



The Seismic Analyzer: Interpreting and Illustrating 2D Seismic Data

Daniel Patel, Christopher Giertsen, John Thurmond, John Gjelberg, and M. Eduard Gröller



cmr

StatoilHydro

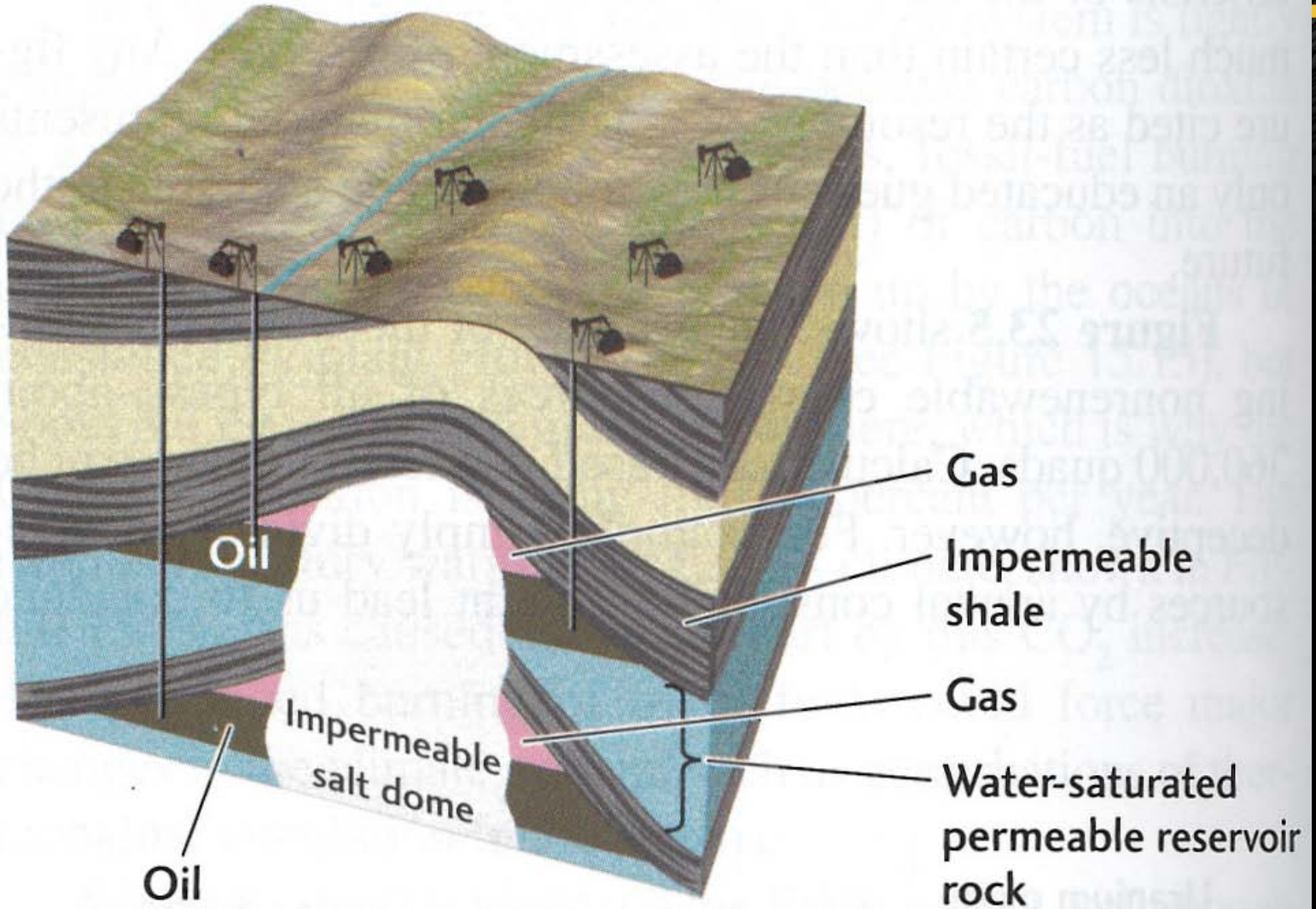


Introduction

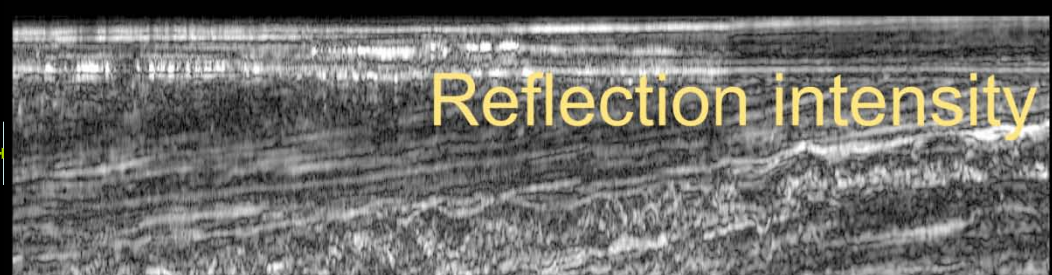
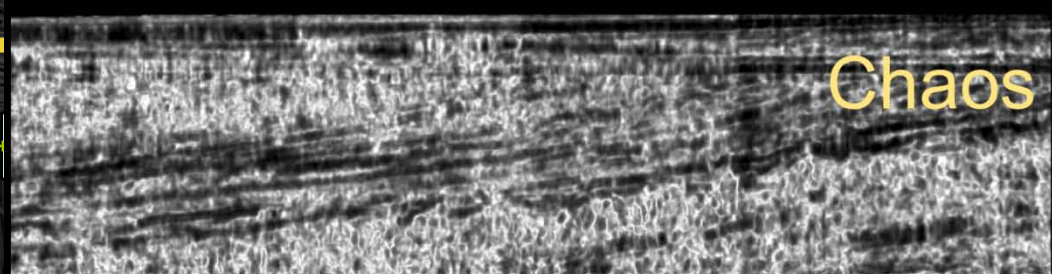
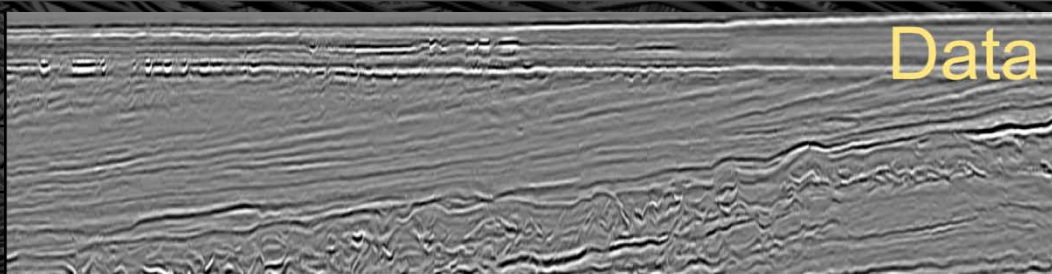


- Society is dependent on oil and gas
- It covers two thirds of the world energy consumption
- Most simple reservoirs have been found
 - Increasingly difficult measuring, analysing and extraction
- Measured by echo imaging and wells
 - requires expensive equipment, performed over vast areas

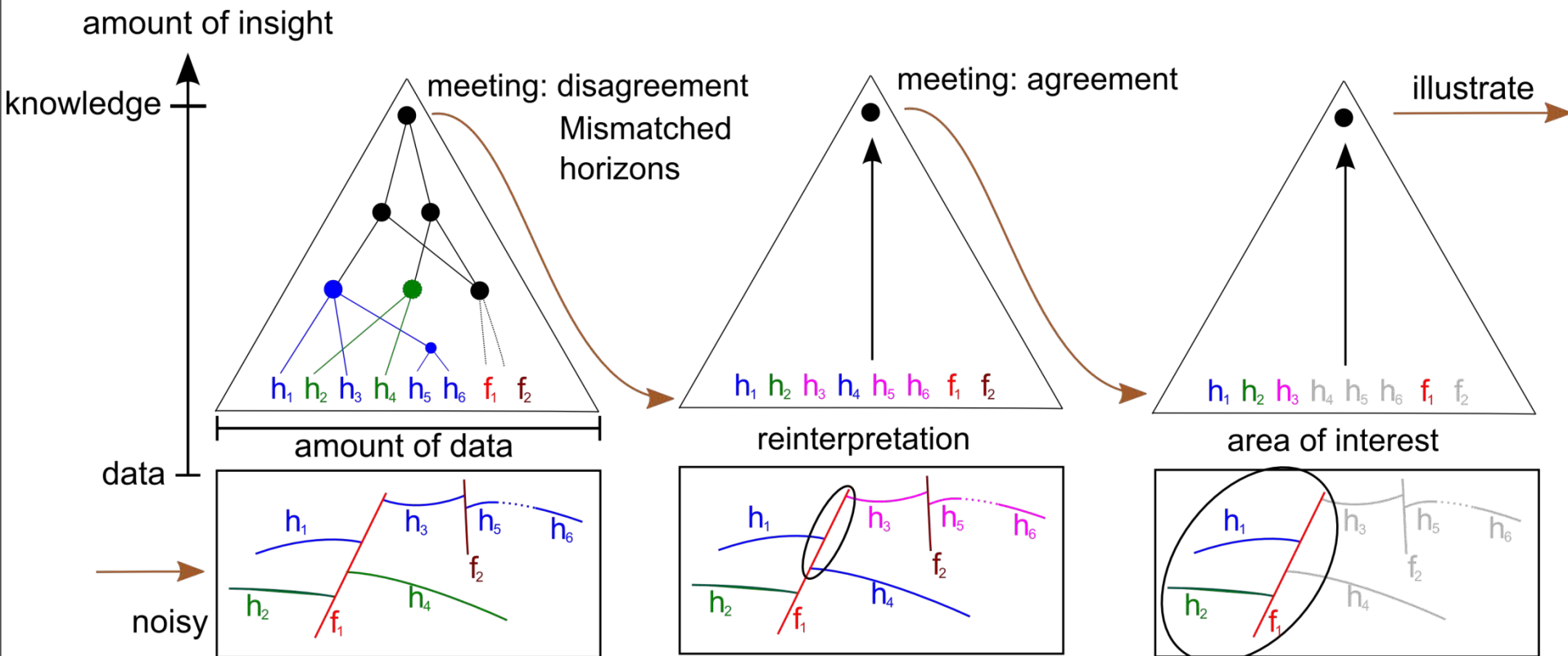
Interpreting the seismic data



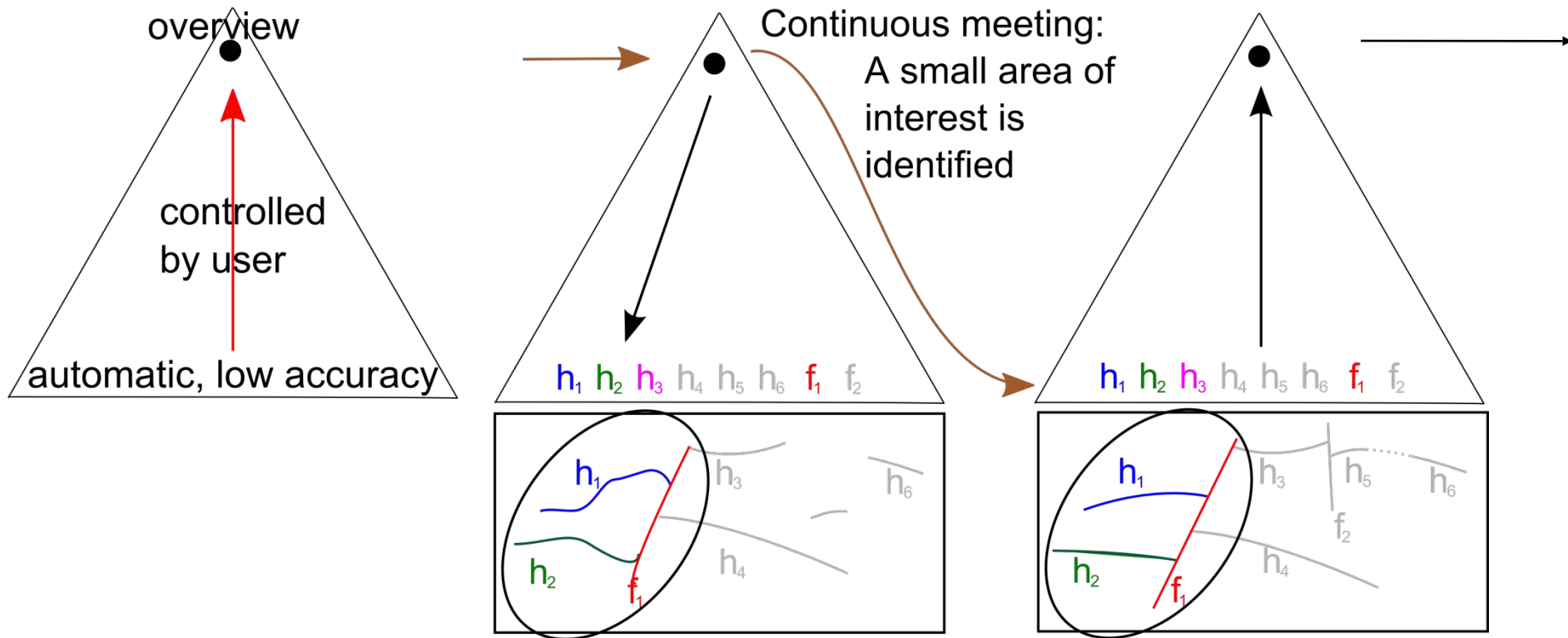
Seismic data



Current interpretation workflow – bottom up



New interpretation workflow first top-down, then bottom-up



The Seismic Analyzer

seismic reflection data

seismic surveys



trace horizons

derive attributes

parameterize horizons

well log

horizons

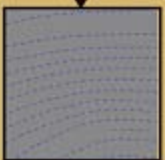
dip

intensity

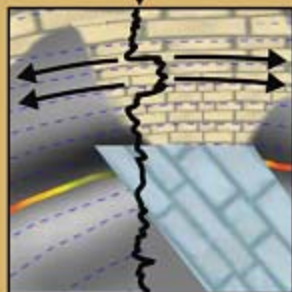
parameterization



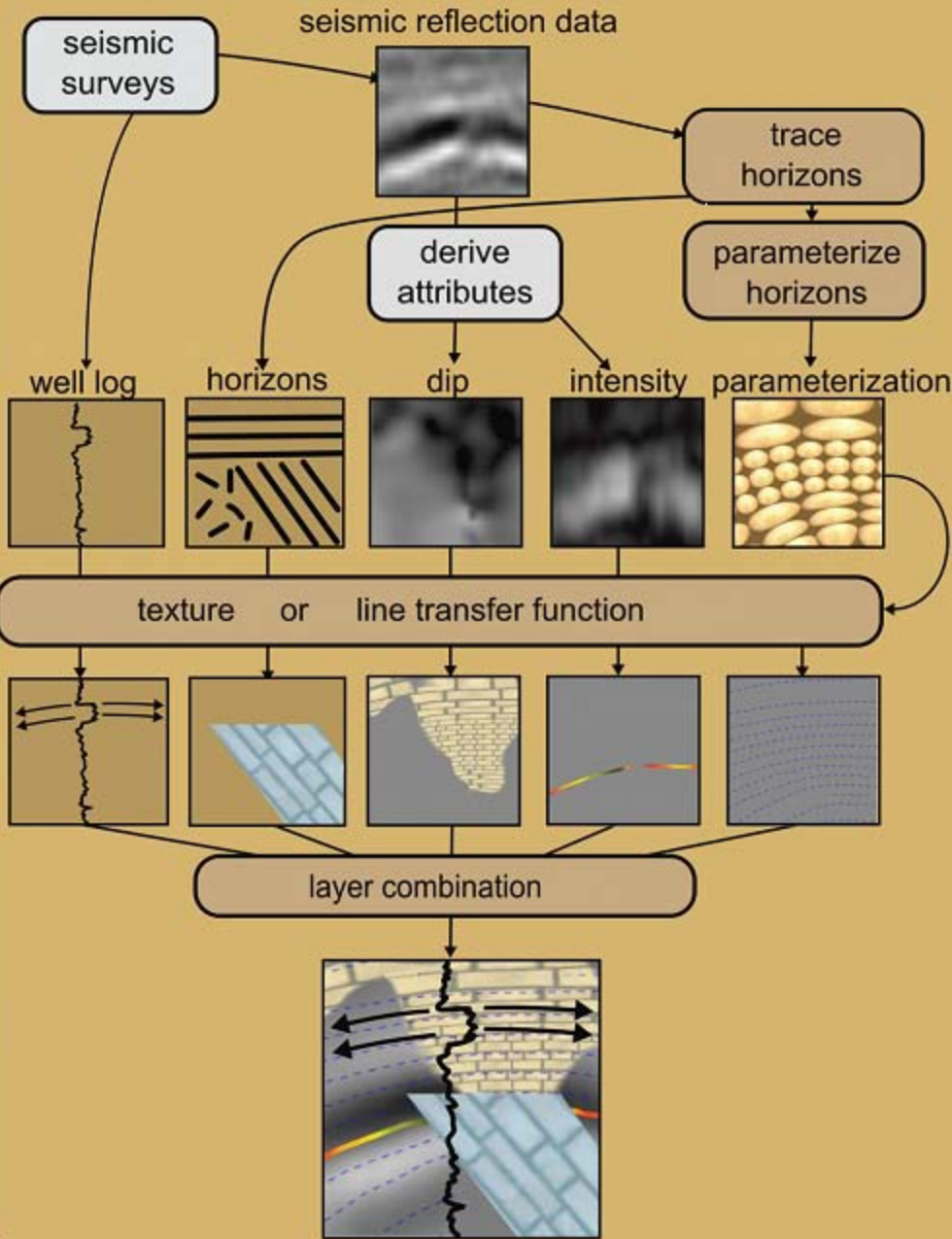
texture or line transfer function



layer combination



The Seismic Analyzer

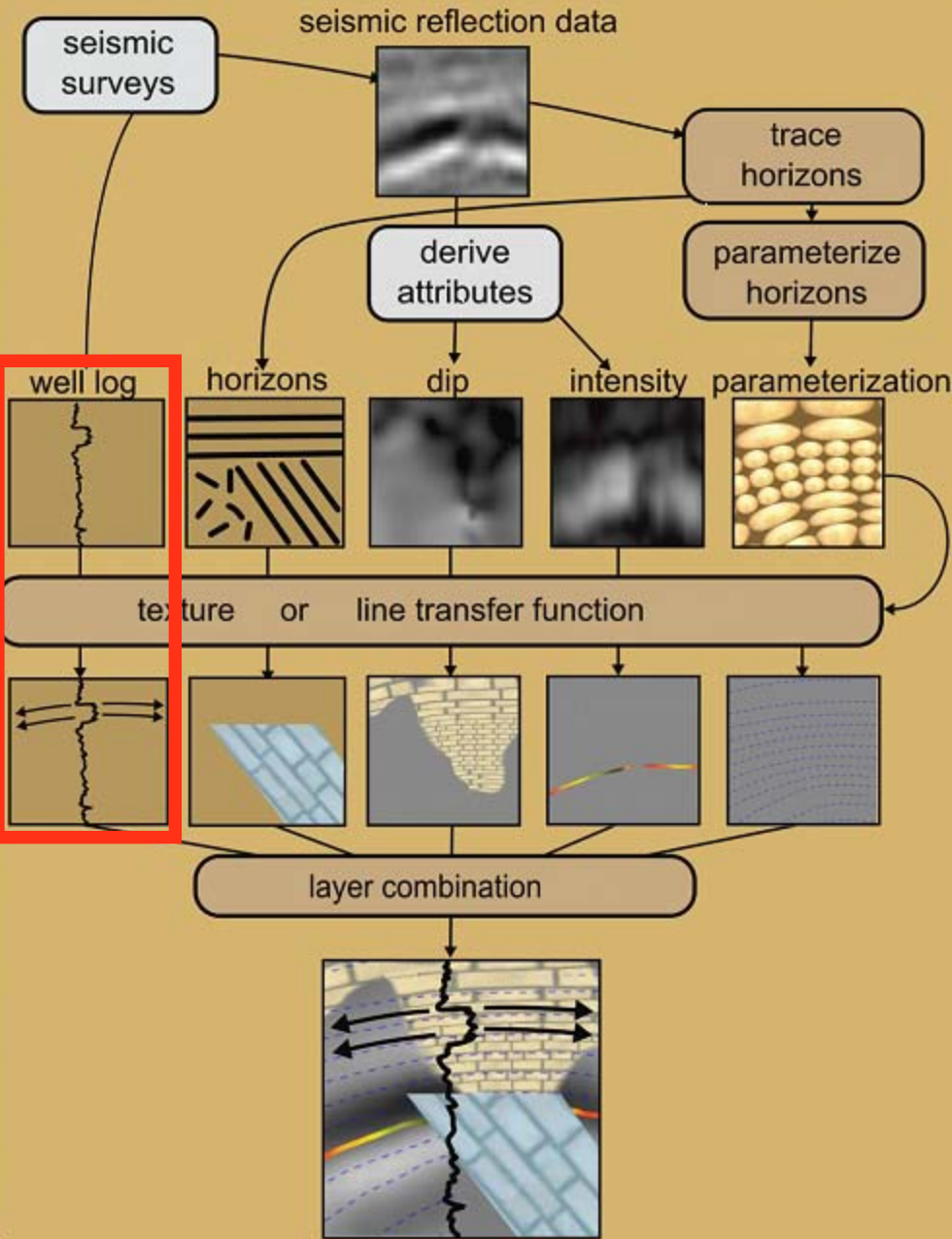


Automated interpretation



- Well logs and layers are extrapolated along horizons
- Horizons are identified in a preprocessing step
- Horizons are manually picked or automatically filtered
- Filtering horizons by angles or average reflection strength groups horizons into seismic structures

The Seismic Analyzer

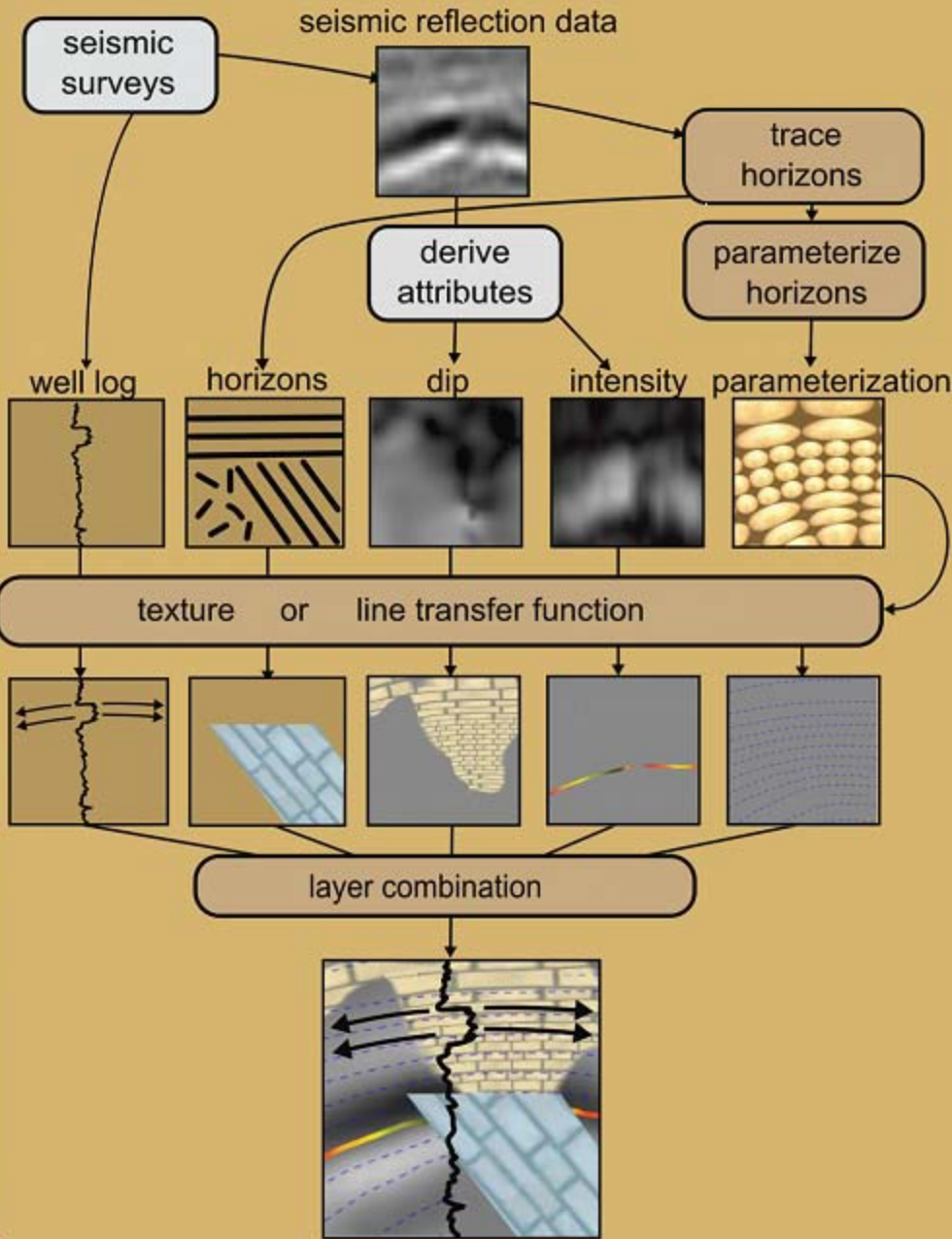


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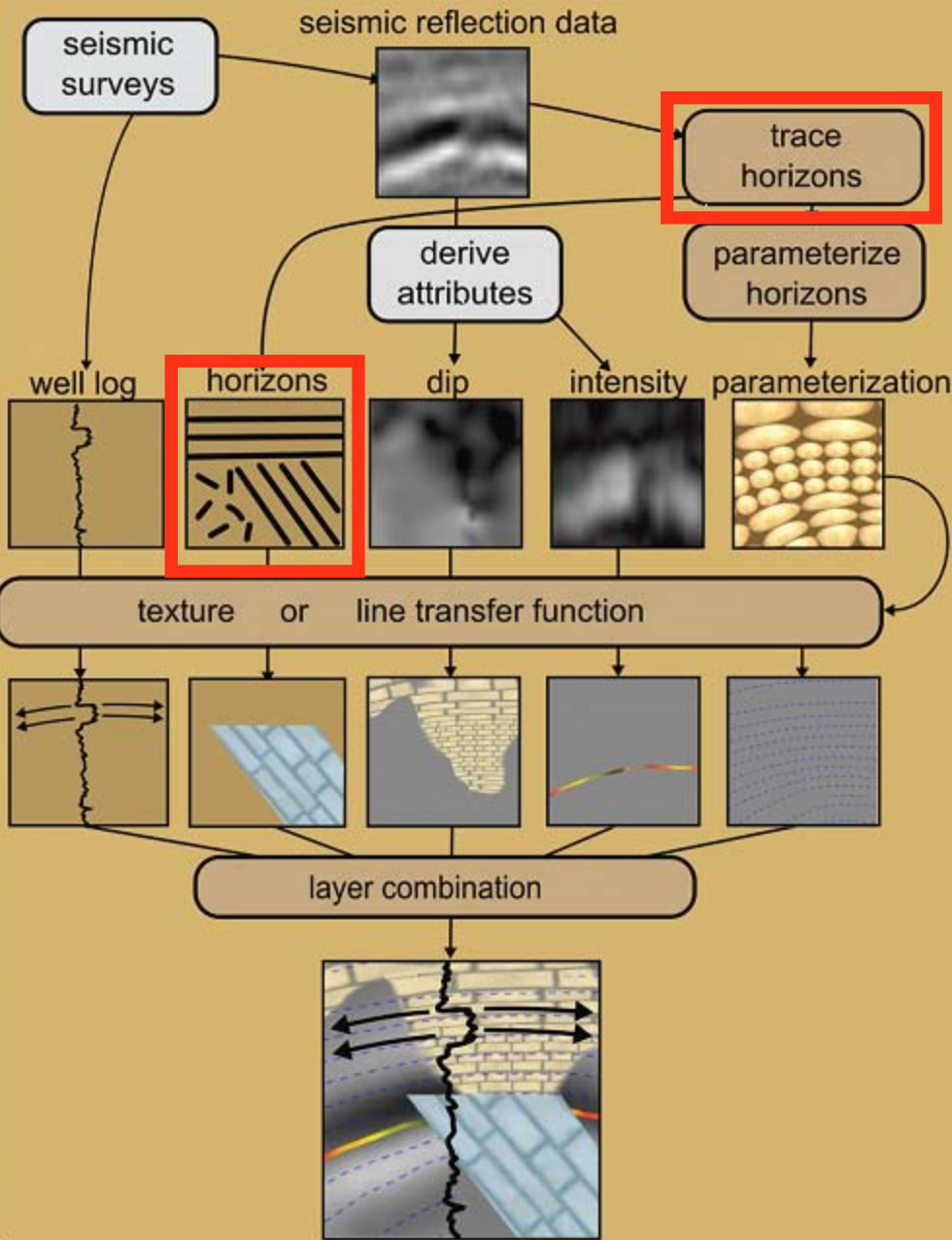


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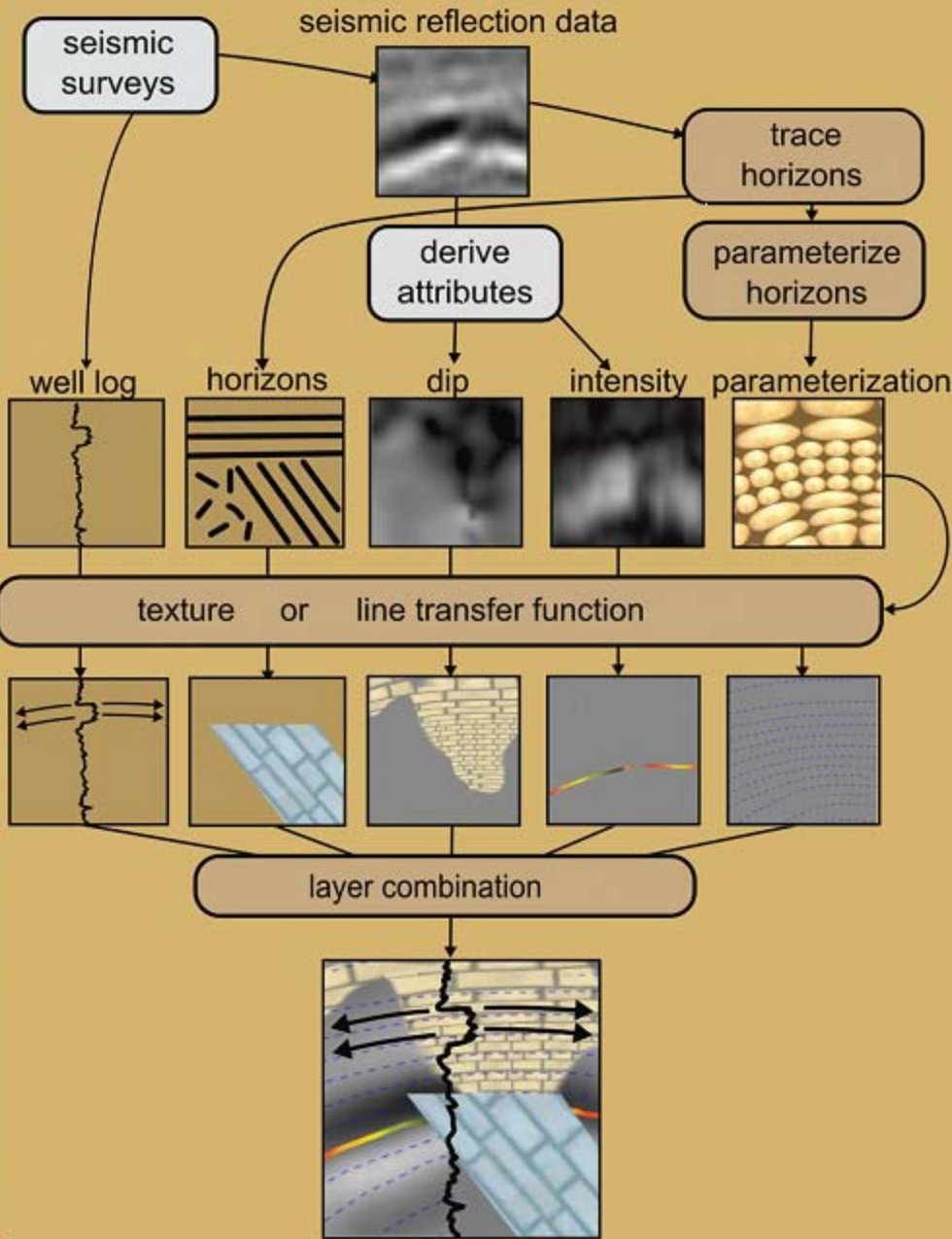


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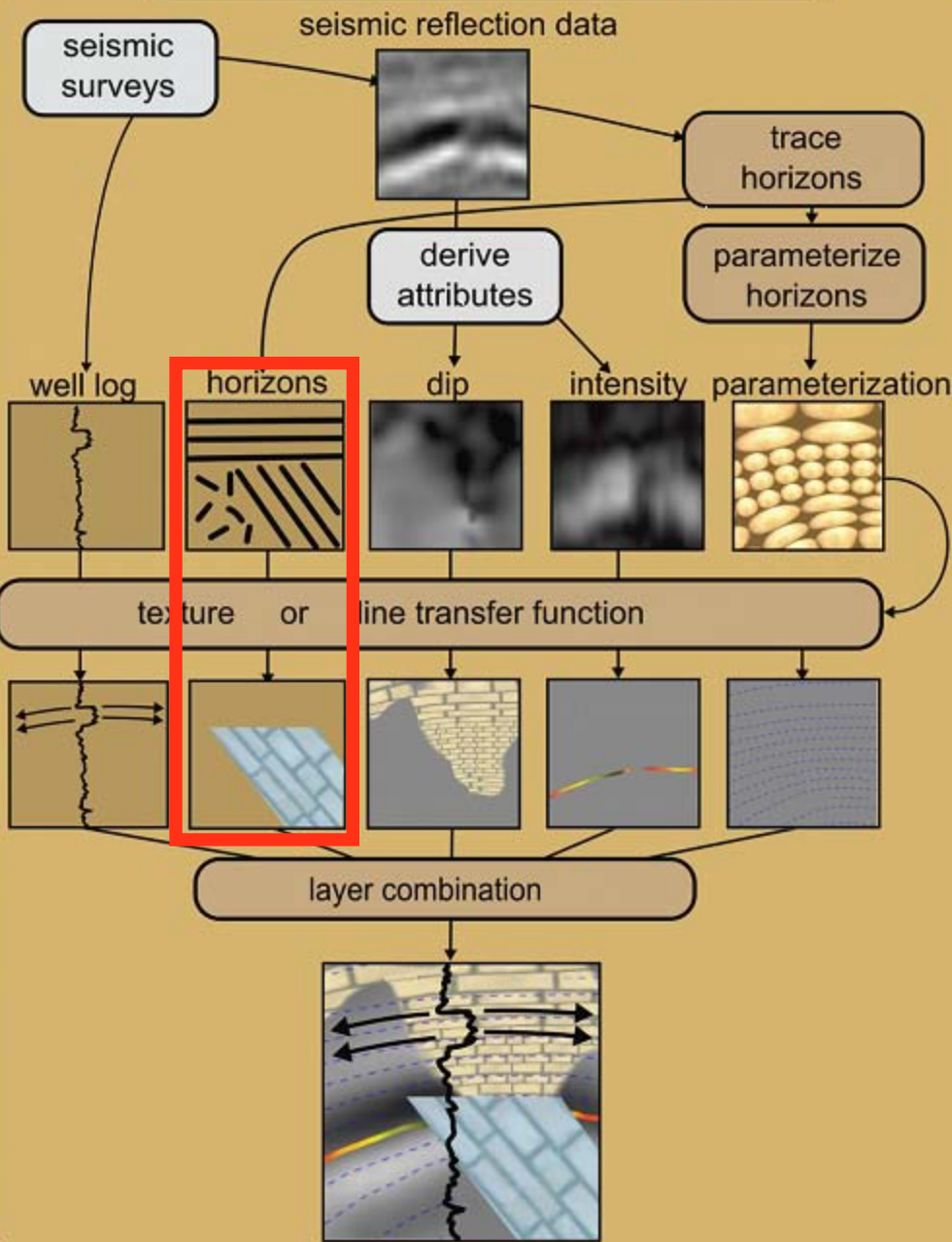


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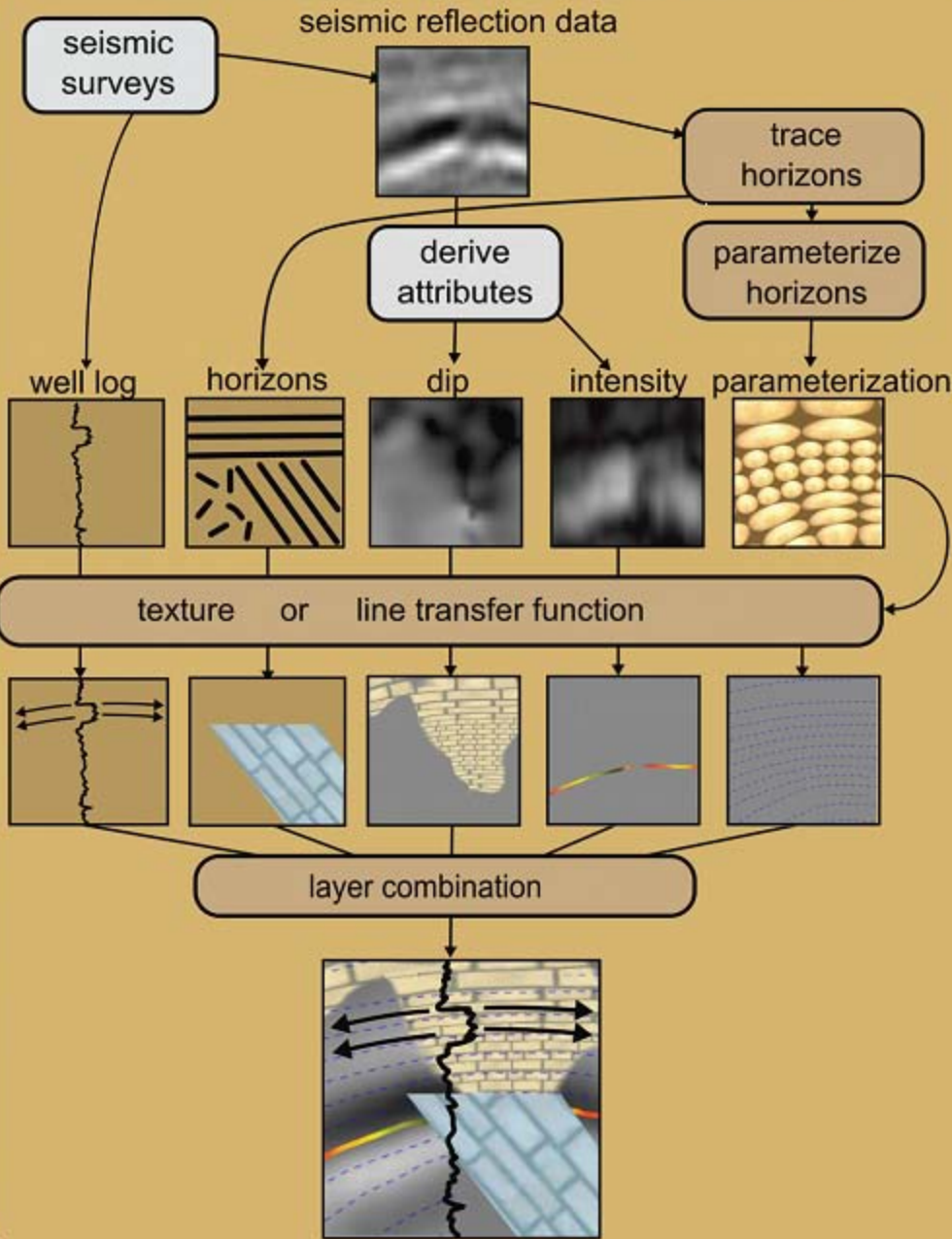


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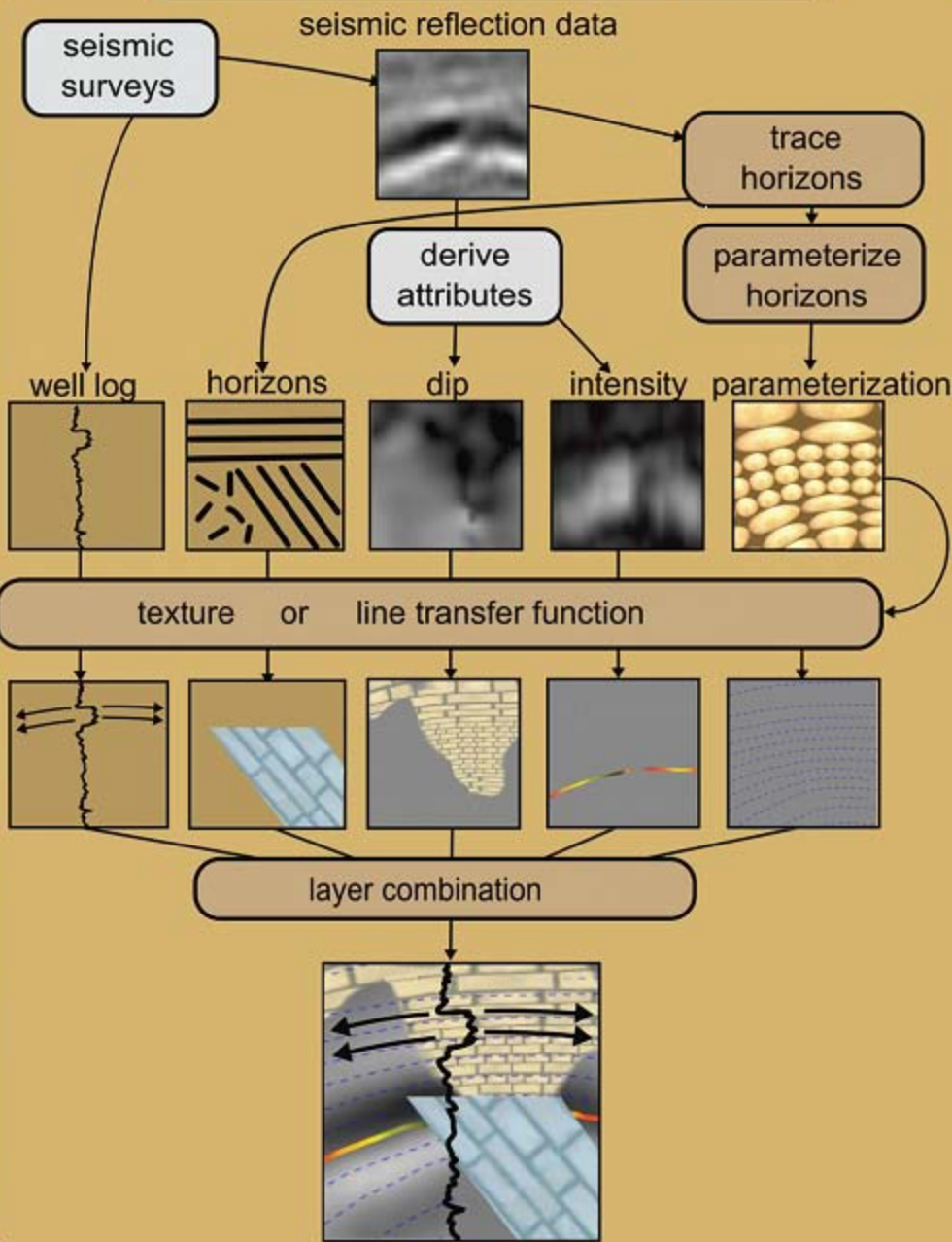


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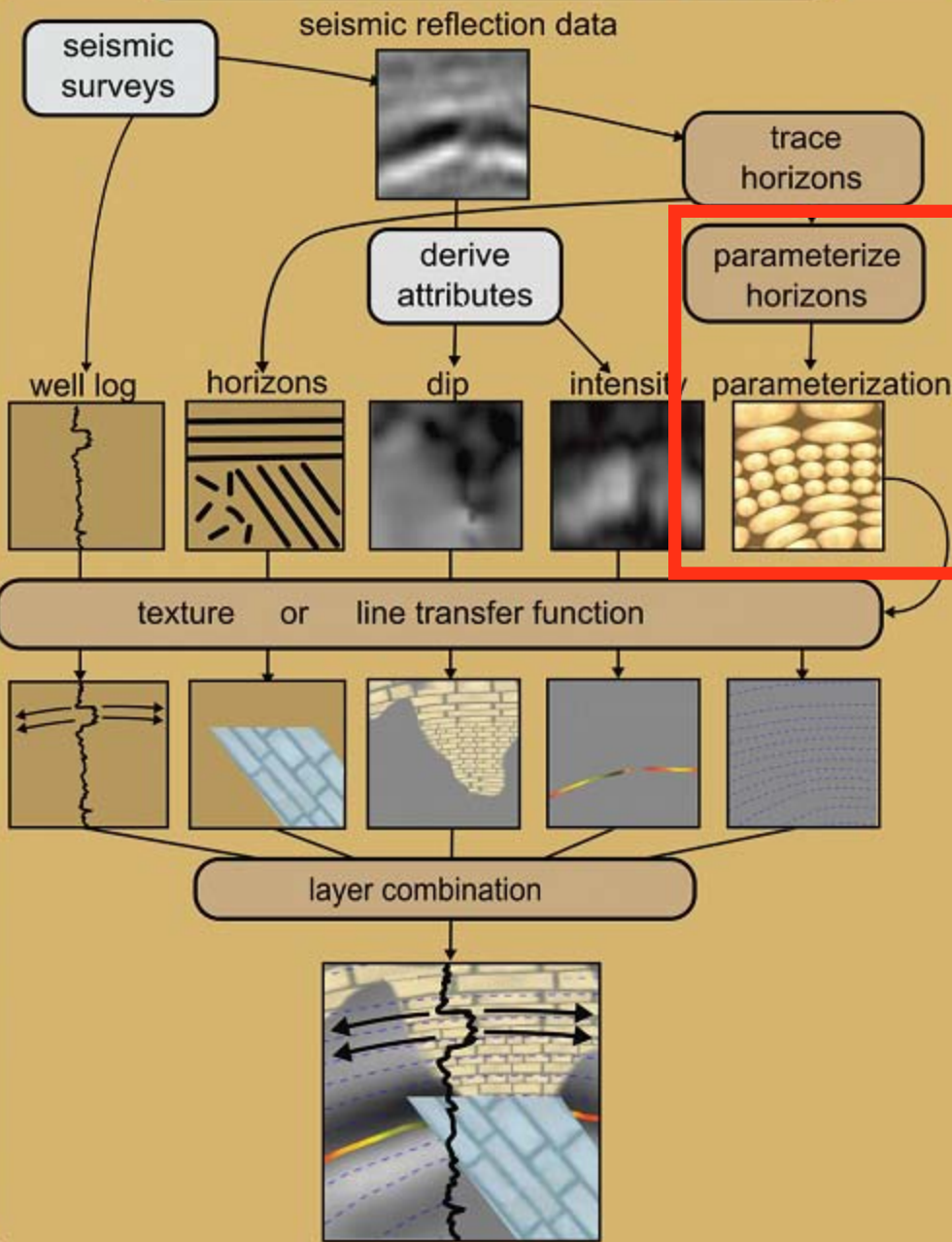


Automated illustration



- Parameterization of extracted horizons open up for:
- Seismic data mapped to textures and flow lines that bend along the horizons
- User assigned appearance with texture and line transfer functions.
- Illustrative layers
- Multi-attribute visualization

The Seismic Analyzer

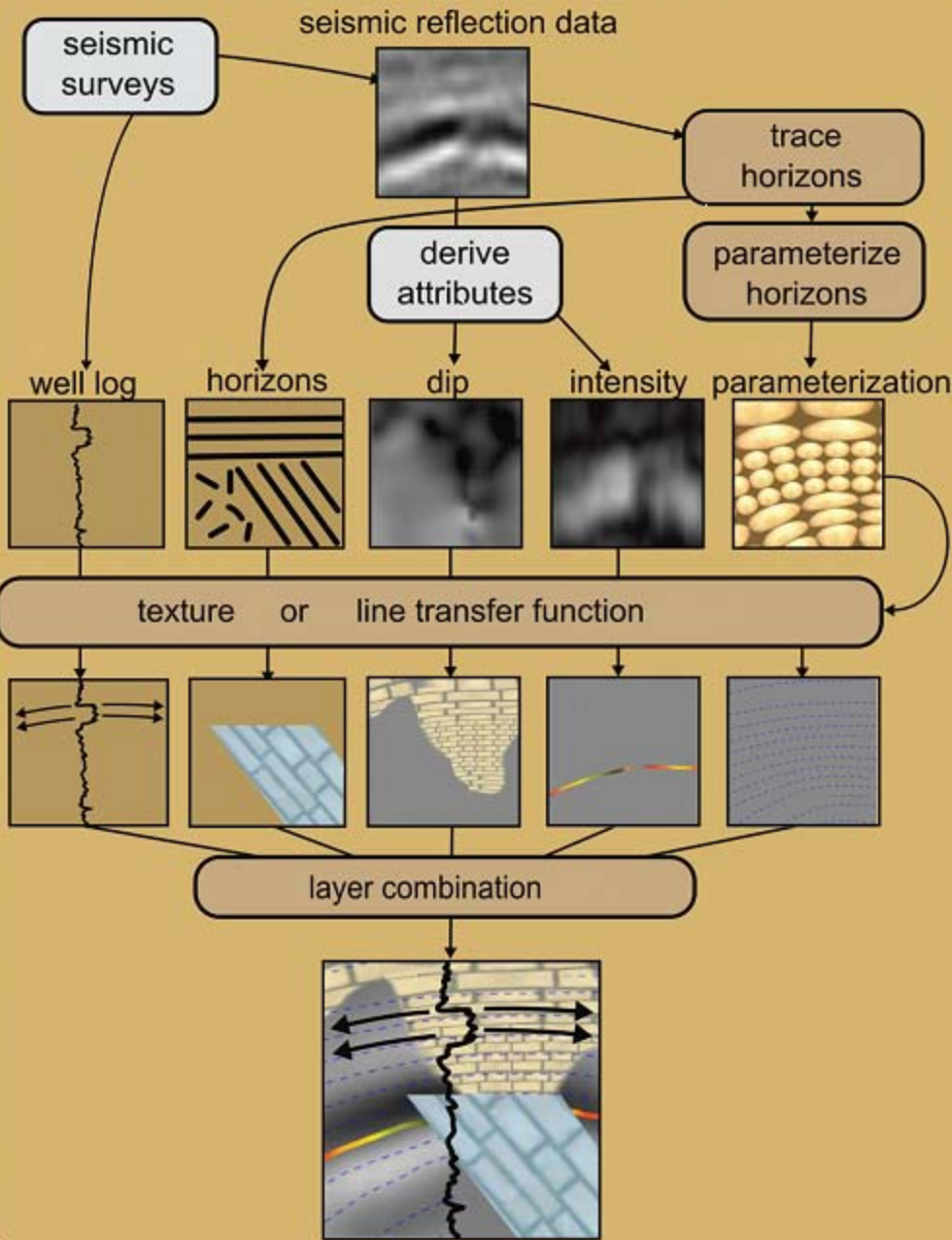


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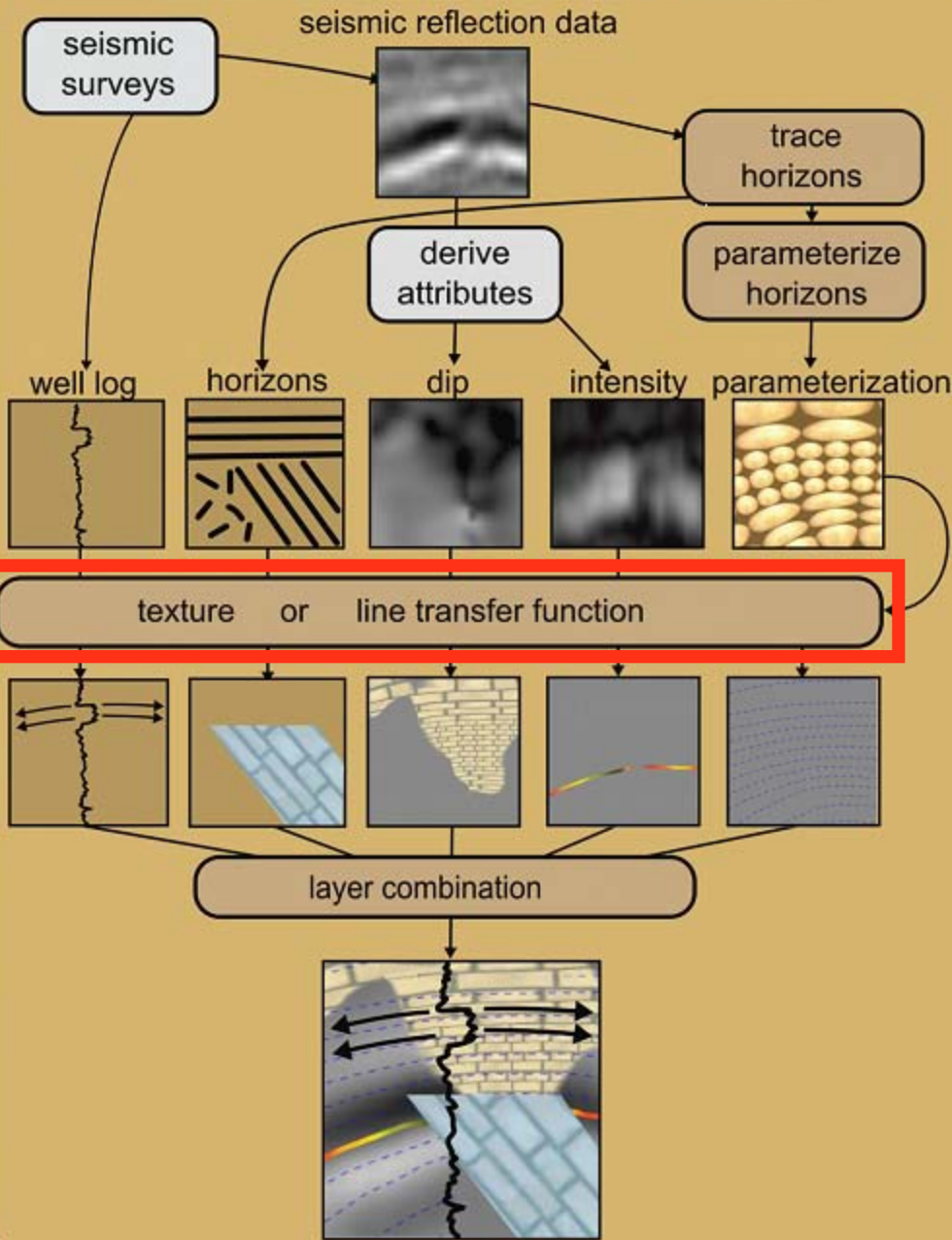


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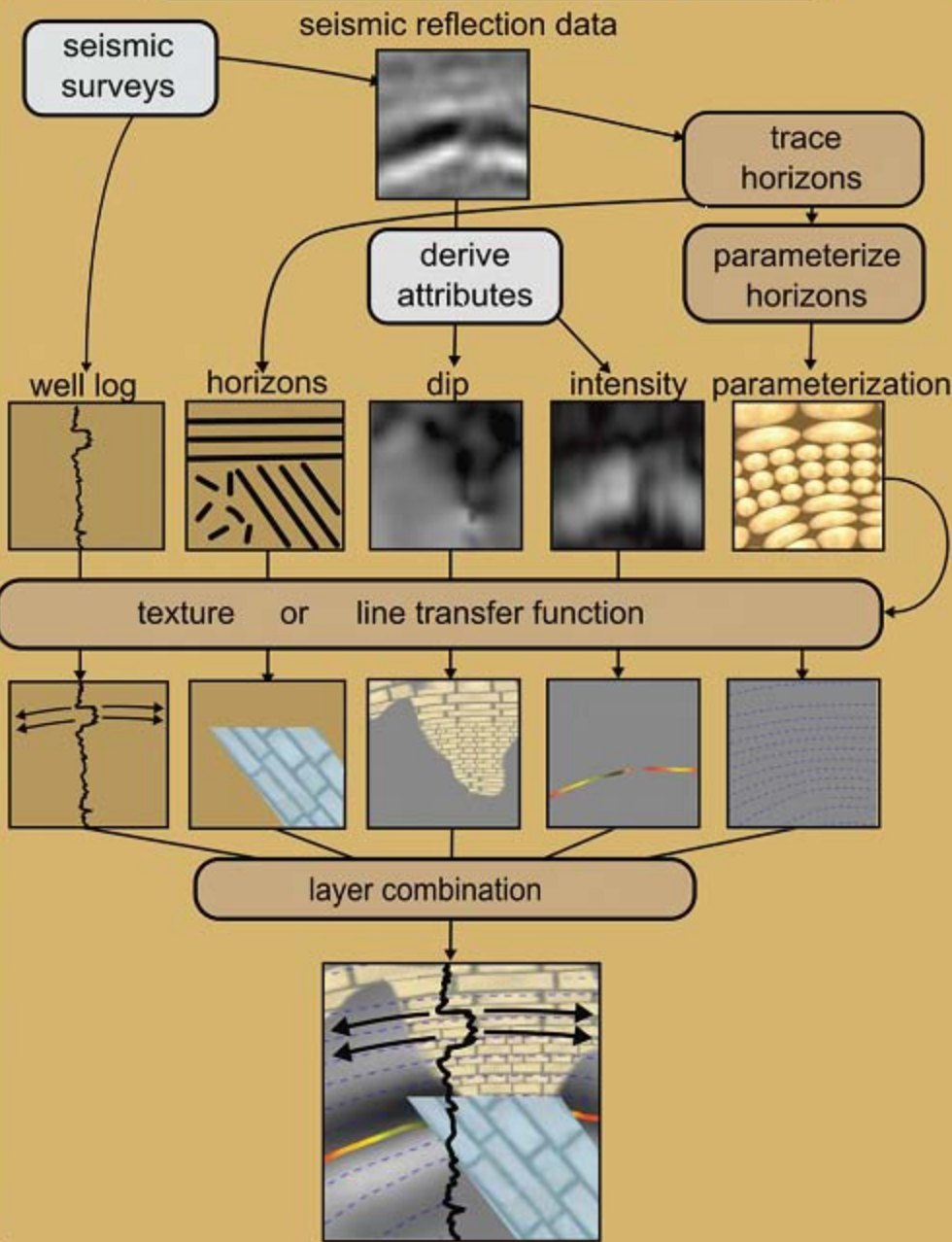


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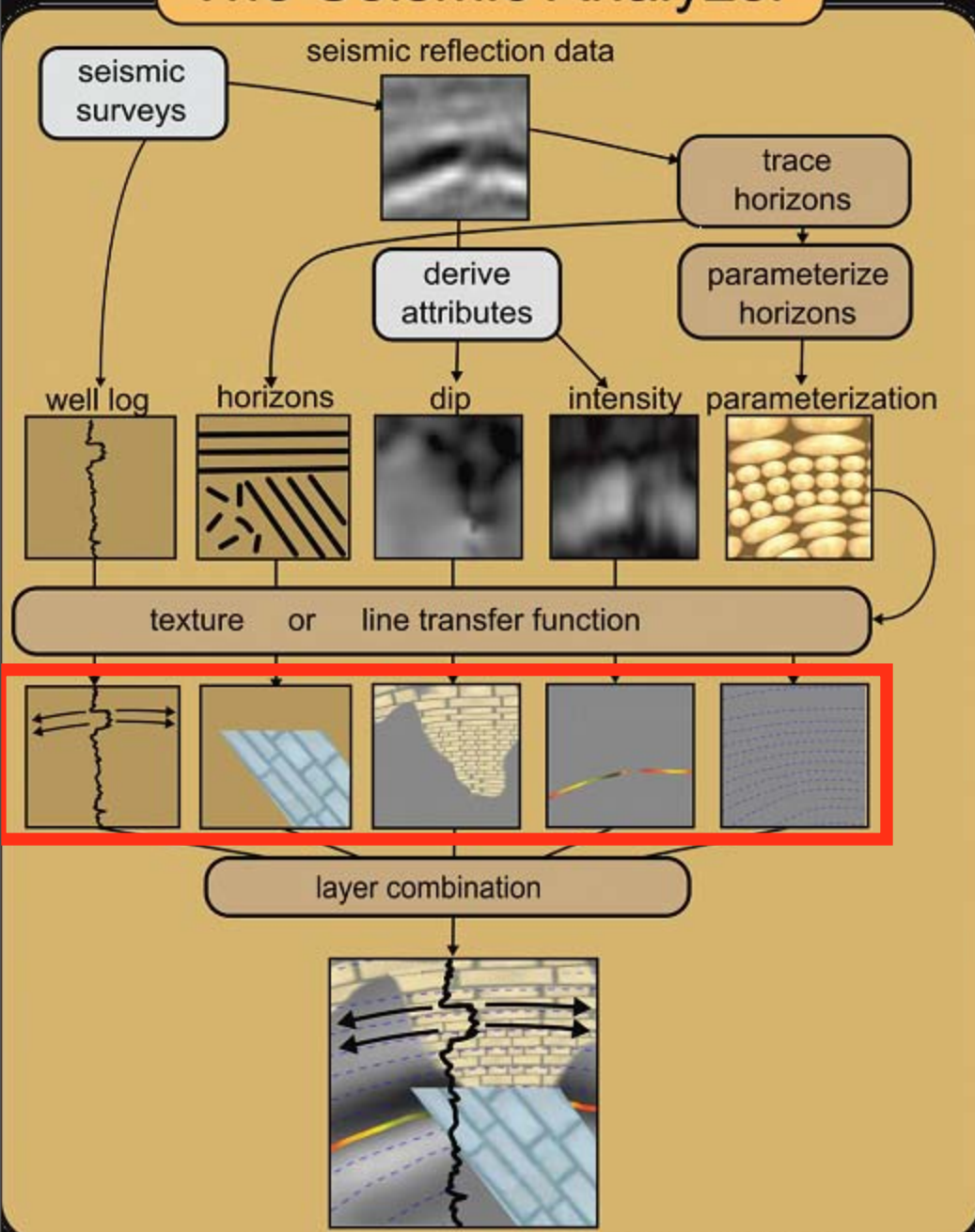


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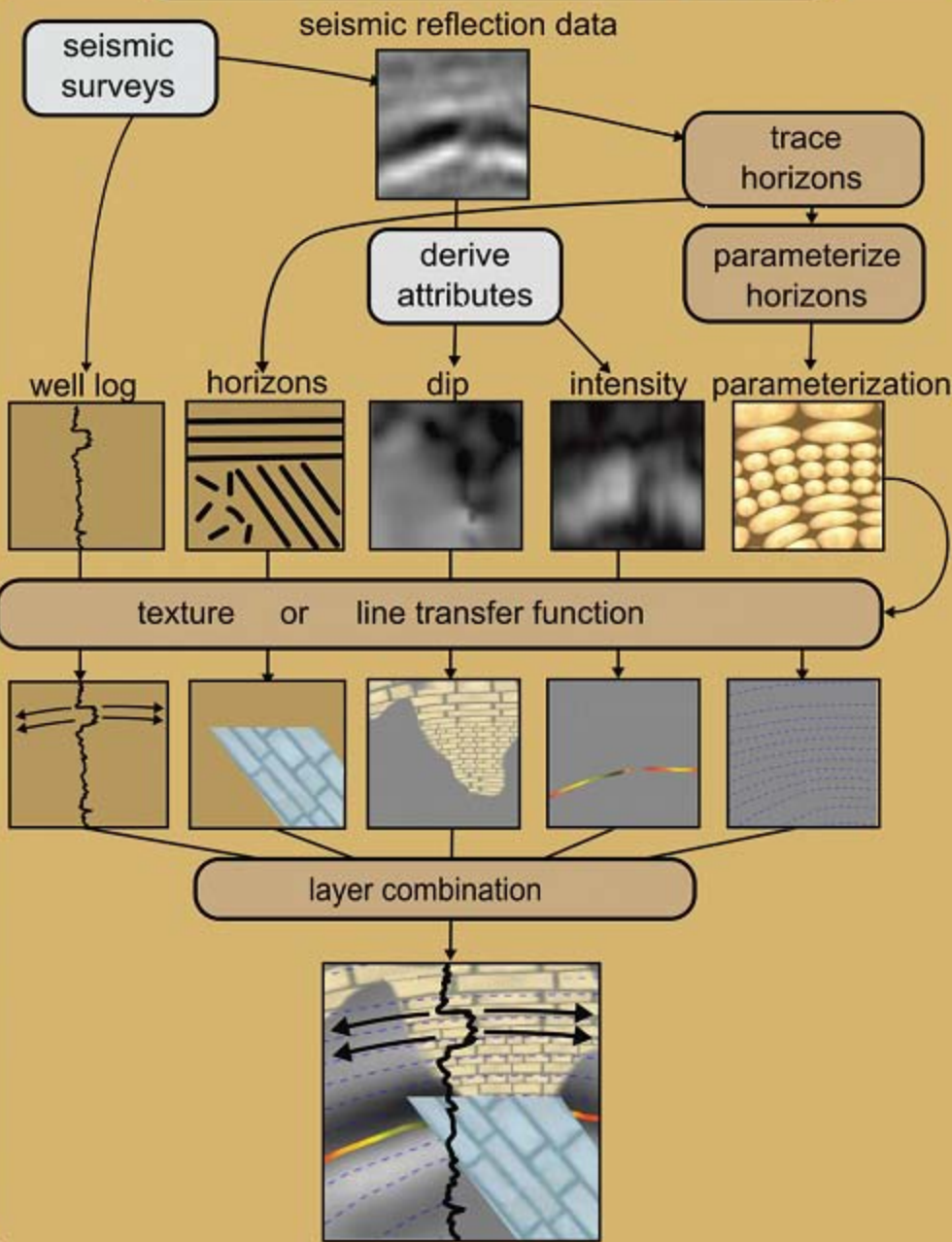


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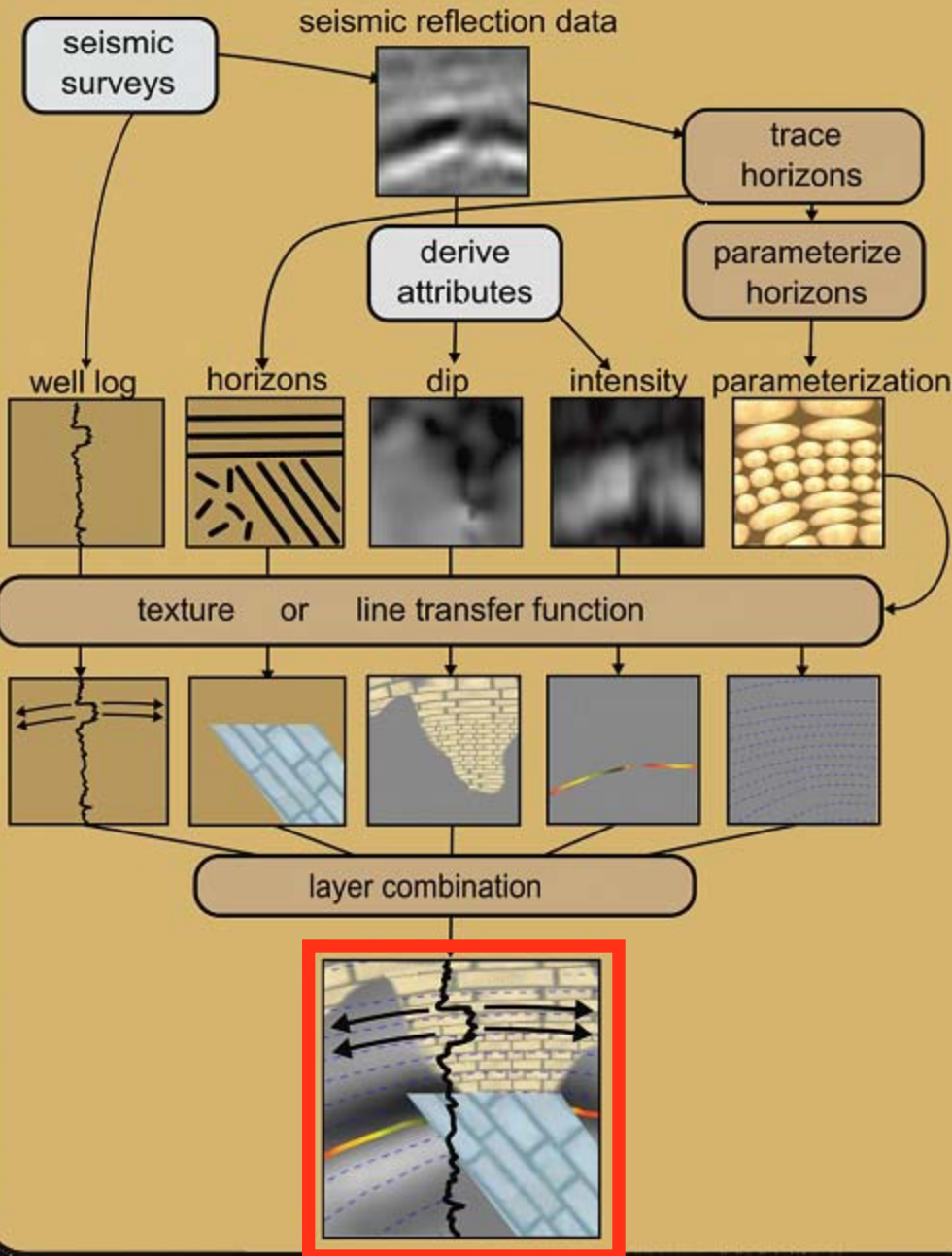


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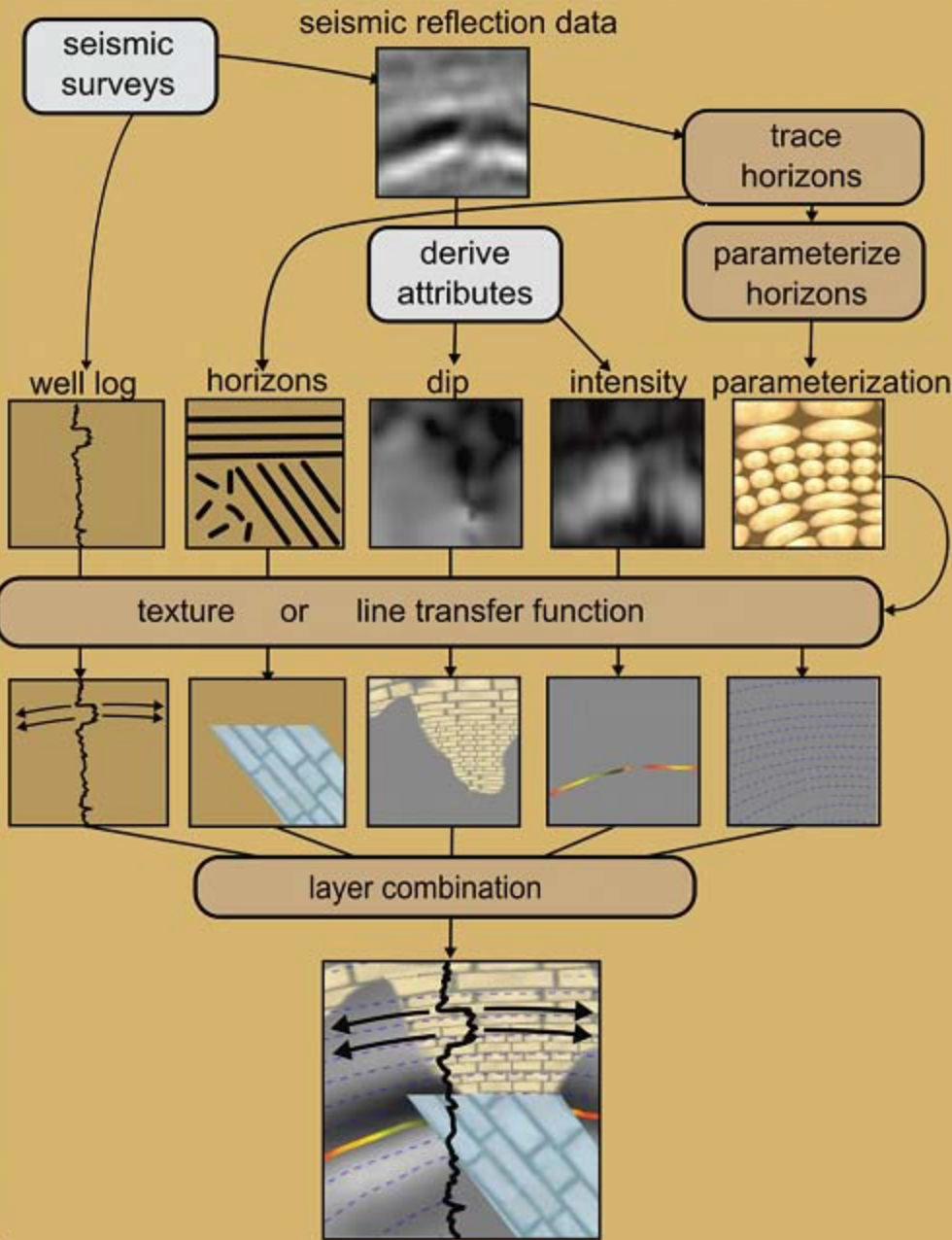


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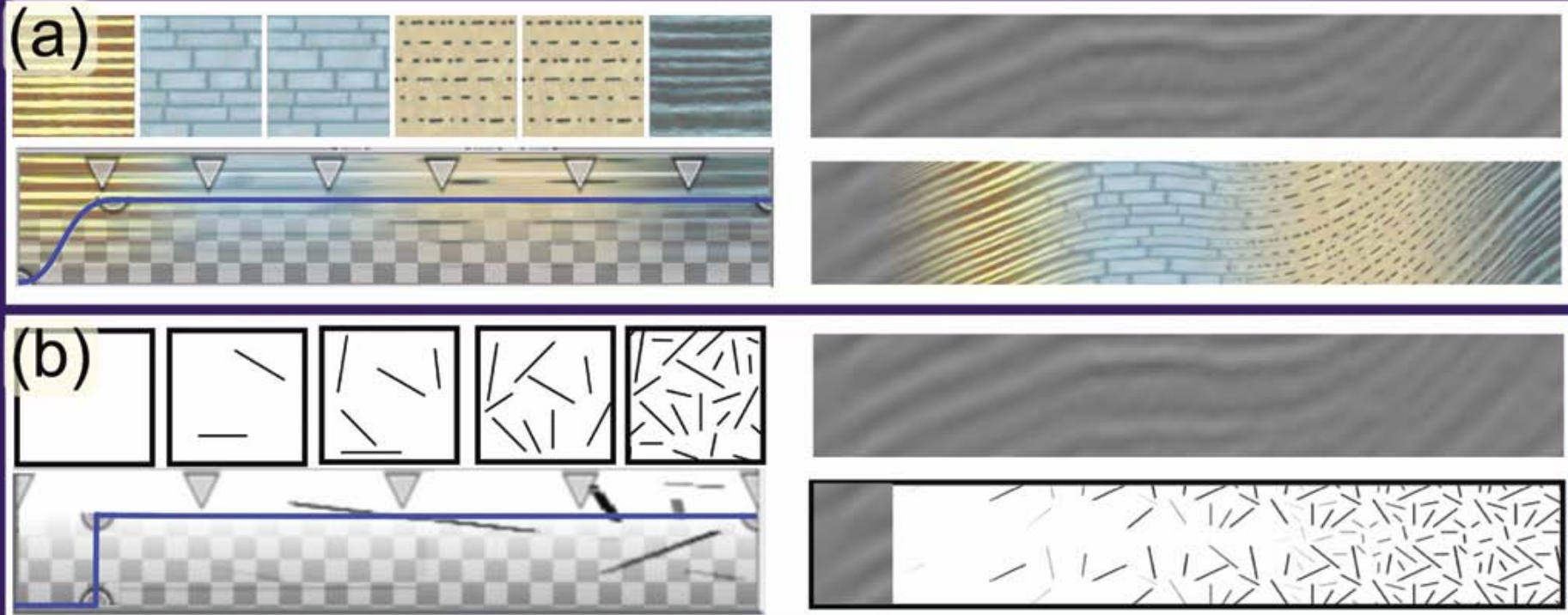
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The texture transfer function

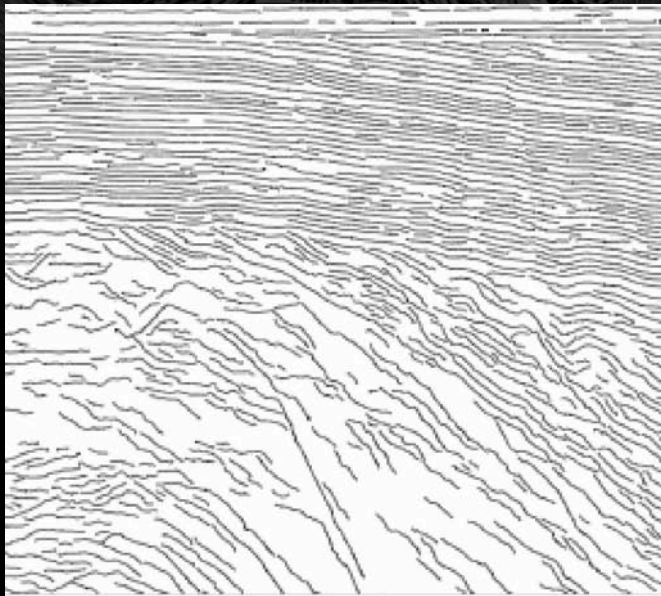


- Maps from attributes to textures
 - derived attributes
 - horizons
 - well log values with extrapolation
 - depth intervals with extrapolation

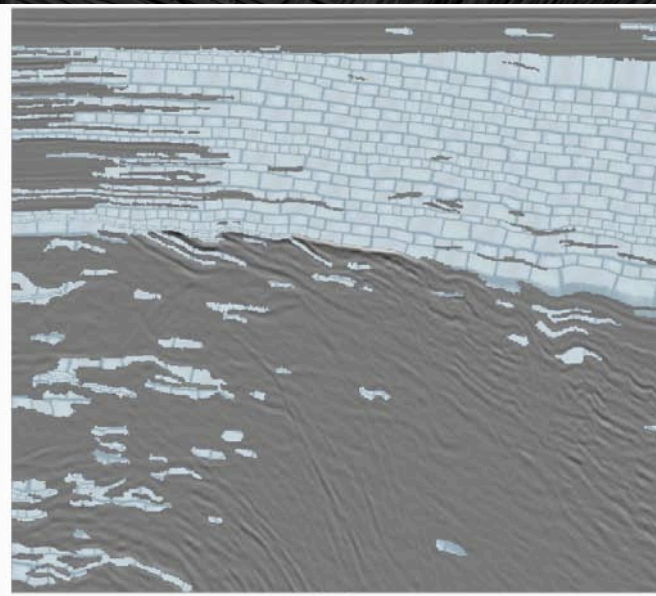
The texture transfer function



The texture transfer function on horizons



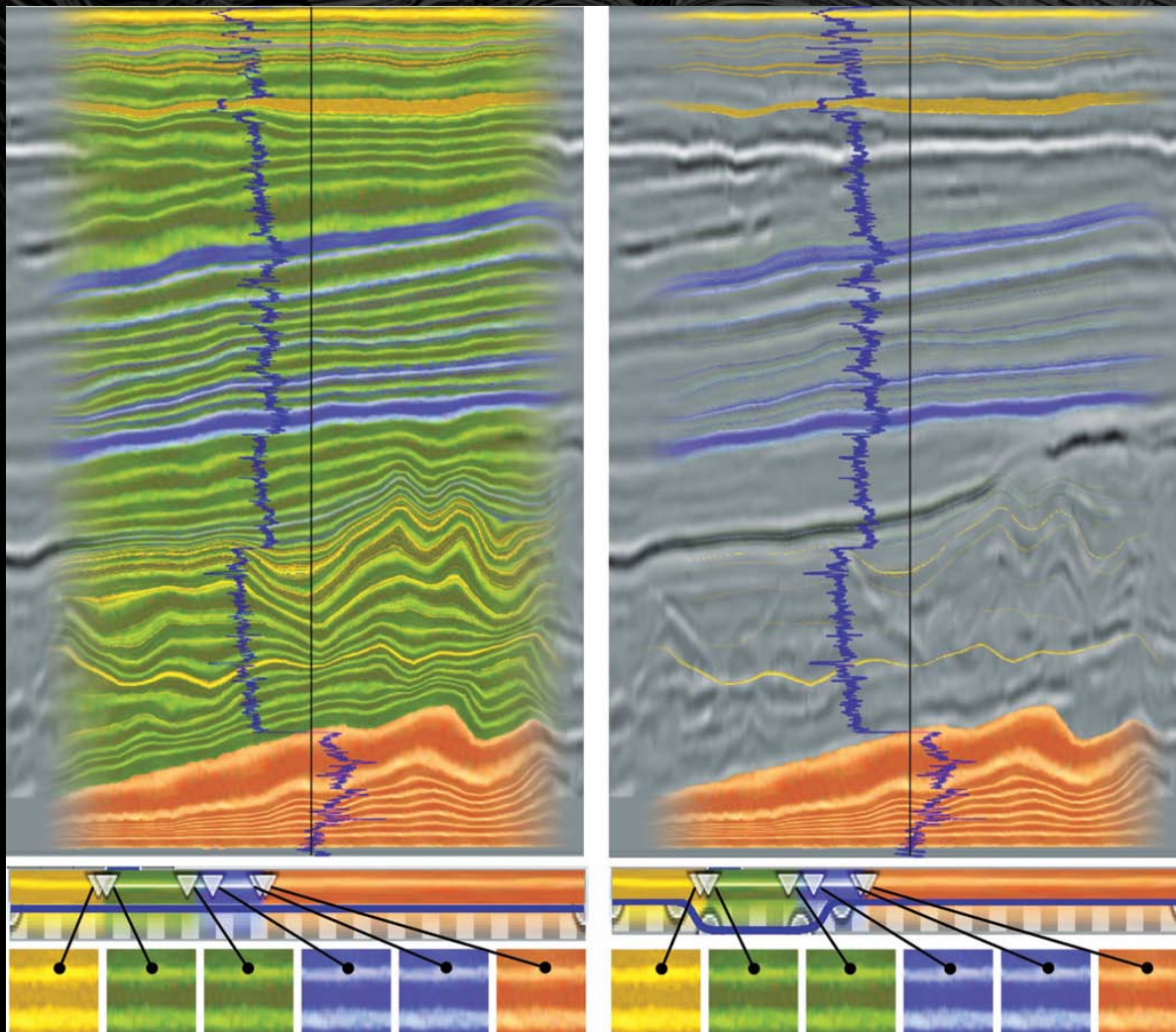
(a)



(b)

- Mapping slightly dipping lines (2-10 degrees) to a blue brick texture

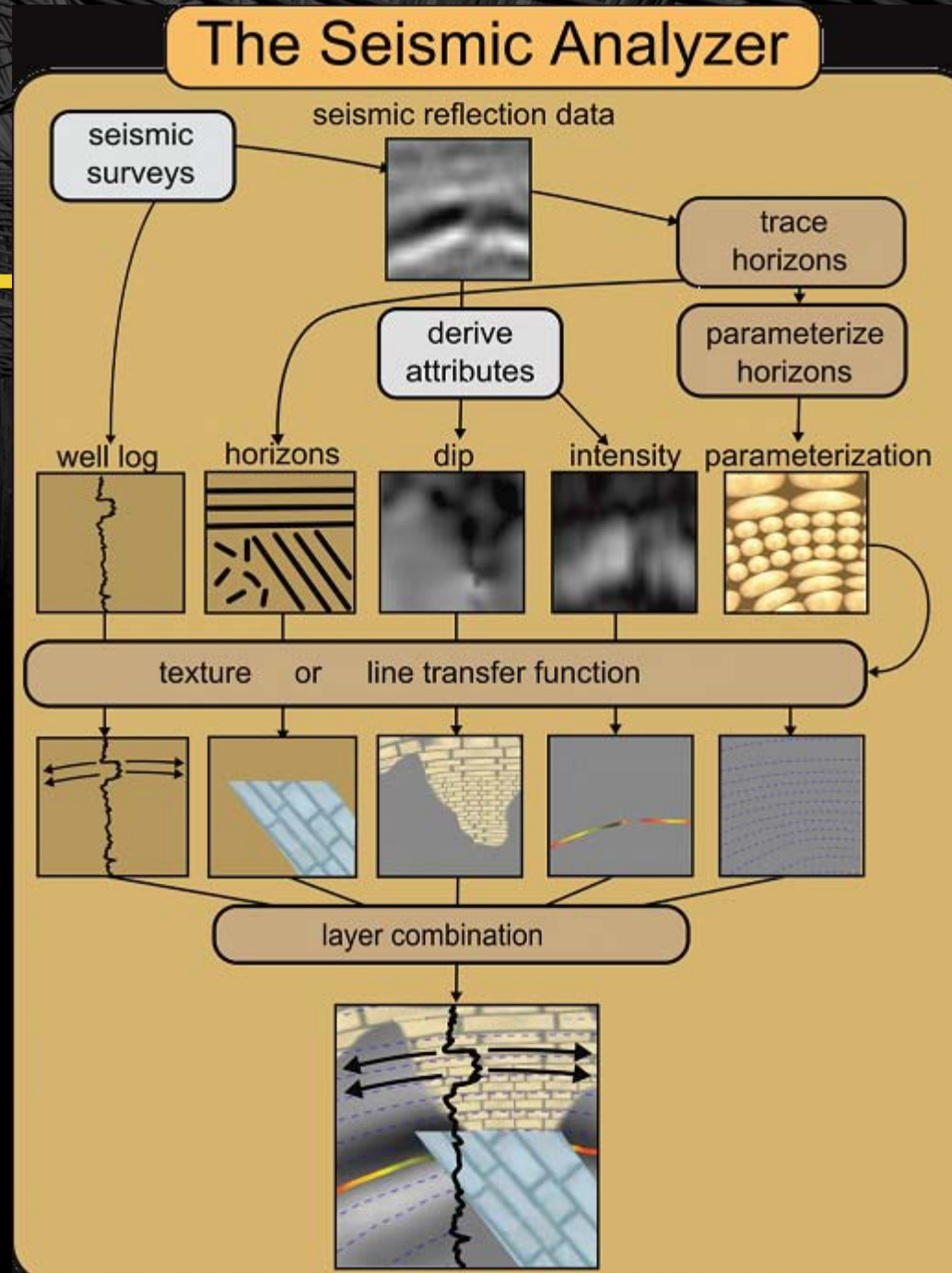
Texture transfer function on a well log



- Textures are extrapolated along horizons by using the parameterization

The line transfer function

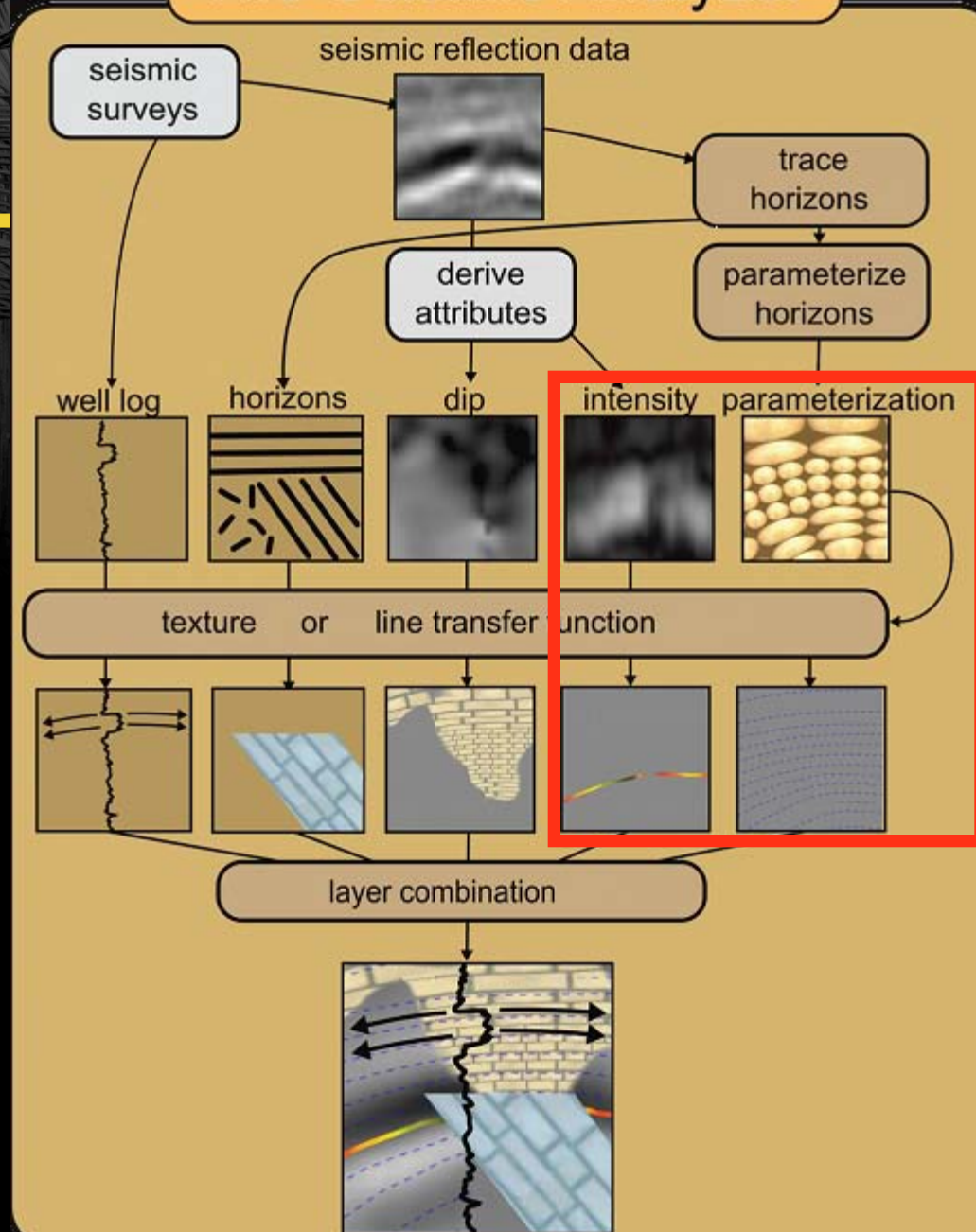
- Randomly seeded lines
- Maps from derived attributes to line stipple patterns, density and colors
- Maps from general 'flow' trend to lines



The line transfer function

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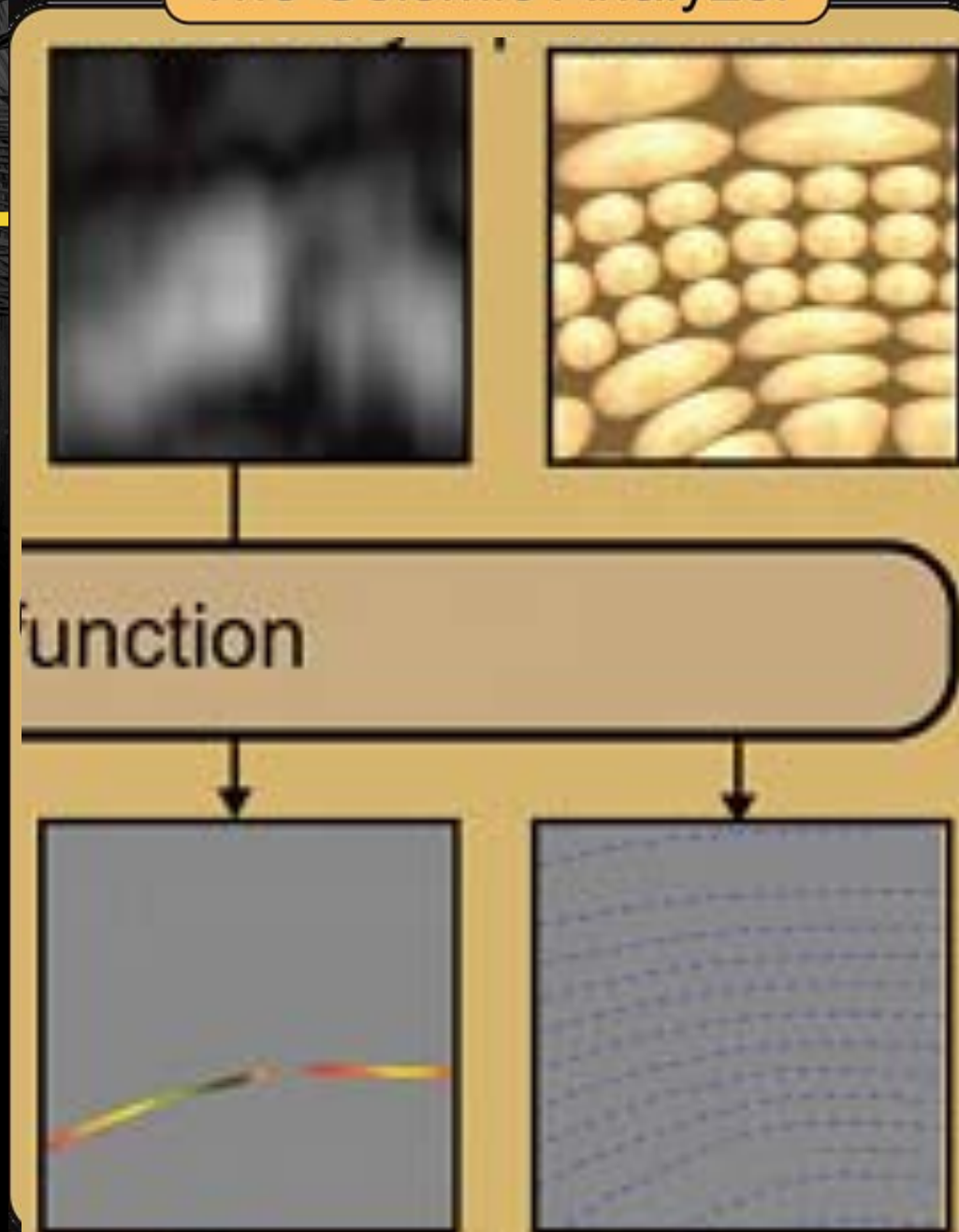
The Seismic Analyzer



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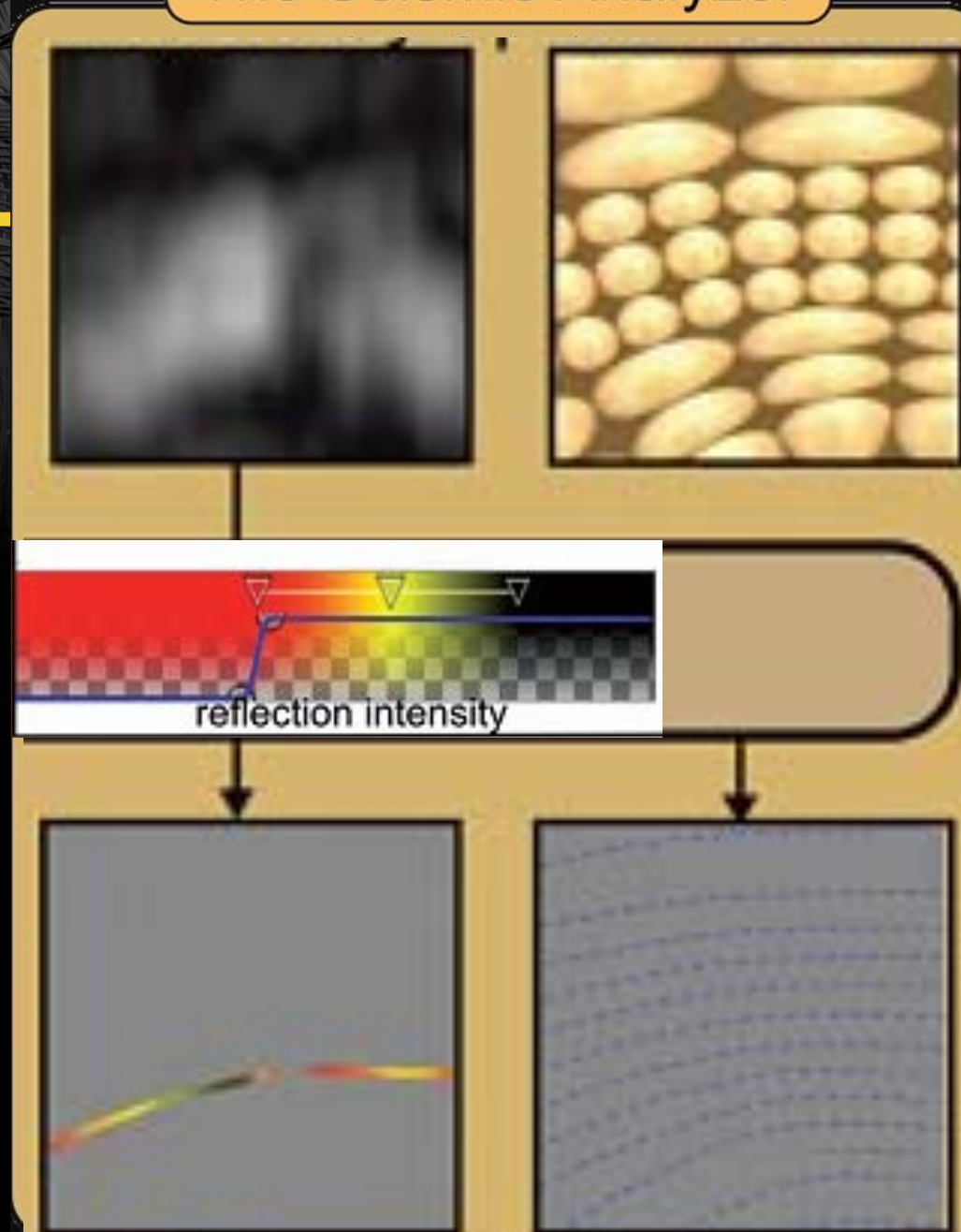
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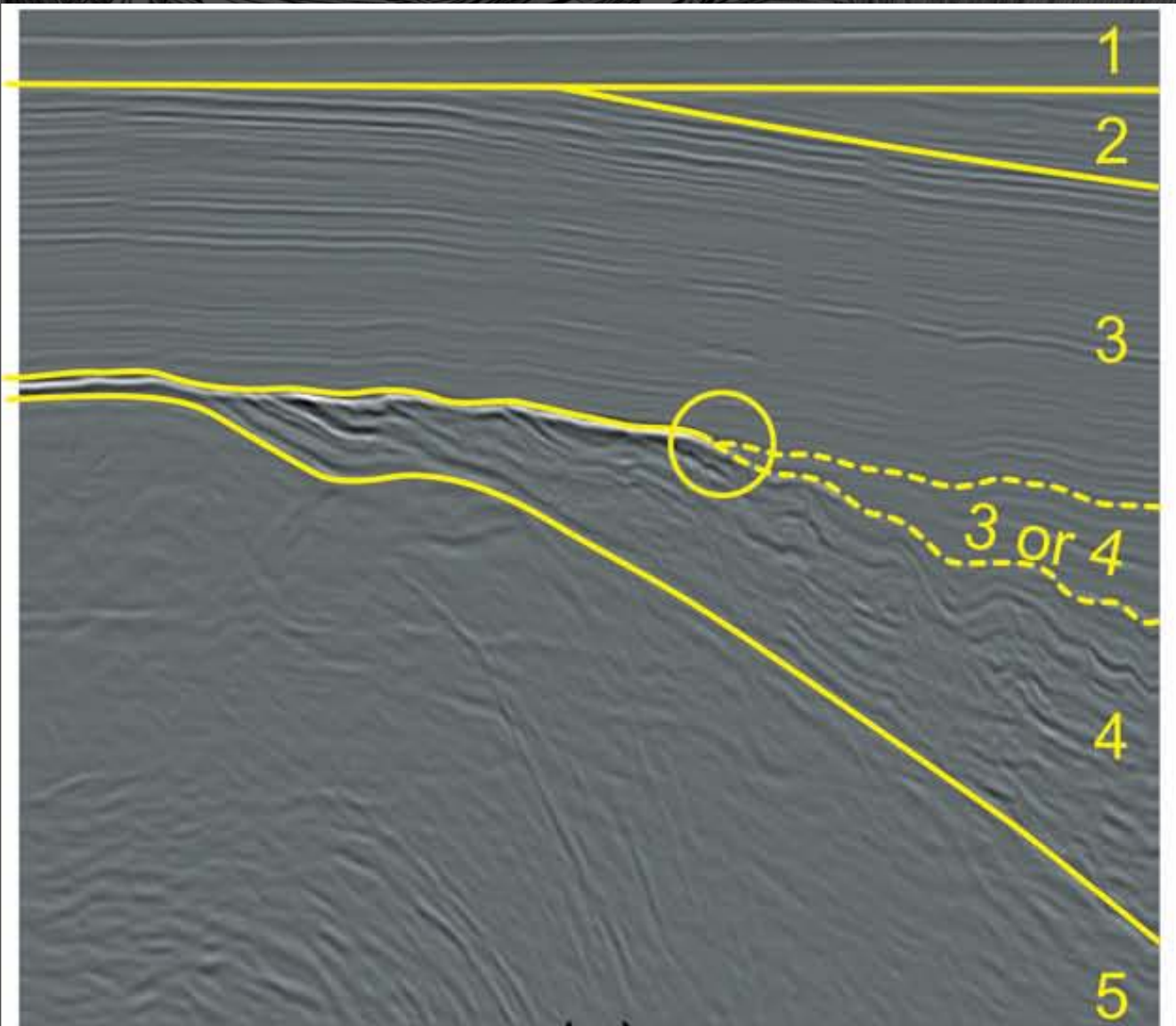
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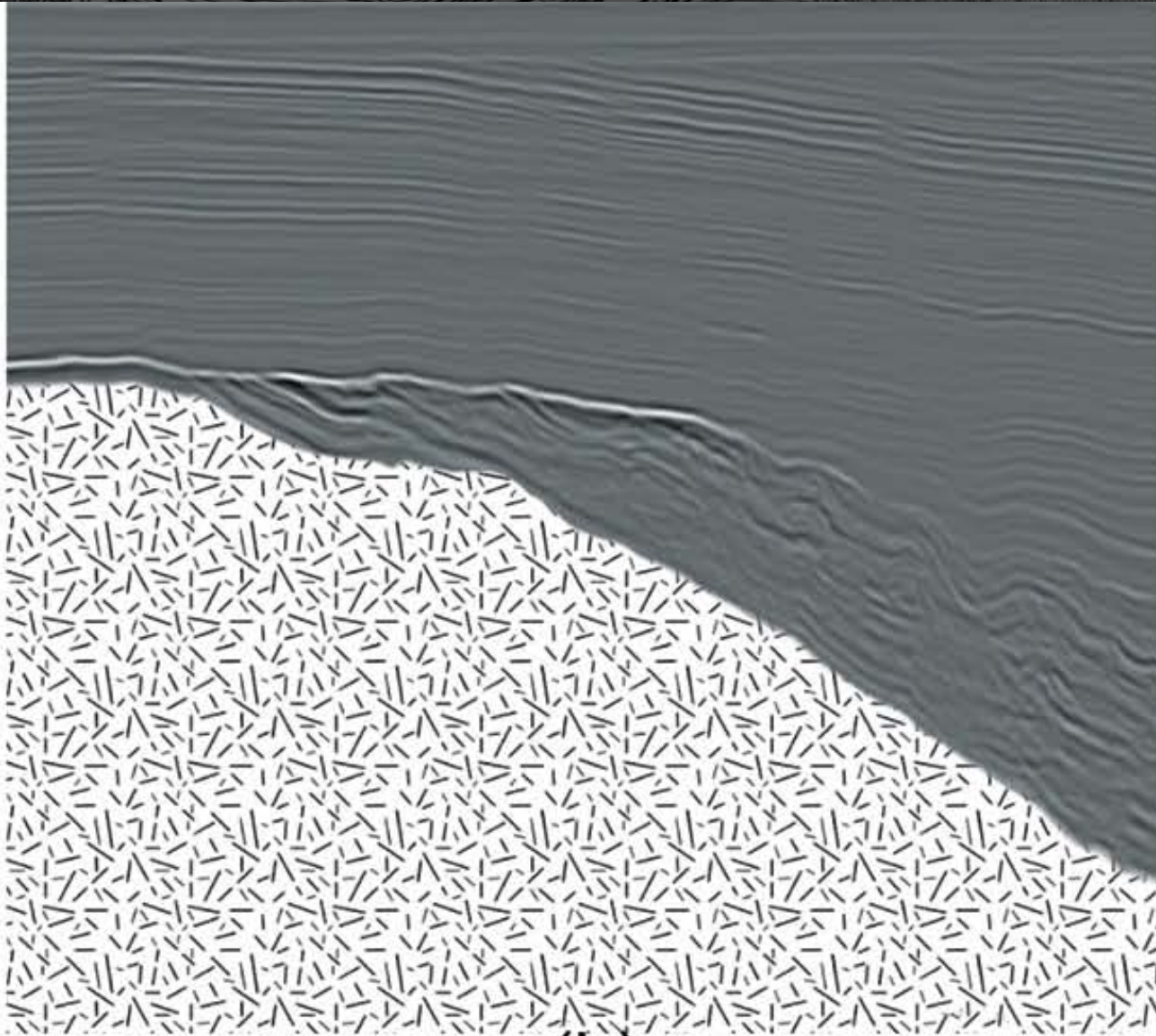
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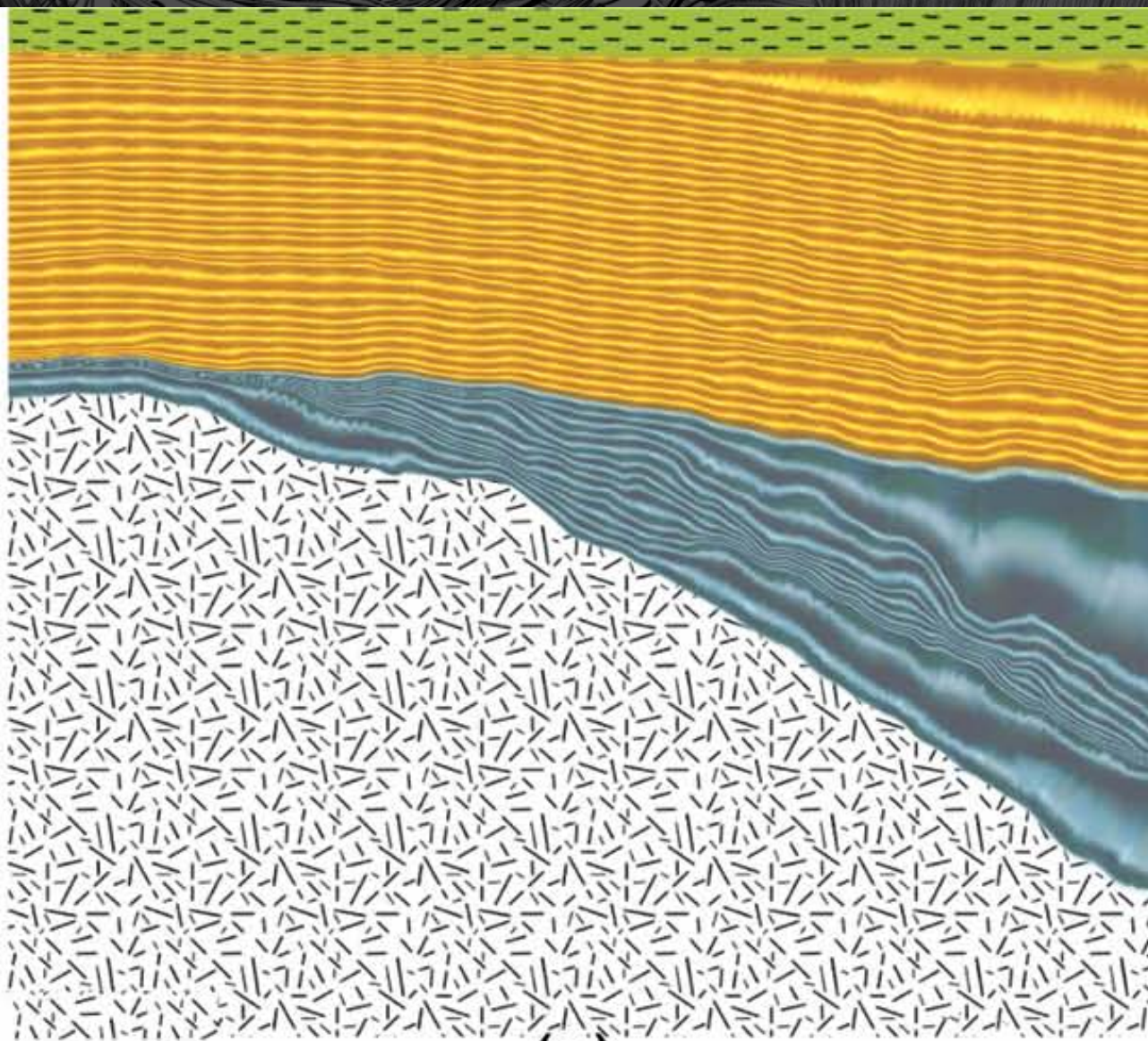
Results – use case developed with statoilhydro



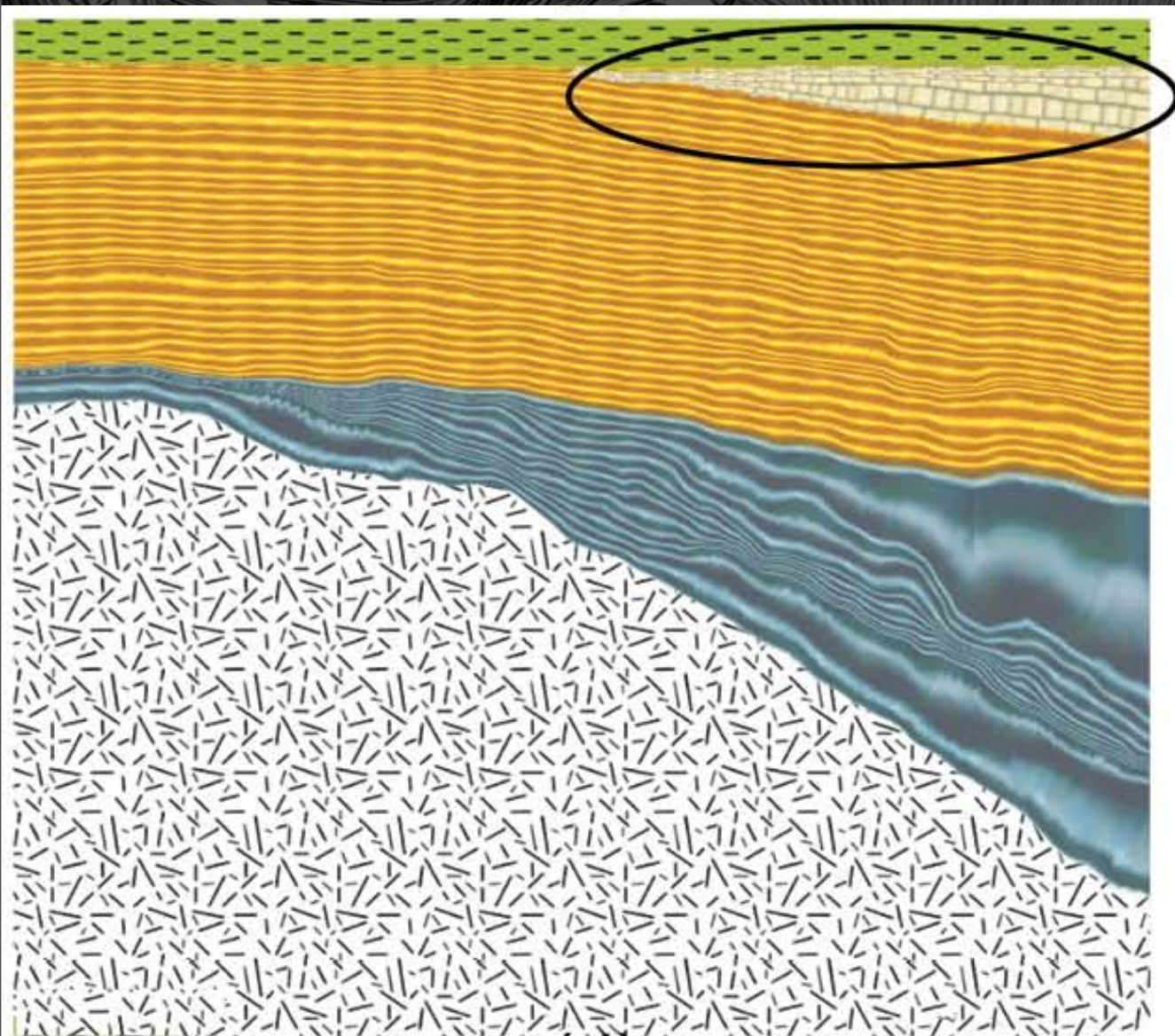
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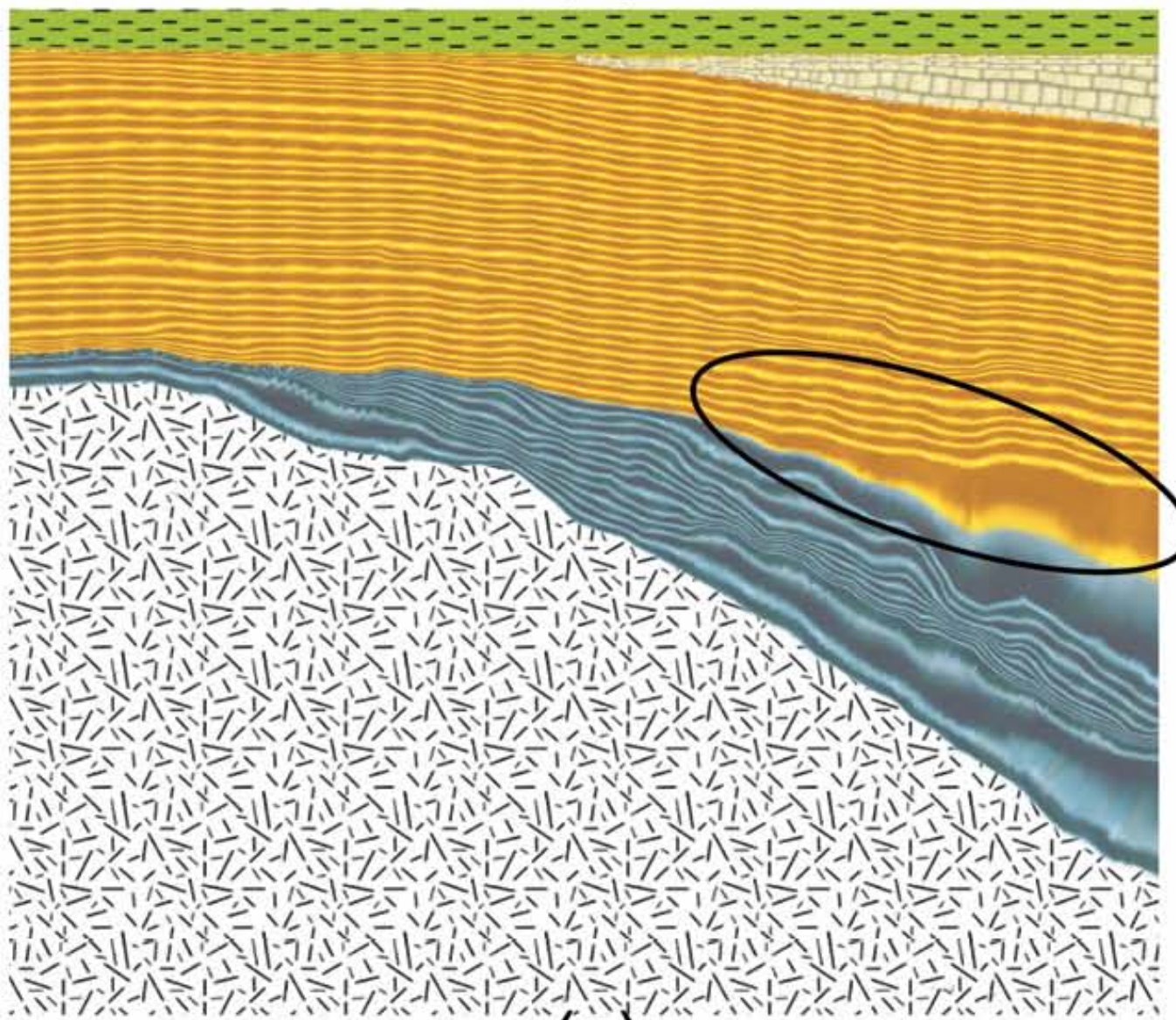
(b)



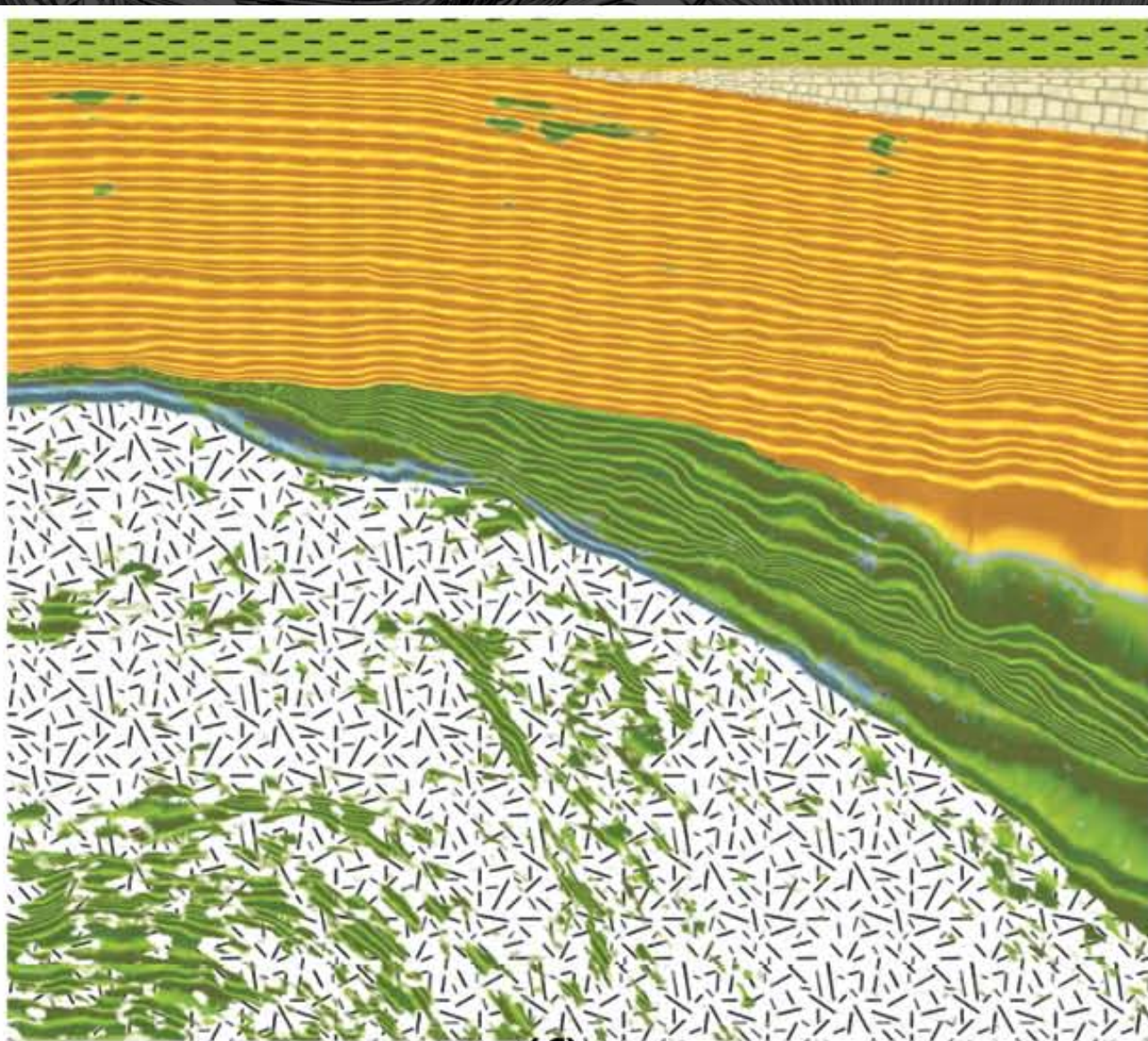
(c)



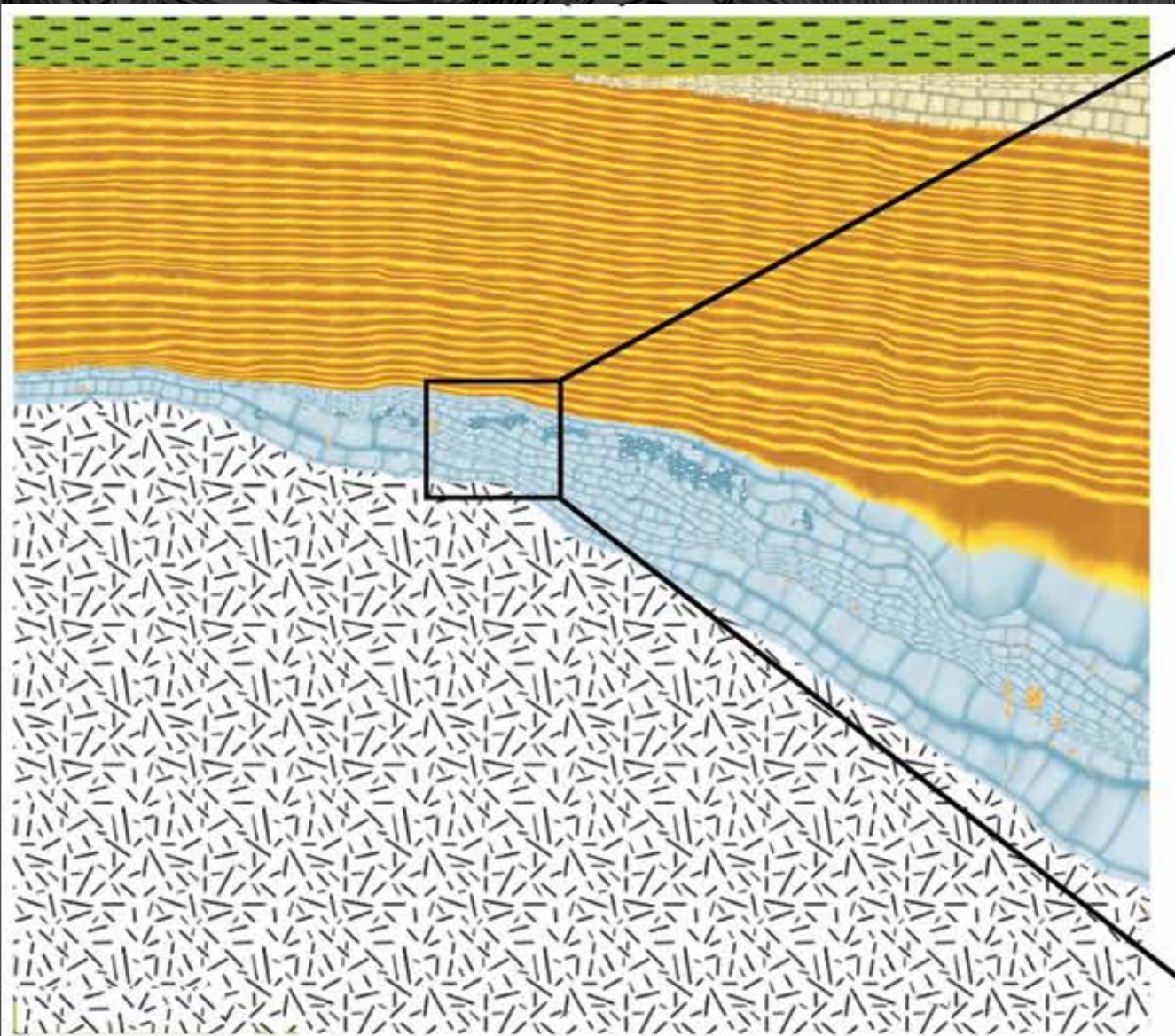
(d)



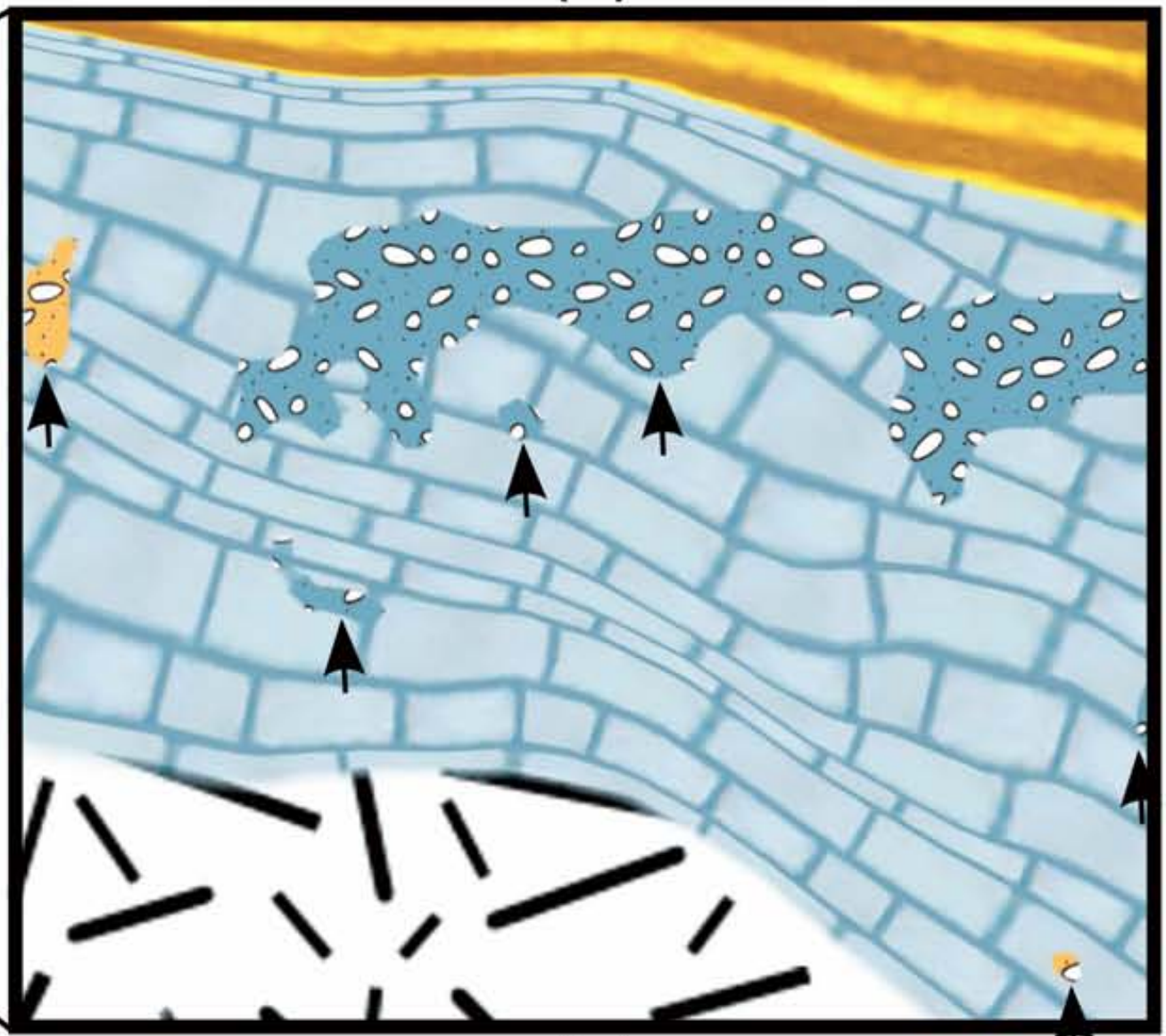
(e)



(f)



(g)



(h)

Conclusions



- Tight interpretation-illustration loop speeds up interpretation
- First round results are credible due to collaborative nature
- Application domain likes the new approach, a larger, funded project, is planned

Questions

