

Bringing digital geology back to life

Advancements in technology rooted in classic geologic concepts are giving mainstream geologists a whole new spectrum of interpretation tools.

Bill Ross, Landmark

For years, the development of modern digital technologies for geology and well log interpretation has lagged behind constantly evolving software tools for geophysics. It wasn't so long ago, 2006 in fact, that former AAPG Distinguished Lecturer Cindy A. Yeilding of BP gave a popular talk at local society meetings titled "Is the workstation killing geology?" In it, she cited serious limitations of the digital workstation, including aesthetically pleasing maps that are not always geologically valid, failure to recreate best practices based on the first principles of geology, and the lack of stratigraphic interpretation tools for mainstream users. She was, however, optimistic that one day geologists would be able to create, iterate, collaborate, and capture their projects in a completely digital framework.

The day Yeilding hoped for is finally dawning. In the years since she nailed the shortcomings of geologic software, dramatic progress has been made. New technologies like Landmark's Dynamic Frameworks to Fill capability are bringing digital geology back to life. Next-generation interpretation and mapping tools designed specifically for mainstream geoscientists combine classic geologic concepts in sequence stratigraphy and structural geology with automated processes and intuitive interfaces.

How? For one thing, technology workspaces enable geologists and geophysicists to build a properly sealed, 3-D "framework" of structural and stratigraphic surfaces, fault networks, and unconformities as a natural part of interpreting seismic and well data. They can interactively fill selected intervals with 2-D or 3-D reservoir properties computed automatically from well logs. And all it takes to generate consistent, high-quality structure or property maps from an integrated, multi-surface framework is a few clicks of the mouse. Now mapping is a byproduct of accurate 3-D framework construction. What's more, dynamic updating tools allow geologists to change an interpretation or add a new pick and watch every related part of the framework shift accordingly – without manual intervention. Saving a sealed framework with reservoir properties to a common project database makes it accessible to every

member of the team through a unified, multi-discipline workspace.


Geological and geophysical workflows in a digital environment like this leverage two new additional technologies built on classic geologic concepts.

One of these is "conformance." All geologists know that the majority of stratigraphic units comprising sedimentary basin fill are relatively parallel or "conformable." That is, layer thicknesses tend to remain uniform over large areas. This fundamental principle represents a valuable tool that can assist geologists in correlating logs, identifying discontinuities – faults and unconformities – and building more accurate stratigraphic and structural frameworks. What modern conformance technology essentially does is use a well-sampled surface – a seismic horizon or marker bed with numerous well tops – as a reference to guide, or conform, the shape of poorly sampled surfaces above or below it. With conformance technology, geoscientists can

interpret stratigraphic layers between wells at essentially the same lateral resolution as the most detailed surface available. Apart from picking tops or seismic, the process is automated.

The other new technology is an advanced "topology" engine built into today's multi-domain interpretation environment. It segregates and grids surface data (seismic, well tops, or both) within individual fault blocks or stratigraphic domains;

recognizes the complex geometric intersections between surfaces, faults, and unconformities; and properly truncates and seals surfaces against one another. Again, most of the process is automatic. Although advanced topology tools are not exactly new, they have not been integrated with mainstream interpretation software or made accessible to ordinary exploration and development geoscientists until now.

The ability to build sealed 3-D stratigraphic and structural frameworks while interpreting – filling them with detailed reservoir properties, updating and sharing them with multiple users in a seamlessly unified workspace, and generating maps with the click of a button – represents a huge leap forward for digital geology. Is the workstation killing geology? No. Not anymore. Revolutionary new tools are indeed bringing geology back to life. 

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