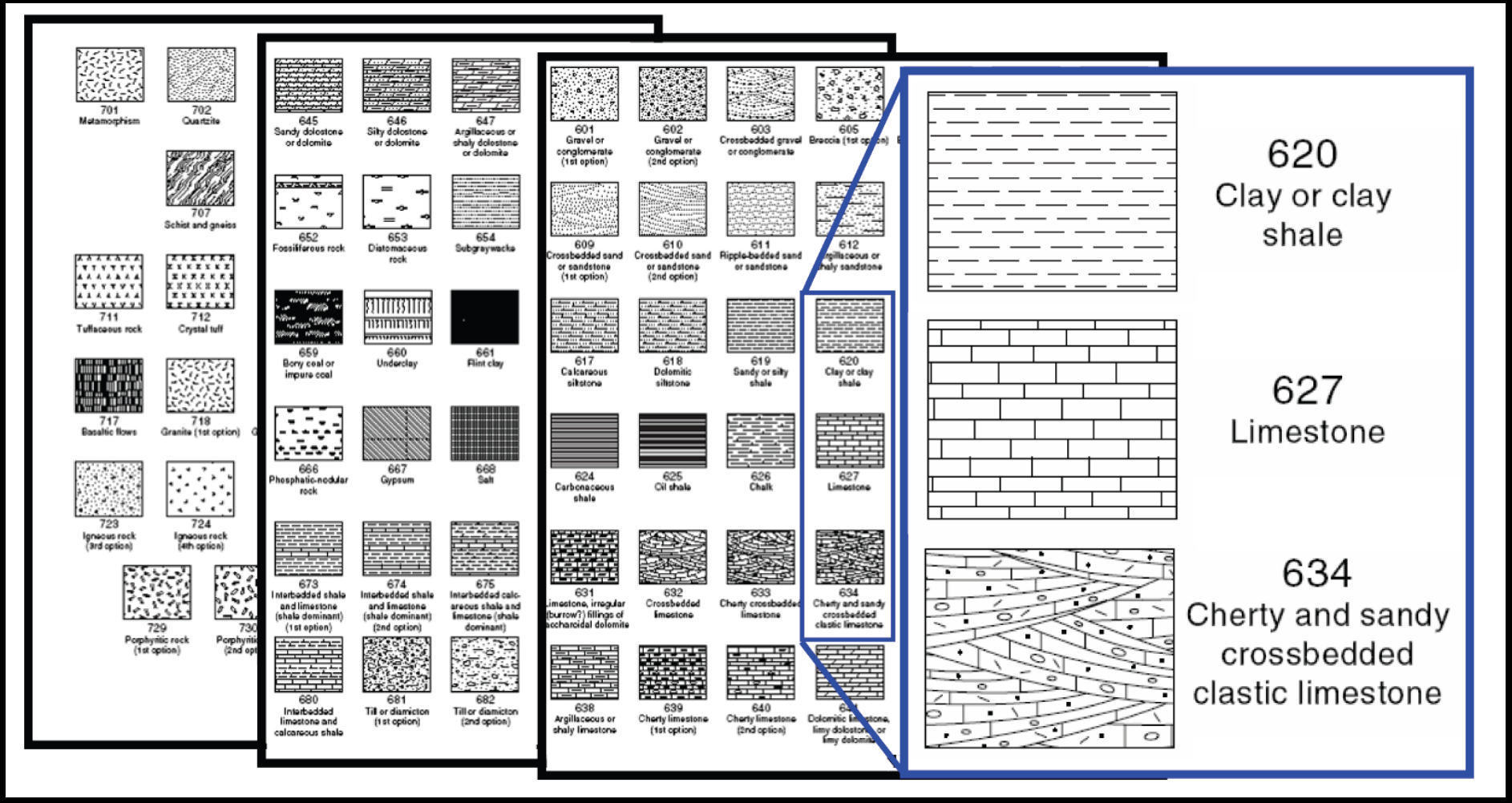
J. Grotzinger, T. H. Jordan, F. Press, and R. Siever. *Understanding Earth*. W. H. Freeman and Company, 1994.

More about geological textures

- To ease communication, geologists and geoillustrators use a standardized texture language for representing rock types.
- Textures have advantages in that they can give an integrated visualization of layers and faults.
- The layer type and its orientation is communicated locally at any point on the texture as opposed to when using labelling
- Visualizations are easier to digest



US standard geological textures

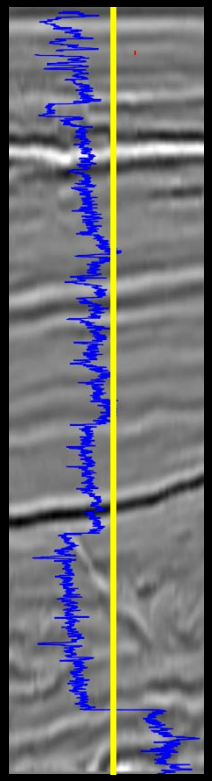


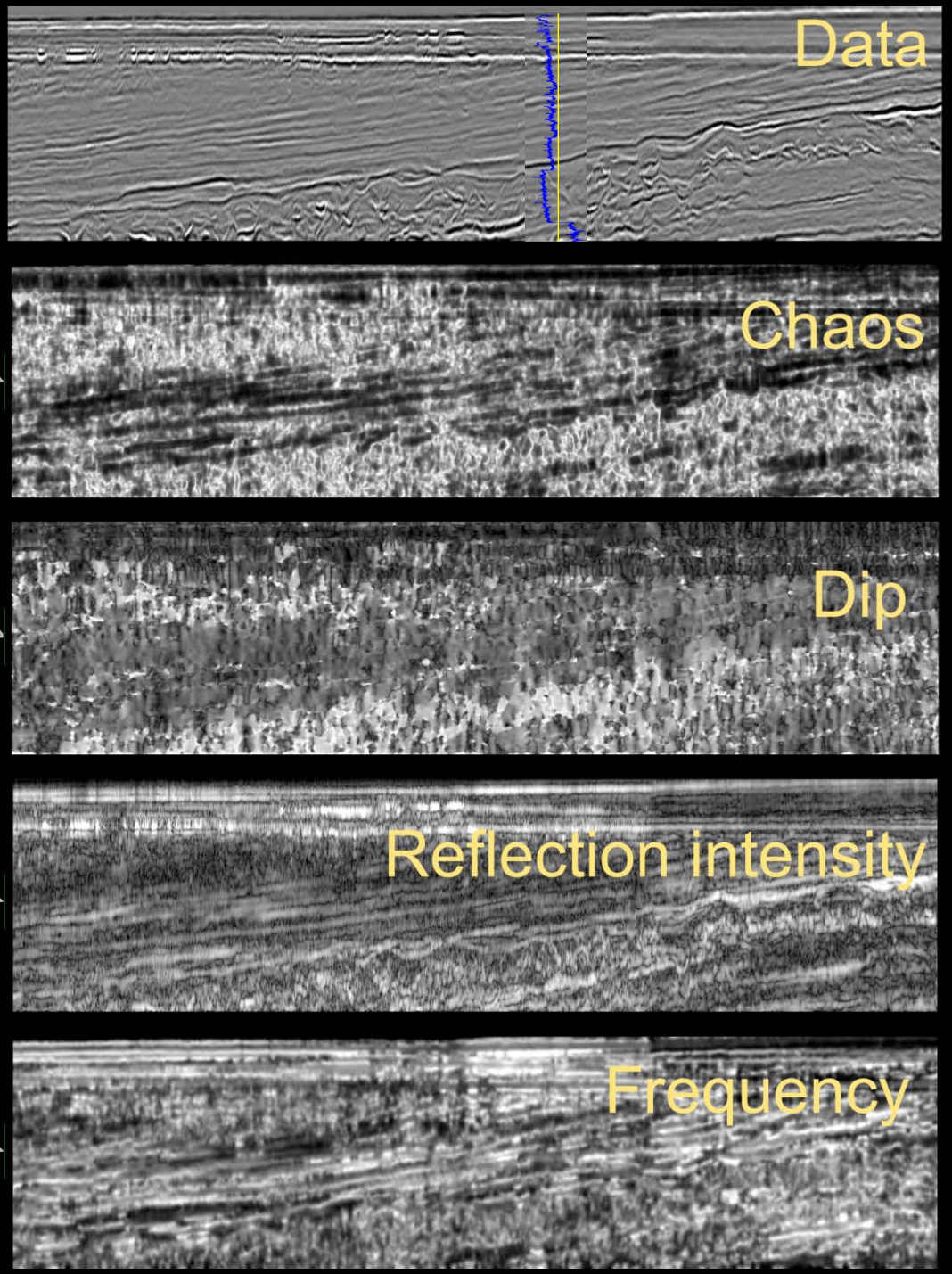
Illustrative rendering of uninterpreted data

Seismic data

-derived attributes

-well logs

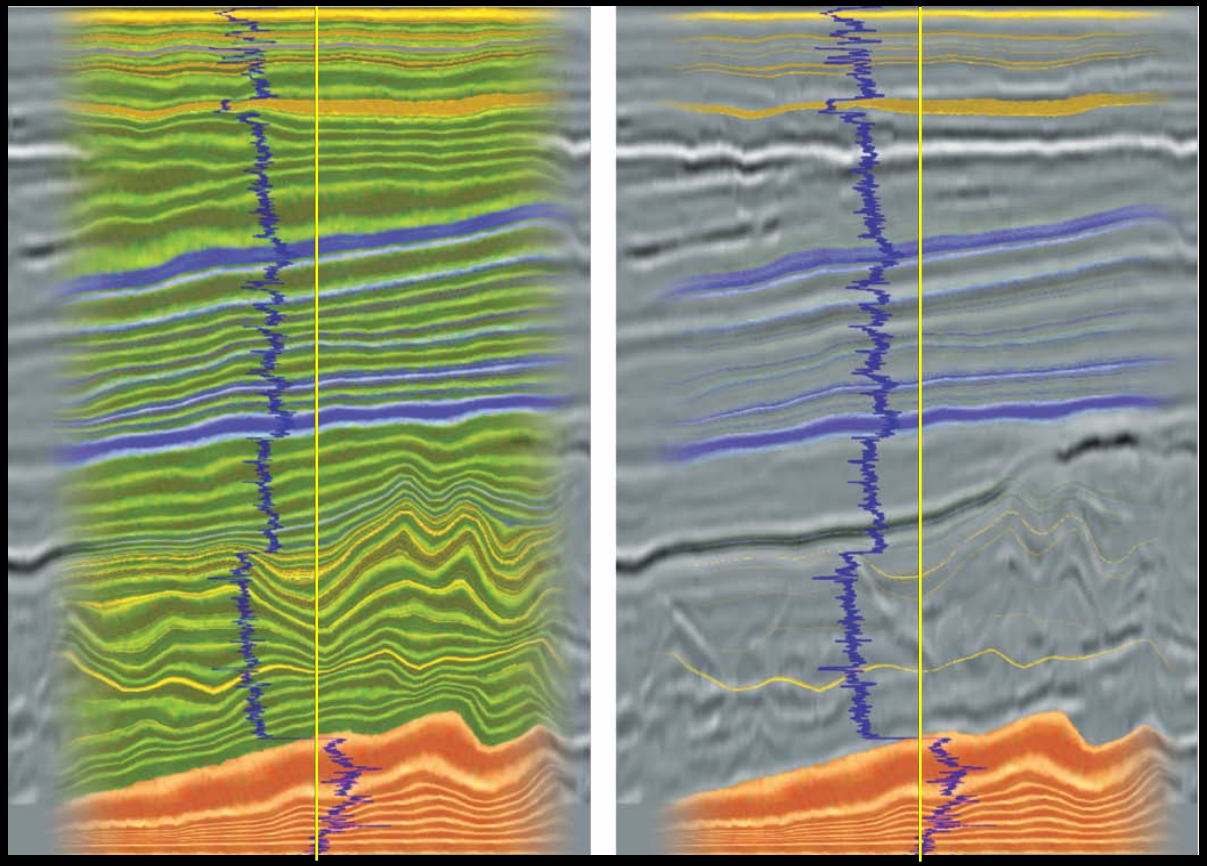




Automatic interpretation

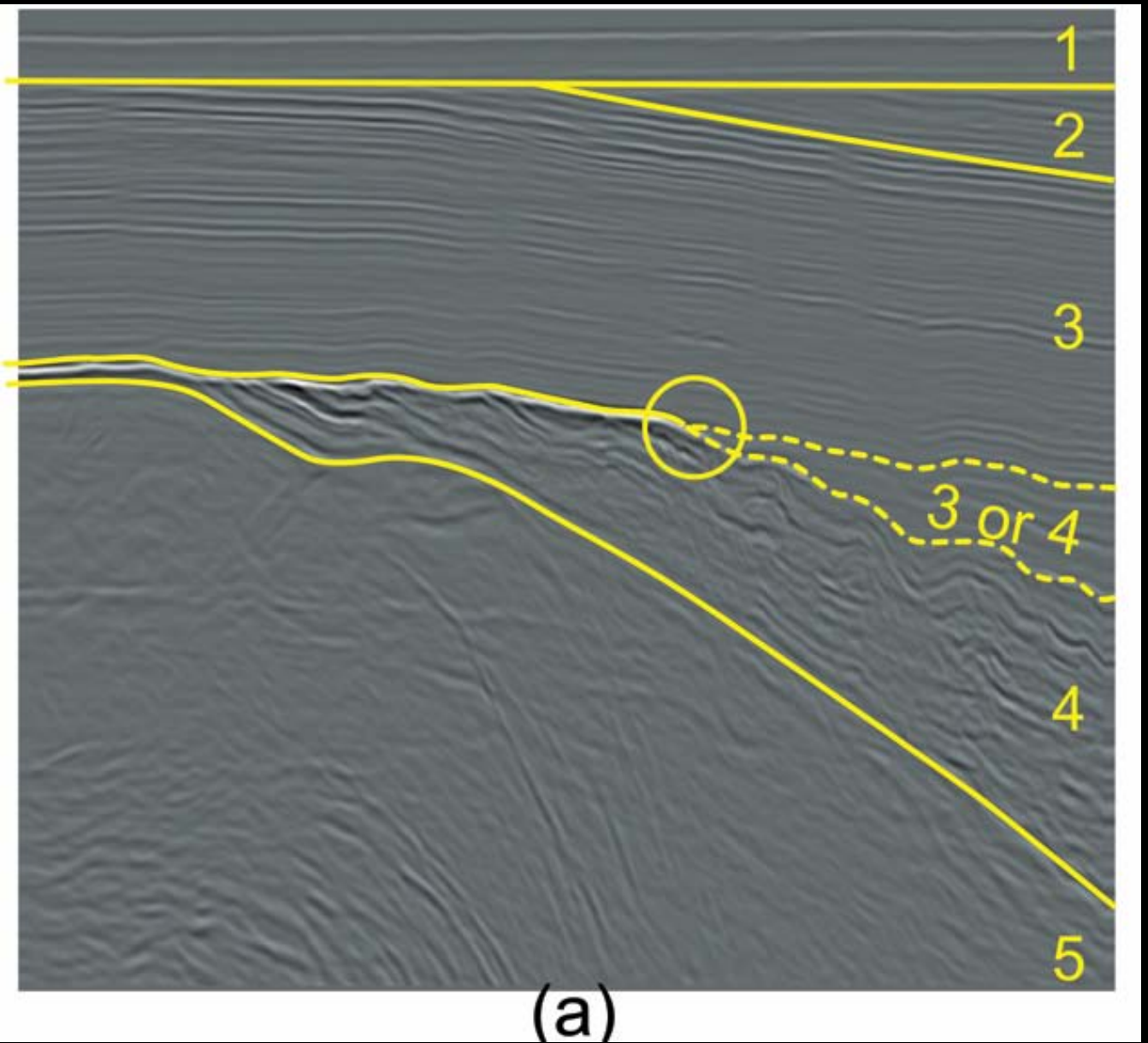
- Horizon finding
- Parameterization

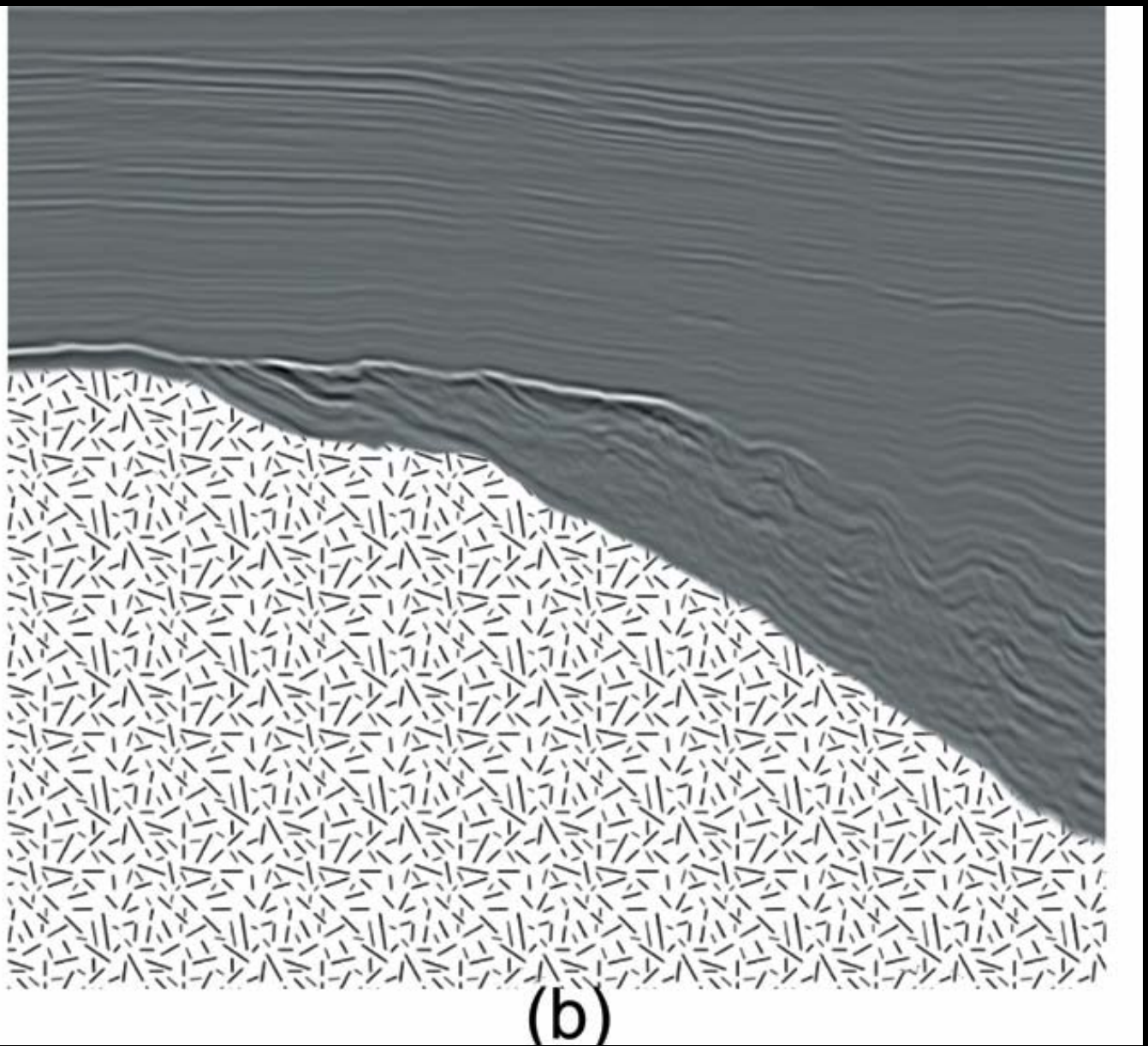
Well logs

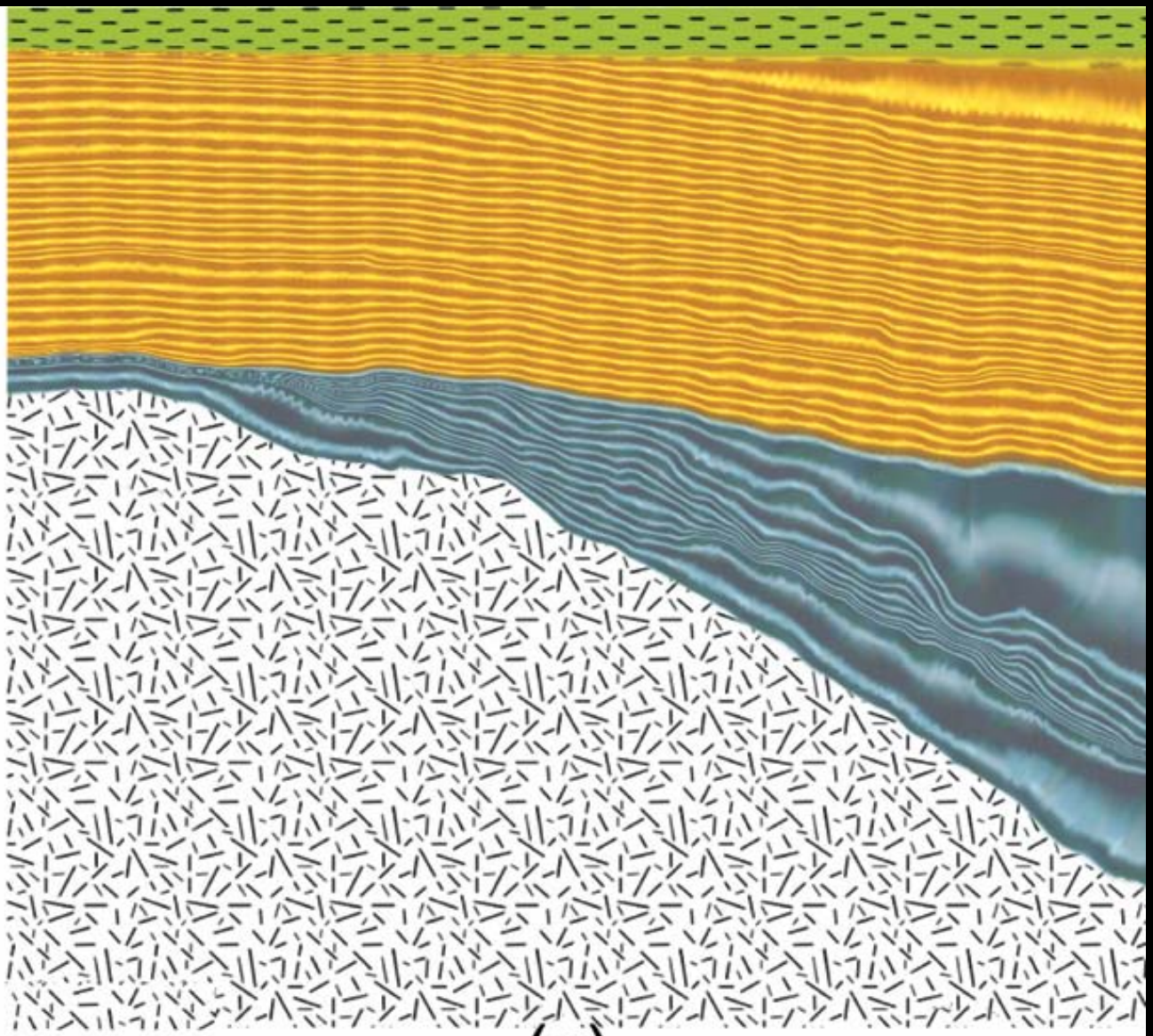


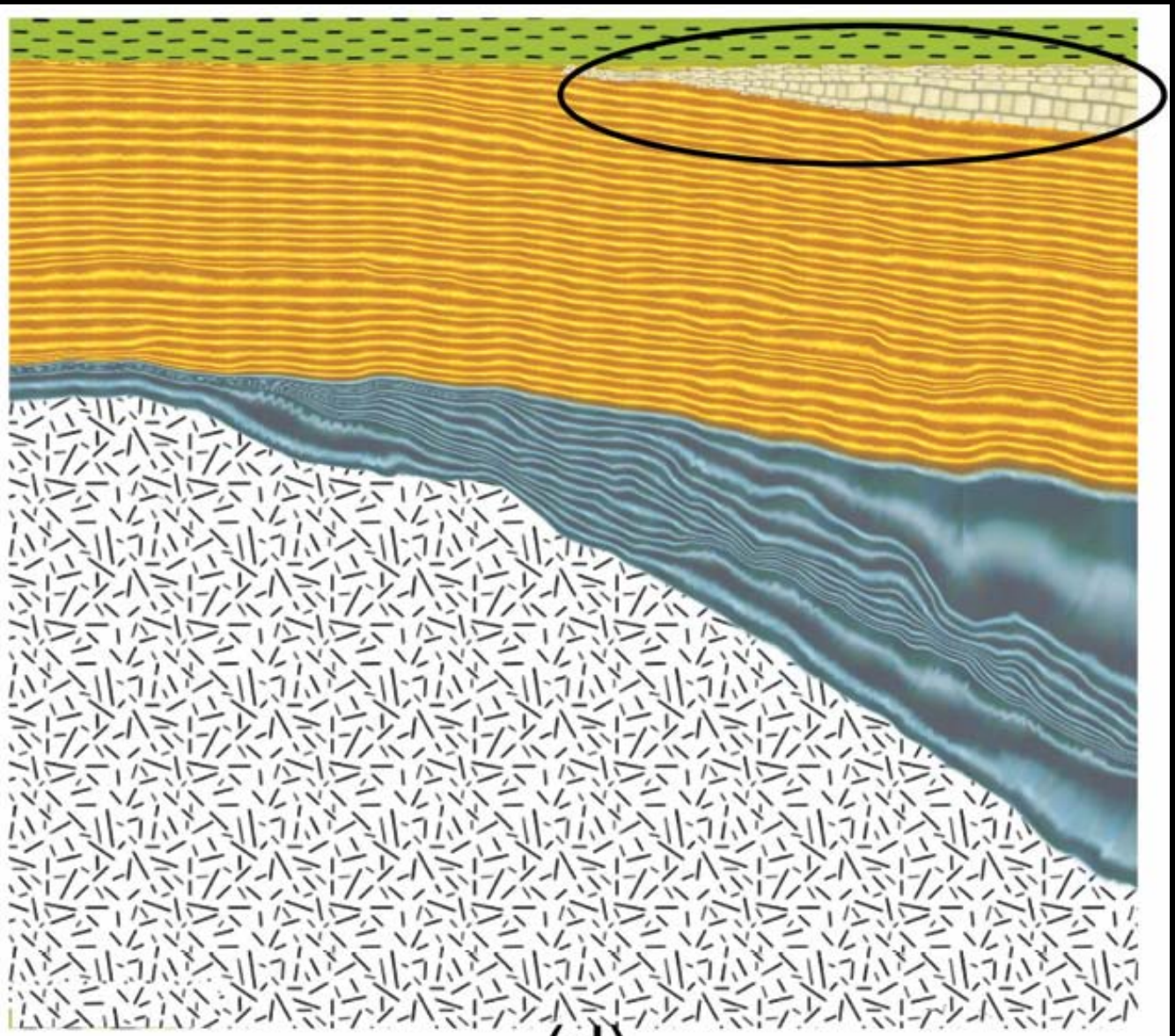
- Textures are extrapolated along horizons by using a parameterization

Results – use case developed with StatoilHydro

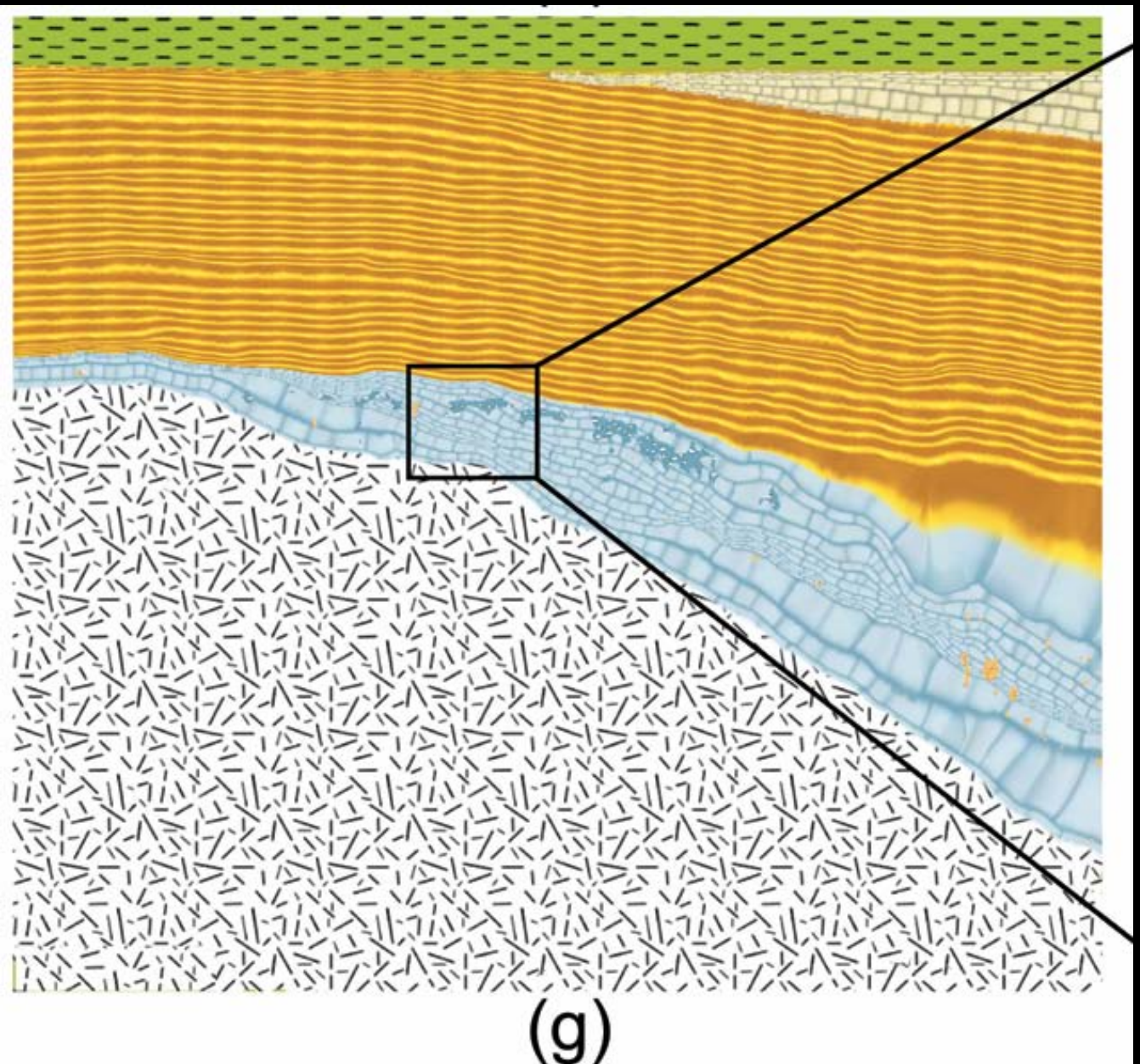



(b)

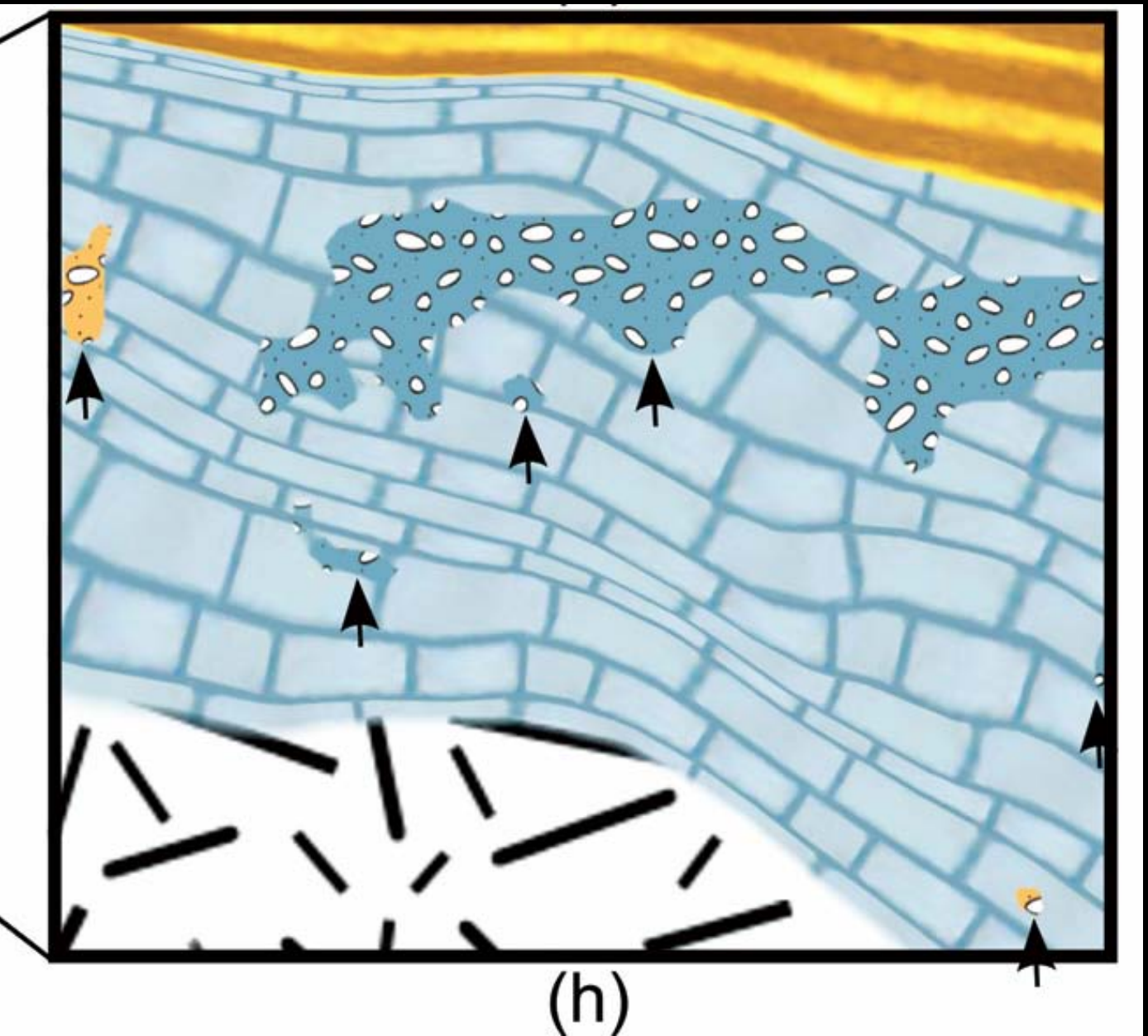

(c)



(d)



(g)



(h)

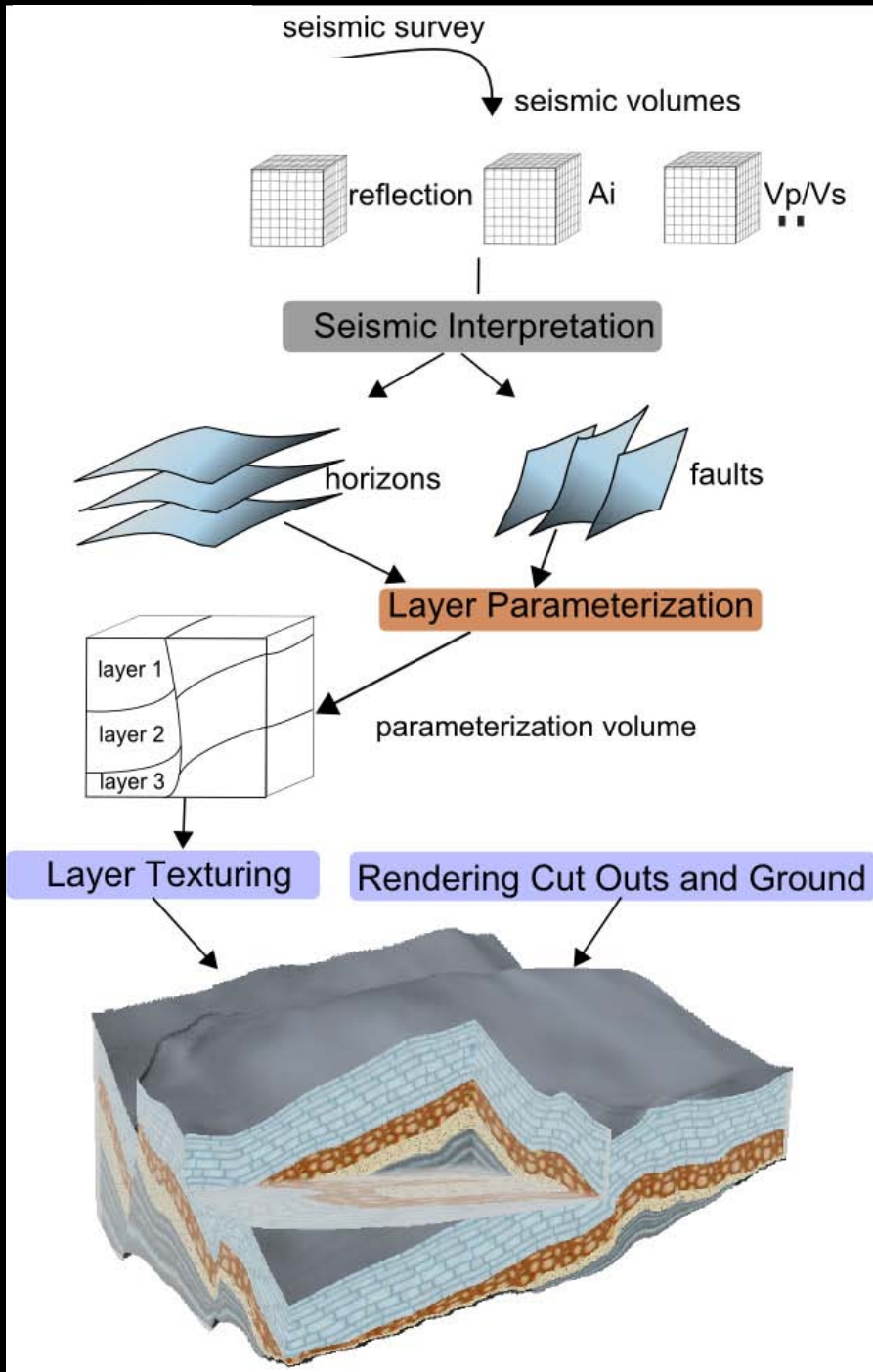
Illustrative rendering of uninterpreted data

- Tight interpretation-illustration loop speeds up interpretation
- Work faster by studying combinations of attributes instead of one at the time
- Communicate easier by sharing expressive images instead of mental images
- A good way to handle seismic data with its chaotic nature
- Textures give an integrated visualization of layers, faults and attributes
- Images are aesthetic regardless of zoom factor

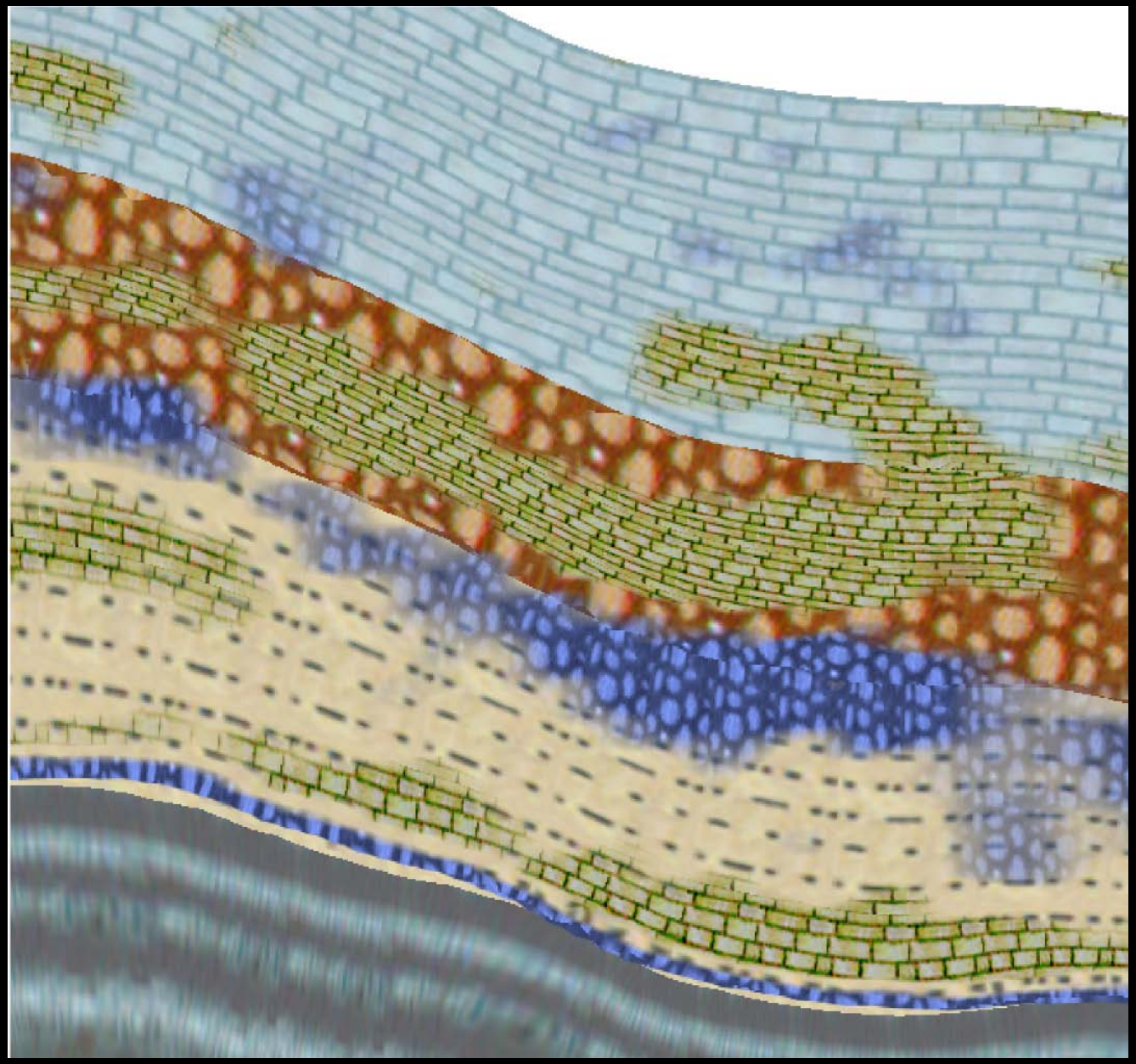
Illustrative rendering of *interpreted* data

Illustrative rendering of faults, layers and cut outs

- Horizon and fault surfaces define a parameterization volume
- Parameterization volume describes texture flow and layer segmentation
- By moving a roaming box into the dataset a cutout is created

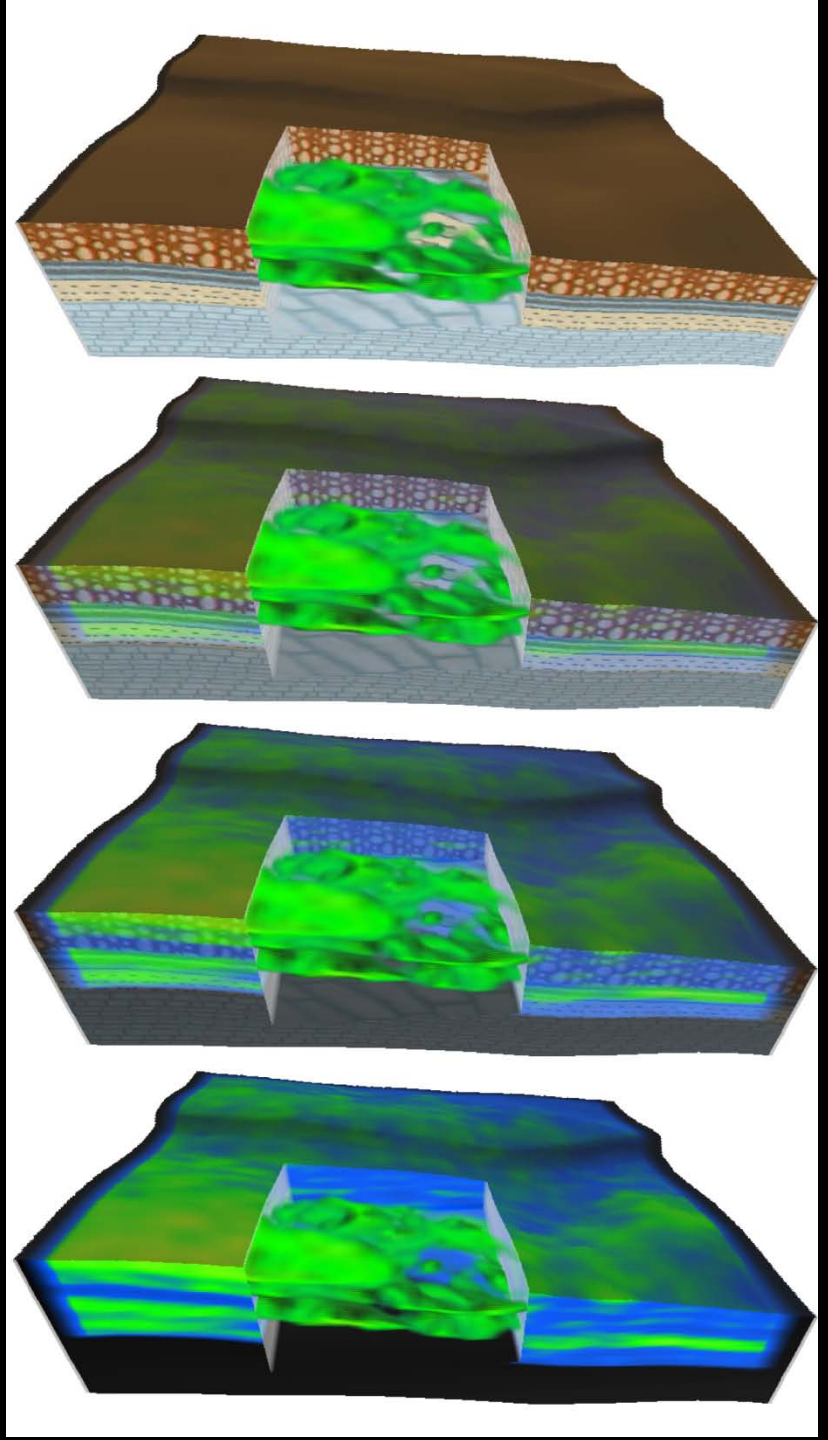


User-configurable textures



3D features

- Volume rendering in cut outs
  - Targeted in selected layers or regions of interest
- Smooth blending in 3D
  - From interpreted to uninterpreted data for verification



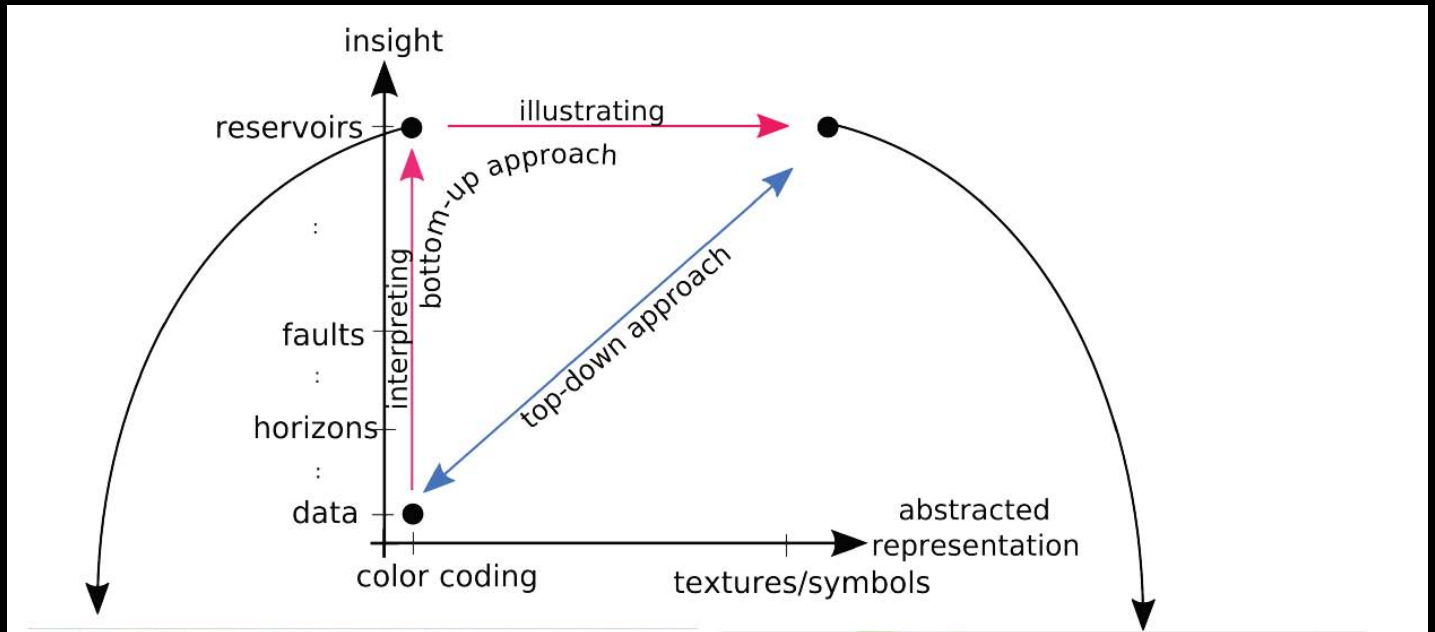
Illustrative rendering of *interpreted* data

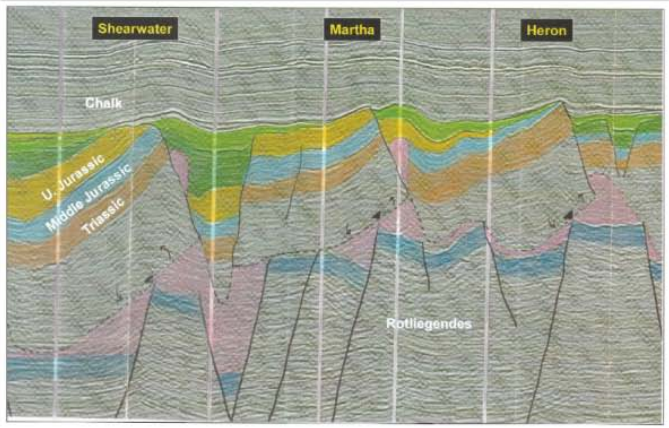
Advantages of geology illustrations

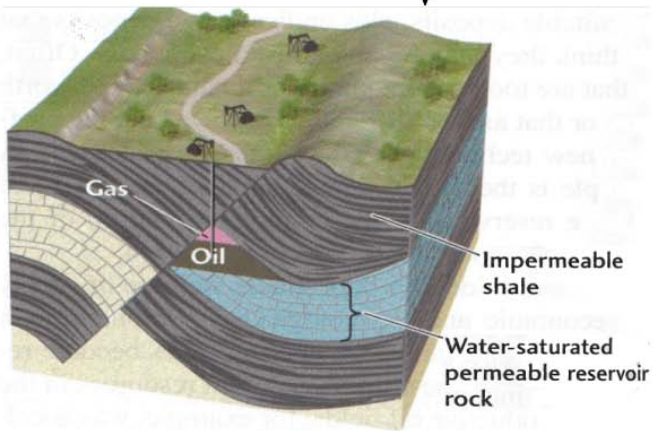
- all big oil companies have illustrators, this can cut time and cost

- for use in reports and government drilling applications

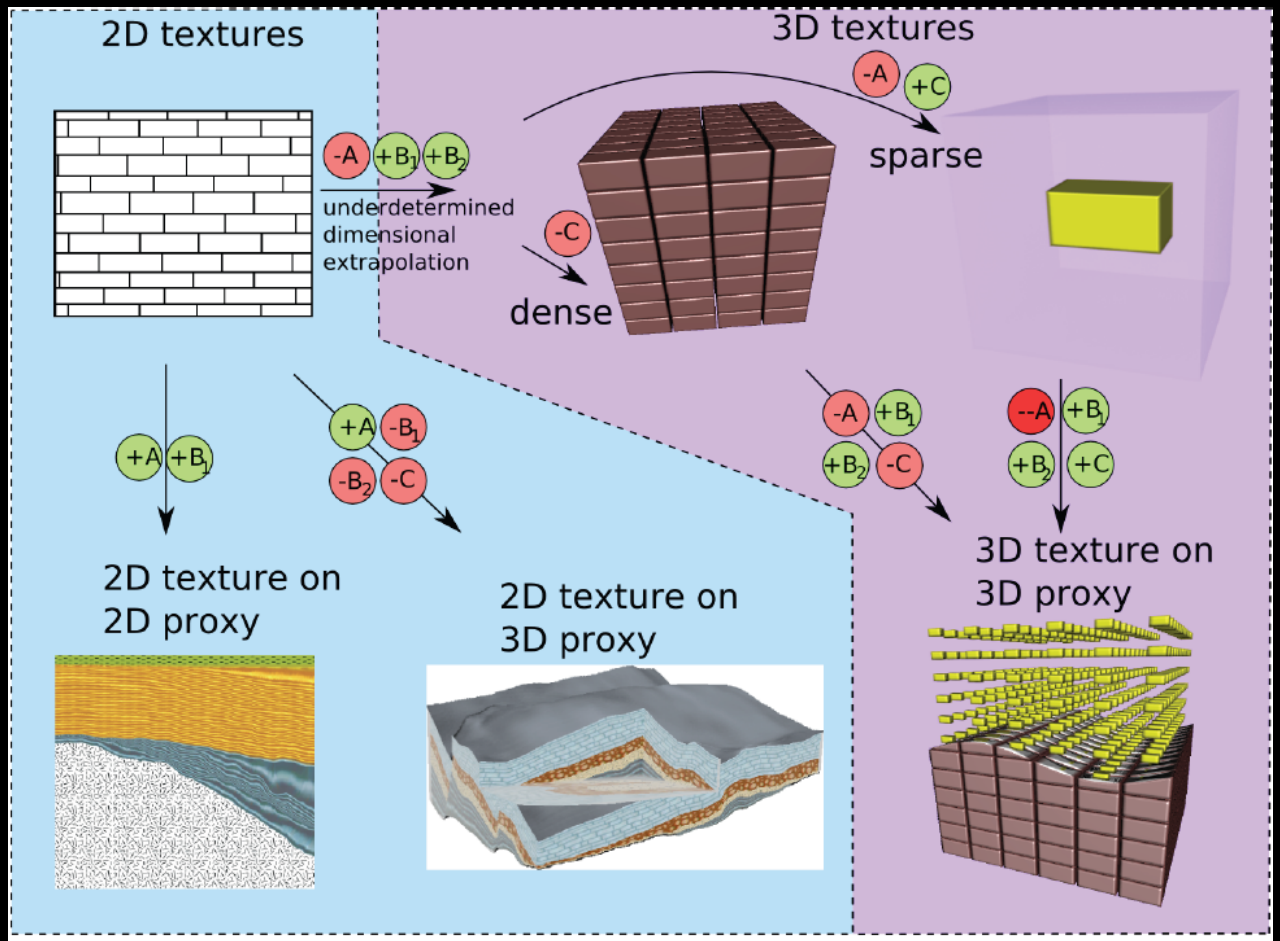
Comparison


insight
reservoirs
illustrating
bottom-up approach
interpreting
faults
horizons
data
top-down approach
color coding
abstracted representation
textures/symbols


Shearwater
Martha
Heron
Chalk
U. Jurassic
Middle Jurassic
Triassic
Rotliegendes


Gas
Oil
Impermeable shale
Water-saturated permeable reservoir rock

2D vs 3D texturing



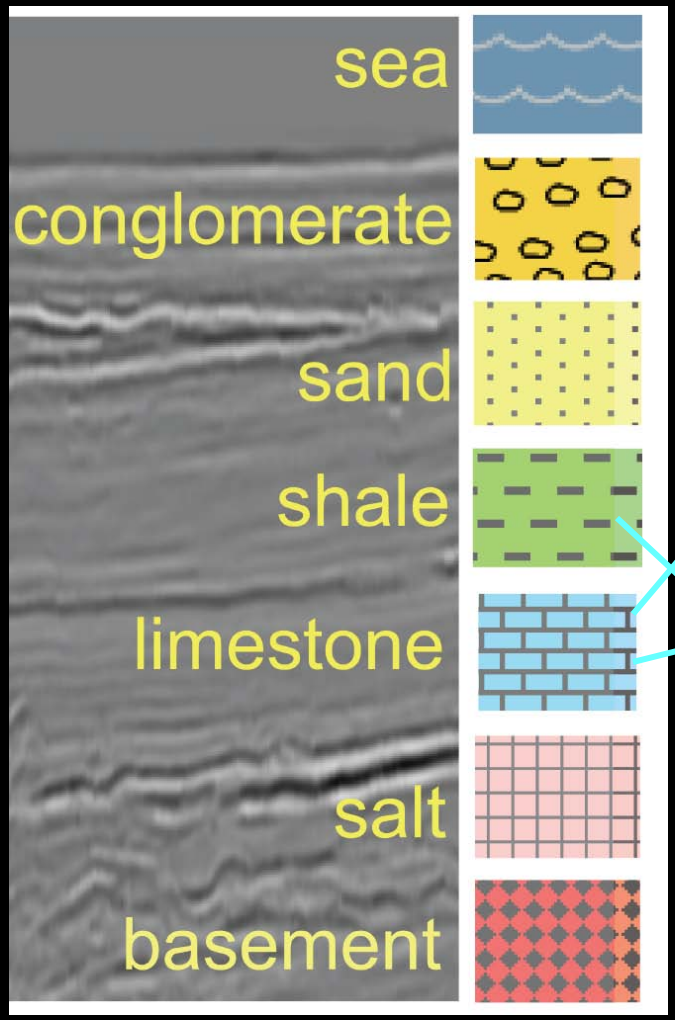
A Recognizability after final projection to 2D screenspace

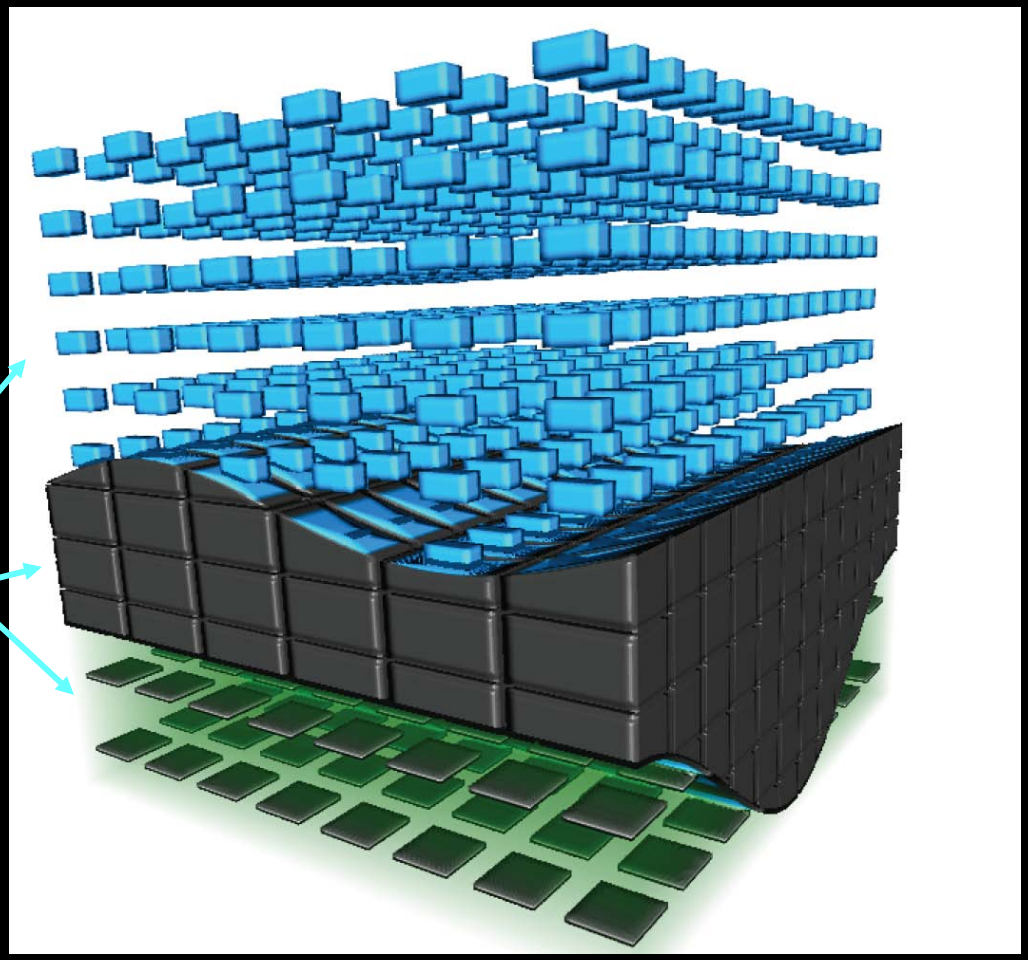
B_1 Spatial coherency

B_2 Frame-to-frame coherency when moving cut-plane

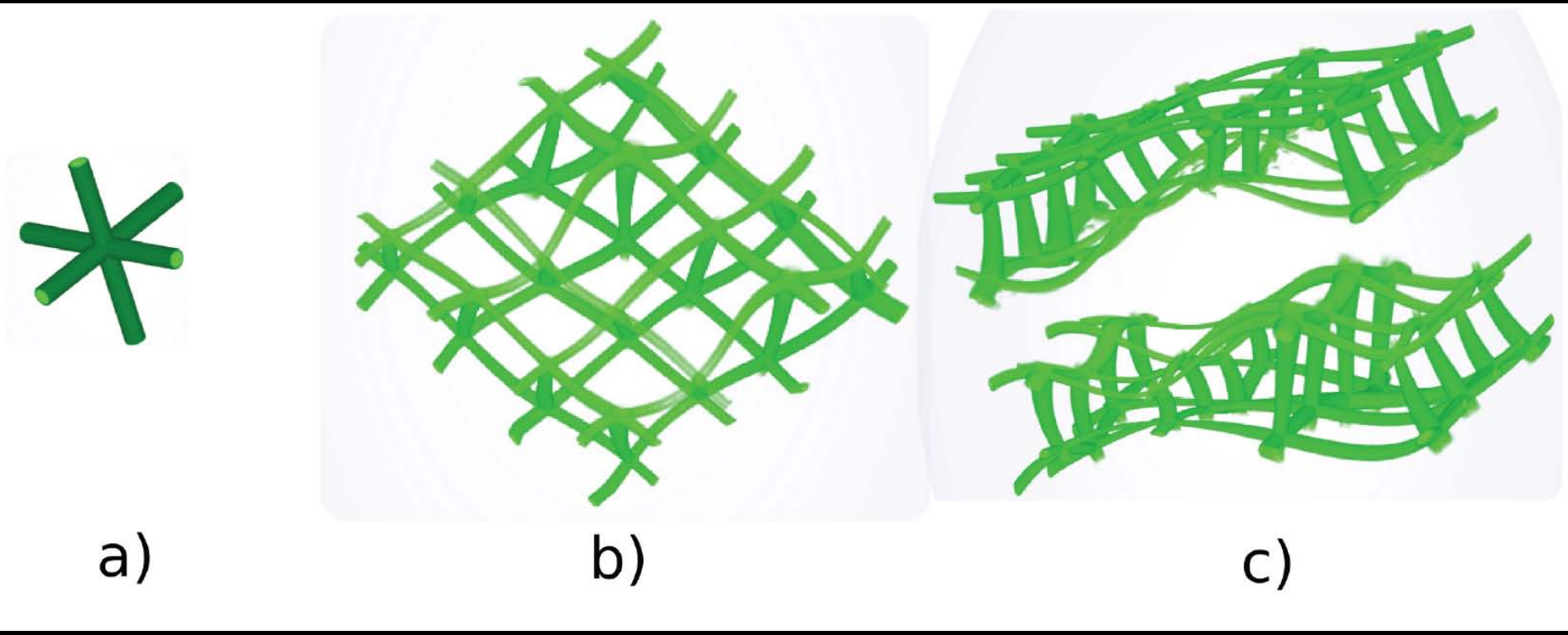
C True 3D that works with transparency

From 2D textures to 3D textures





Deformed 3D sparse textures



THE END