



TRACERMAX

SCIENTIFIC, INC.

TRACERMAX technology is protected
under PCT/CA2010/001446; US Patent
Number US 8,6743,290 B2. (*Published
March 18, 2014*)



The
United
States
of
America



The Director of the United States
Patent and Trademark Office

*Has received an application for a patent for
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description of the invention are enclosed.
The requirements of law have been com-
plied with, and it has been determined that
a patent on the invention shall be granted
under the law.*

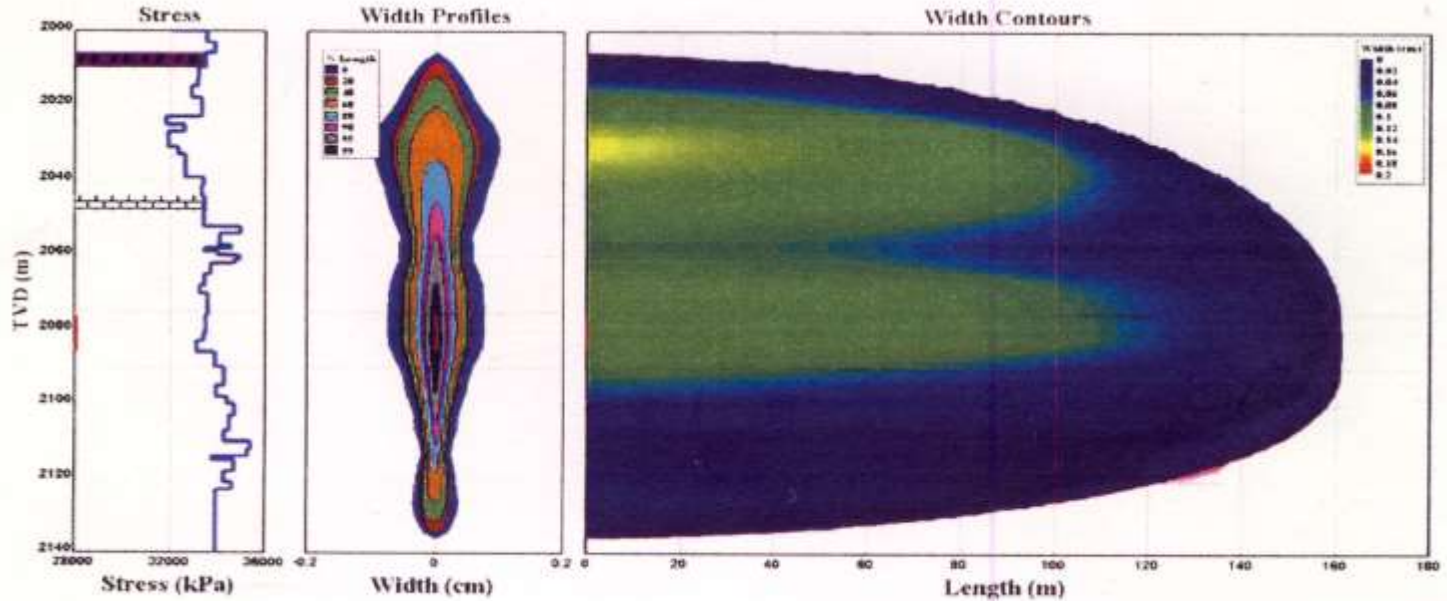
Therefore, this

United States Patent

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Michelle K. Lee

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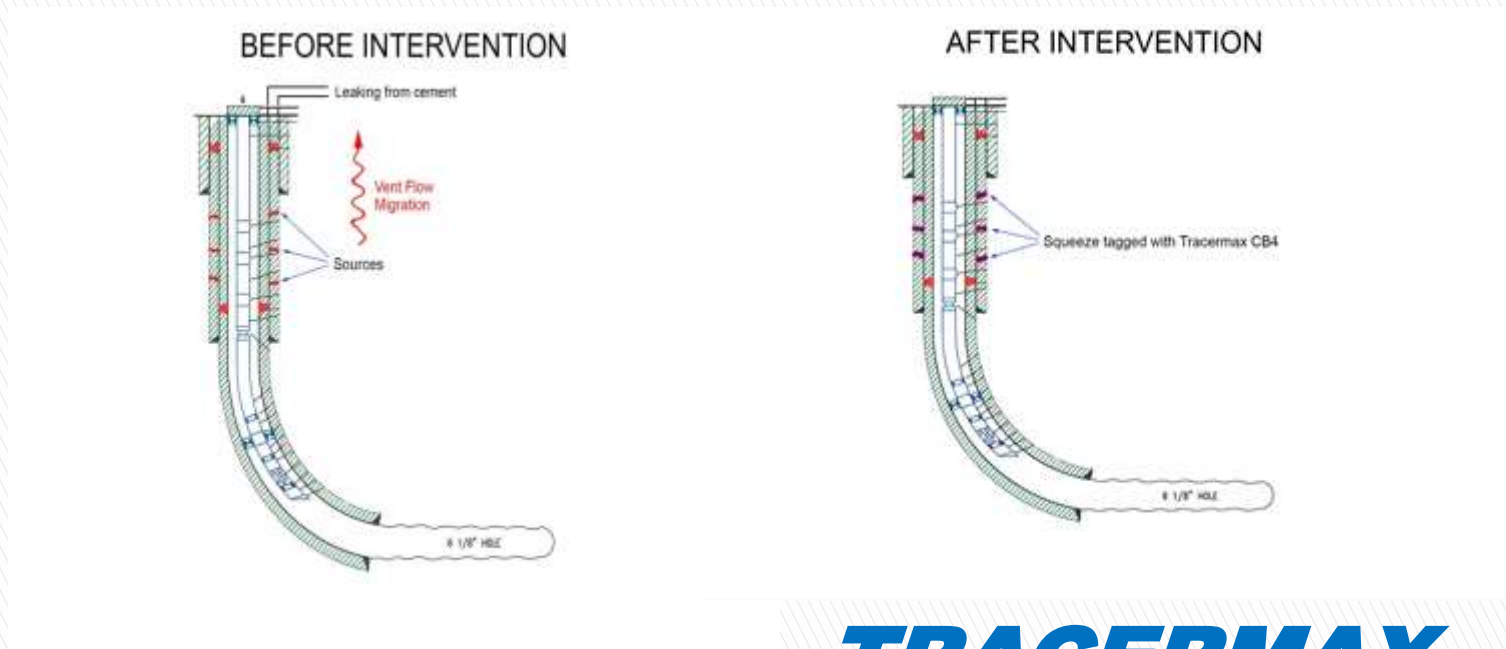
Patented **Tracemax** technology is the zero risk approach for tracing hydraulic fracturing or cementing operations for sub-surface zone location with maximum results. **Tracemax** is a **GREEN** technology that is economic, user friendly, and provides superior well data.

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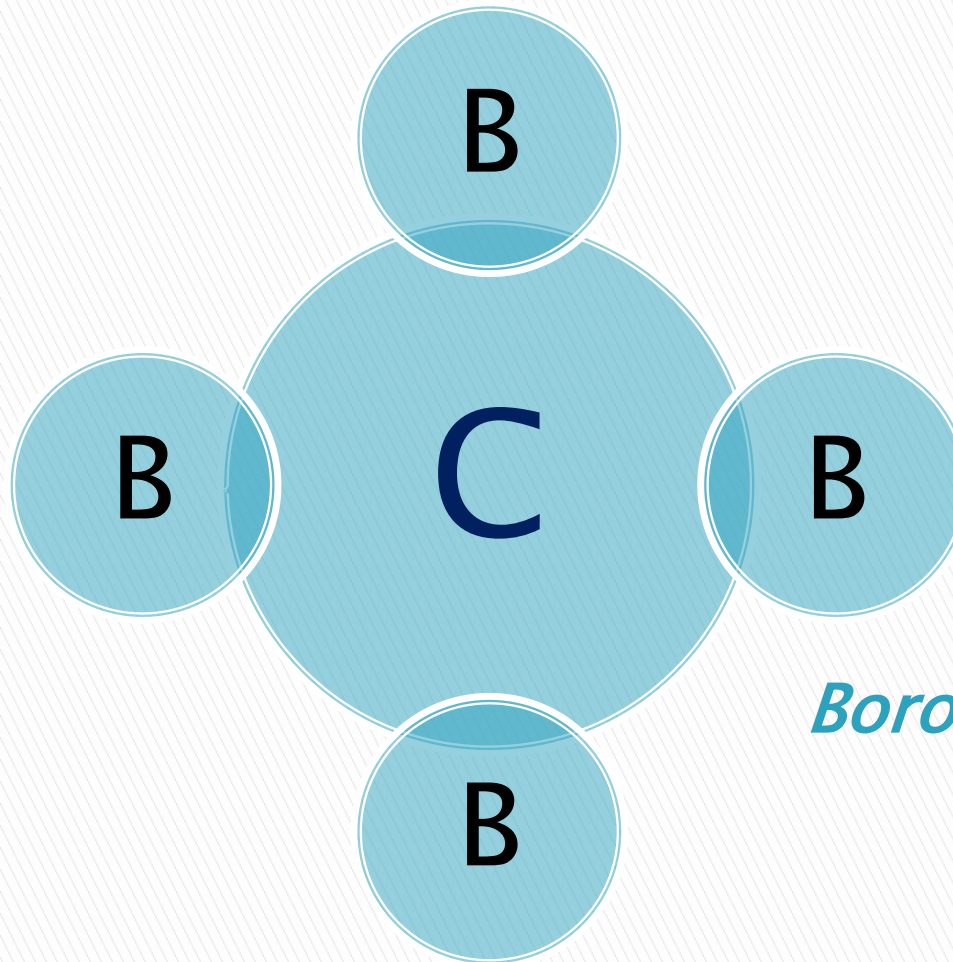
APPLICATIONS

Tracermax technology can be used to determine subsurface zone location as follows:

- ▶ **The presence of light weight cement slurries (<1500 kg / m³)**
- ▶ **Height definition of cement or polymer “squeezes” for remedial intervention**
- ▶ **Identification of surface cement “tops”.**
- ▶ **The placement of fluids used for hydraulic fracturing operations**
- ▶ **Production logging**



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Boron Carbide

Boron-10 is a neutron absorber. Boron-10 nuclides capture neutrons that have a maximum energy of 0.025 eV. Boron transmutes into Lithium under Alpha decay. A capture Gamma-ray with a photon energy of 0.48 MeV is emitted when a Boron nuclide absorbs a thermalized neutron.

The nuclear reaction is shown in the formula: $^{10}\text{B} (n') ^{11}\text{B} (\alpha \text{ decay } \gamma) ^7\text{Li} (\gamma = 0.48 \text{ MeV})$

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- ▶ **Boron Carbide (CB4) is a black granular material that is a metalloid ceramic compound which is chemically inert under typical conditions of a cementing or hydraulic fracturing operation.**
- ▶ **The addition of CB4 to cement slurries will not affect the cross linking of the Calcium Silicate matrix, setting times or adversely affect compressive or tensile strengths of the cement.**
- ▶ **The density of CB4 is the similar to Silica (2.5 g/cm³). Particle sizing ranges of 12/20M to -325M and can be matched to any typical cement powders or proppant materials. CB4 particles will travel uniformly in any fluid displacement.**



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ADVANTAGES

Tracermax technology :

- ▶ Eliminates the use of open source radioactive tracers. Risks associated from using open source radioactive tracers are eliminated; ie: spills, contaminated equipment, personnel radiation exposures and burdens
- ▶ Can be easily handled by onsite operations personnel using standard PPE as per MSDS and usually already in place.
- ▶ Gives for height definition of fluid placements in hydraulic fracturing and cementing applications. Can be logged over prolonged periods of time
- ▶ Neutron detectors used in neutron logging tools have a higher temperature rating as opposed to gamma detectors allowing for longer logging runs in high temperature environments
- ▶ *Tracermax* tracer materials are relatively inexpensive and do not decay; with a shelf life proportional to the quantity of tracer compound unlike radioactive tracers that decay rapidly
- ▶ Can be easily transported by any mode of transport in standard packaging with basic manifestation
- ▶ Can be used at international destinations reached by air transport , where logistics with respect to transportation of radioactive Class 7 dangerous goods has limited the availability of radioactive materials to these markets
- ▶ *Tracermax* tracer materials do not require any specialized licensing. Federal licensing is required to use neutron logging tools using special form sealed source nuclear substances as well logging source



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HSE Advantages

- ▶ Risks from using radioactive tracers are eliminated; ie: spills, contaminated equipment, personnel radiation exposures and burdens
- ▶ Can be easily handled by operations personnel using standard PPE already in place and as listed on MSDS for chemical tracer(s)
- ▶ Can be easily transported by any mode of transport in standard packaging with basic manifestation
- ▶ Can be used at international destinations where logistics with respect to transportation of radioactive Class 7 dangerous goods has limited the availability of radioactive materials to these markets
- ▶ *Tracermax* tracer materials do not require any specialized licensing. Special form sealed source encapsulations used as neutron well logging sources require federal licensing in all jurisdictions



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QUALITY CONTROL

- ▶ The addition of **Tracermax** CB4 into blending equipment gives an optimum homogenous mixture of the tracer material with the blended fluids.
- ▶ The tracer addition is controlled by the blender operator with the chemical add feeder systems available on most blending equipment. A process control module allows for the tracer addition at a specified concentration. A hard copy strip chart of the tracer addition vs. time displacement of pumped fluids from the blender should be available as reference for interpretation purposes by the service provider.
- ▶ The particle sizing of the CB4 tracer material can be matched to that of most proppants used in fracturing operations or aggregates used in cementing operations. The tracer particles will travel uniformly with the fluid displacement.
- ▶ Positive compatibility tests have been conducted with sintered Bauxite or Alumina proppants tagged with CB4 tracer materials used in fracturing operations.



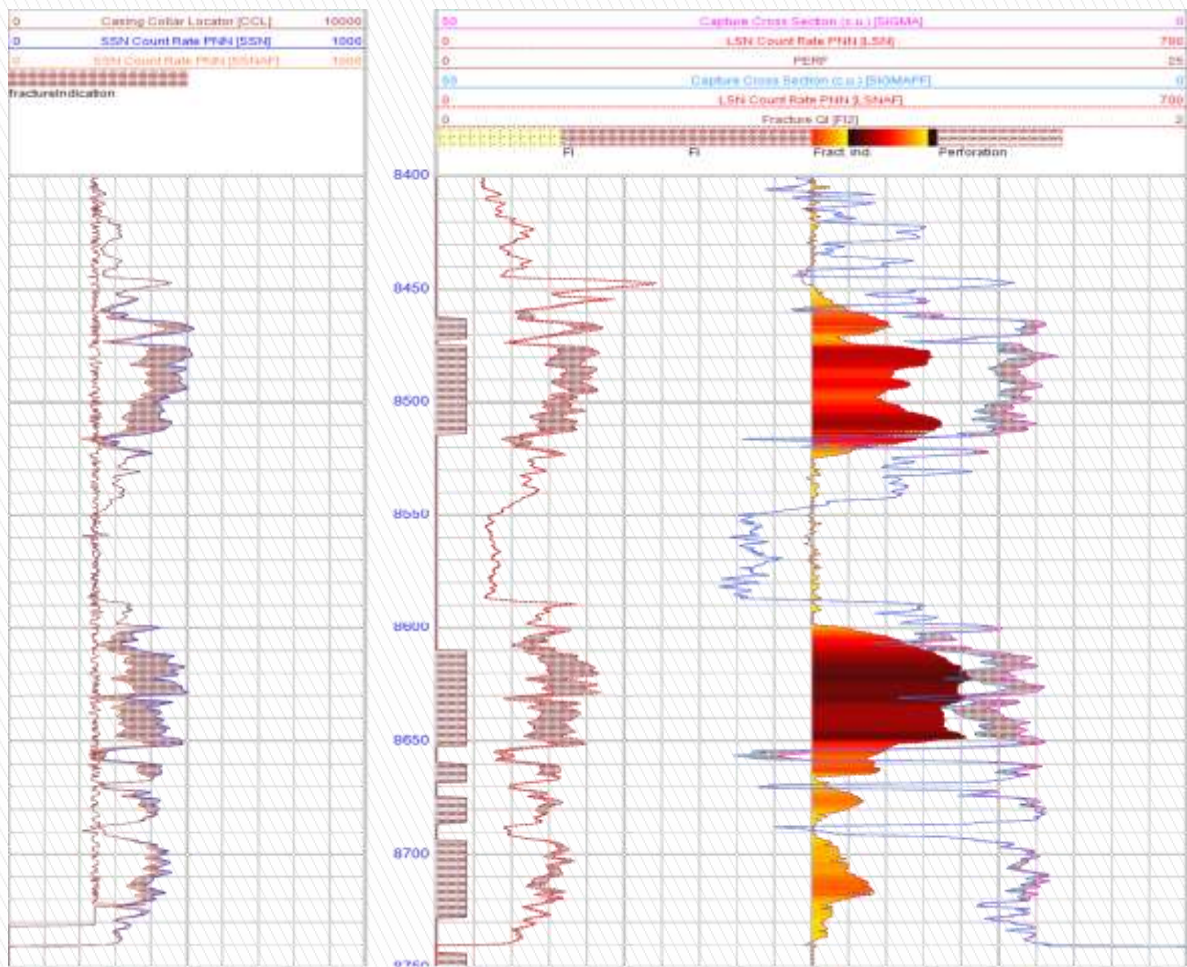
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LOGGING OPTIONS

- ▶ **Tracermax** technology (CB4) is run as a tracer in conjunction with a neutron logging tool. Tracermax looks at descending Neutron-Neutron (N-N) and corresponding offsets between reference and post logging runs to determine height definition with respect to fluid placements. All neutron tools can detect **Tracermax** technology. The character of the neutron curves is repeatable with any tool, so it is possible to normalize descending N-N values from different logging tools to generate a composite tracer log overlay. Tool performance with respect to data acquisition; well log analysis and presentations vary between service providers.



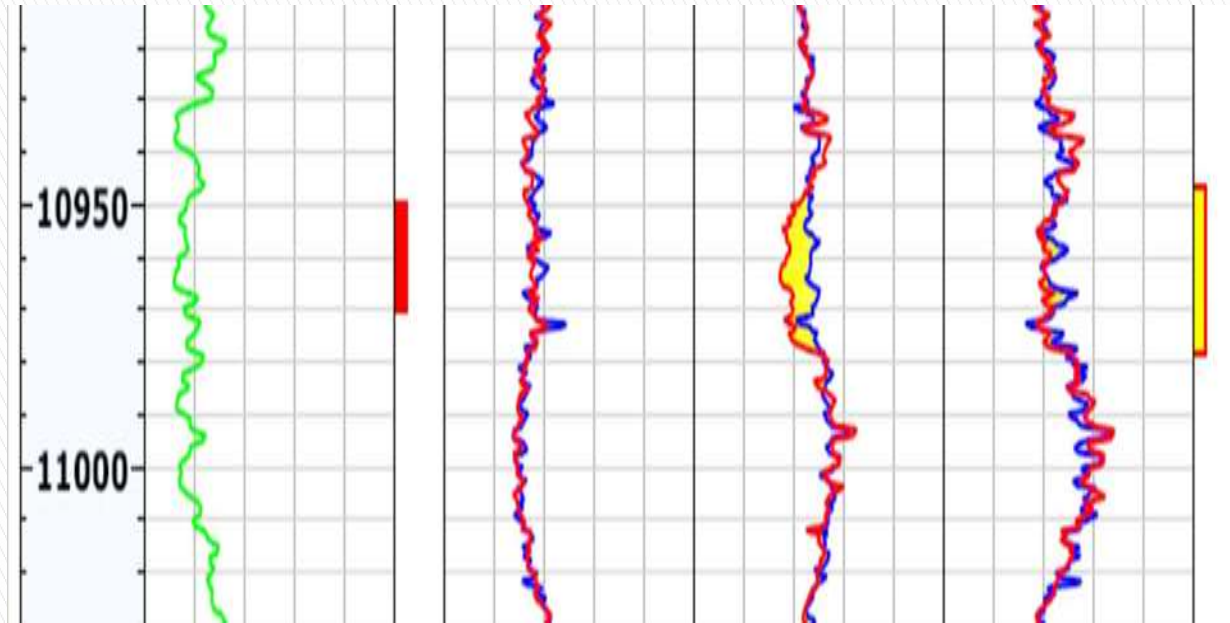
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Geophysical accelerators can be used to log *Tracermax* technology as shown in the log example above. This log is a composite tracer log overlay of descending Neutron-Neutron (N-N) offsets using a reference logging pass with the same logging tool.

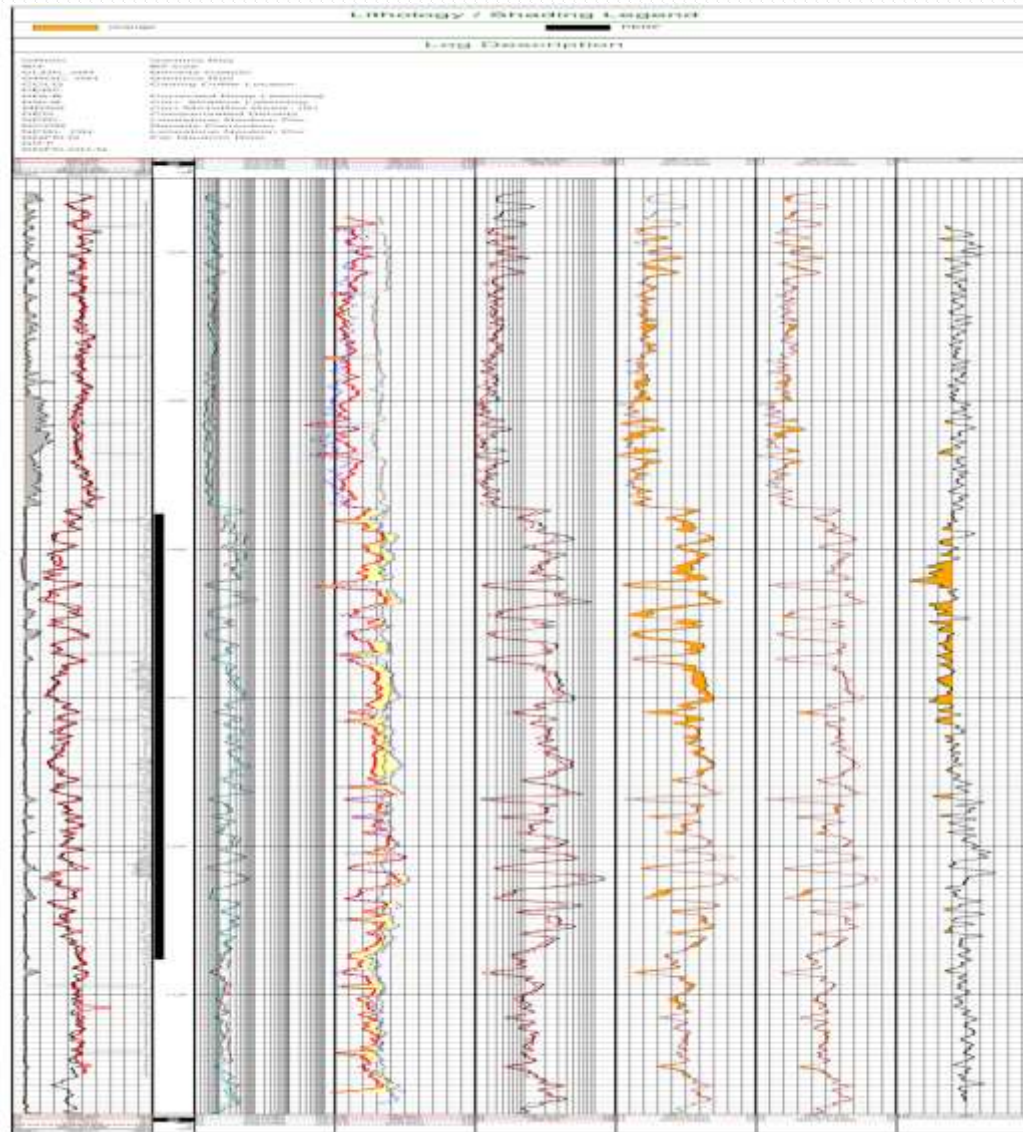
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- ▶ **A compensated neutron tool (CNL) using a radioactive special form sealed source encapsulation can be used to detect CB4 tagged fluid placements. The log example below shows a composite tracer log overlay generated using descending N-N offsets with the same tool.**

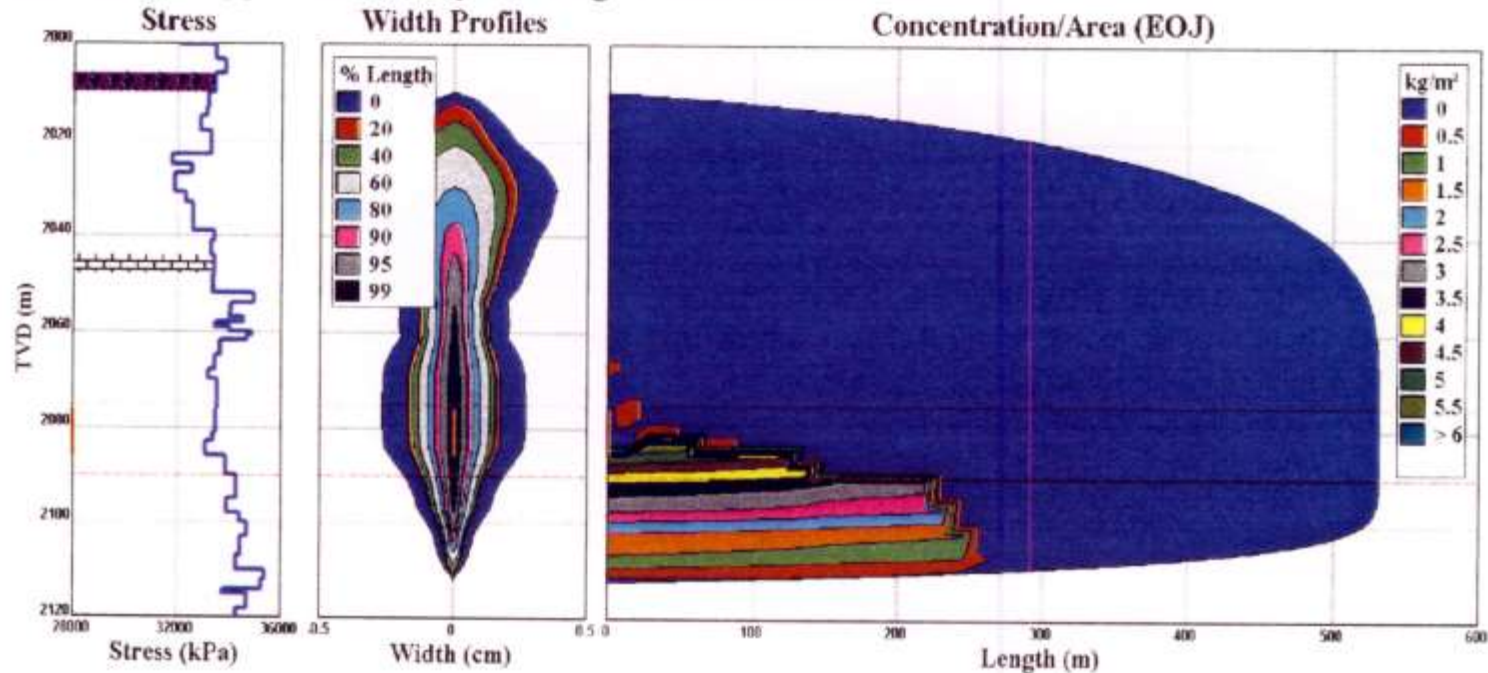


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- ▶ **Composite tracer log overlays can be generated using normalization log processing techniques against existing open or cased hole logs using different logging tools as shown in the example below:**



Predicted Proppant Geometry for Single Plane fracture Growth



Tracermax technology can be used for fracture growth modeling. The calibration of the tracer addition system is necessary to correlate nuclear count rates to tagged fluid displacements in selected intervals. The offsets defined on composite tracer log overlays can be used to identify fluid entry points and to model fluid displacements from a growth or frac width perspective.

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