

# **Geomechanical Properties Advisor / 3D TIV MechPro Processing**

Schlumberger

Geomechanical Properties

Advisor

3D TIV MechPro Processing

Trip 8

|                                                                                                                      |  |                                                                                                                                      |  |
|----------------------------------------------------------------------------------------------------------------------|--|--------------------------------------------------------------------------------------------------------------------------------------|--|
| COMPANY: DCP Midstream LP<br>WELL: Zia AGI D2<br>FIELD: AGI Devonian Exploration<br>COUNTY: Lea<br>STATE: New Mexico |  | COMPANY: DCP Midstream LP<br>WELL: Zia AGI D2<br>FIELD: AGI Devonian Exploration<br>COUNTY: Lea<br>STATE: New Mexico<br>COUNTRY: USA |  |
| Location                                                                                                             |  | Other Services:                                                                                                                      |  |
| Field: 1893 FSL & 950 FWL<br>Section: 19 township: T19S Abstract: R32S<br>Section: 19 Township: T19S Range: R32S     |  |                                                                                                                                      |  |
| API: 30-025-42207                                                                                                    |  |                                                                                                                                      |  |
| Permanent Datum: CL<br>Log Measured From: KB<br>Drilling Measured from: KB                                           |  | Elevation: 3547<br>27ft above the permanent                                                                                          |  |
| Date                                                                                                                 |  | 11-Dec-2016                                                                                                                          |  |
|                                                                                                                      |  |                                                                                                                                      |  |
| Depth Driller                                                                                                        |  | 14771 ft                                                                                                                             |  |
| Depth Logger (Sch)                                                                                                   |  | 14771 ft                                                                                                                             |  |
| Bm Log Interval                                                                                                      |  | 14770 ft                                                                                                                             |  |
| Top Log Interval                                                                                                     |  | 13635 ft                                                                                                                             |  |
| Casing Driller                                                                                                       |  | 7 in @ 13622 ft                                                                                                                      |  |
| Casing Logger                                                                                                        |  | 13635 ft                                                                                                                             |  |
| Bit Size                                                                                                             |  | 6 in                                                                                                                                 |  |
| Type Fluid in Hole                                                                                                   |  | Fresh Water                                                                                                                          |  |
| Dens.   Visc.                                                                                                        |  | 8.4 lbm/gal   41 s                                                                                                                   |  |
| pH   Fluid Loss                                                                                                      |  | 10   9 m3                                                                                                                            |  |
| Source of Sample                                                                                                     |  | Adive Tank                                                                                                                           |  |
|                                                                                                                      |  | 72 degF                                                                                                                              |  |
| Rmt @ Meas Temp.                                                                                                     |  | 0.19 ohmm @ 72 degF                                                                                                                  |  |
| Rmt @ Meas Temp.                                                                                                     |  | -999.25 ohmm @ 68 degF                                                                                                               |  |
| Source: Rmt   Rmt                                                                                                    |  | Calculated   174.75 degF                                                                                                             |  |
|                                                                                                                      |  |                                                                                                                                      |  |
| Circulation Stopped                                                                                                  |  | 12:30:00                                                                                                                             |  |
| Logger on Bottom                                                                                                     |  | 16:15:00                                                                                                                             |  |
| Max Rec Temp.                                                                                                        |  | -999.25 deg F                                                                                                                        |  |
| Equipment   Location                                                                                                 |  | 2191   Midland, TX                                                                                                                   |  |
| Recorded by:                                                                                                         |  | J.Shull                                                                                                                              |  |
|                                                                                                                      |  |                                                                                                                                      |  |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                    |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|
| FOLD HERE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | The well name, location and borehole reference data were furnished by the customer |
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|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|-------------------------|---------------------|------------------------------|--|
| DS Job #: DS-2016-33049                                                                                                                                                                                                                                                                                                                                                                                                                                | DS Software: Techlog 2015.3 | Process Date: 1/11/2017 | PTS Center: Midland | Log Analyst: Jermaine Packer |  |
| <div><div>Processing Parameters:</div><div>GENERAL - Parameters are assumed to be Default Parameters unless otherwise noted</div><div>BOREHOLE FLUID: (Dtmud = 181 us/ft)<br/>HOLE DIAMETER: 8.75 in<br/>BOTTOM HOLE TEMPERATURE: 174.75</div><div>MECHPRO PARAMETERS:<br/>Dynamic-Static YME correlation used = Modified Morales<br/>Bore Pressure Gradient: 0.5 psi/ft<br/>Overburden = 1.05psi/ft<br/>UCS = Coates-denoio<br/>Alpha = 1</div></div> |                             |                         |                     |                              |  |

TRACK

Track 1: Gamma Ray

GR - standard gamma ray  
BS- bit size  
HD1-PPC1- Hole diameter 1 from powered positioning caliper 1  
HD1-PPC2-Hole diameter 1 from powered positioning caliper 2  
Mudcake area shading - indicates caliper < bit size  
Washout area shading - Indicates caliper > bit size

Track 2: Depth

Depth numbers - depth scale  
MinEne - overall minimum cross energy  
MaxEne - overall maximum cross energy  
OffEne area shading - indicates the difference between MinEne and MaxEne  
SLOANI- Slowness Anisotropy-Azimuthal

Track 3: Porosity

TNPH - neutron porosity  
SPHI - sonic porosity

Track 7: Porosity

Aniso\_Class- Anisotropic Classification (Blue- TIV, Red-TIH, White- Isotropic)

Track 8: UCS, Tensile and Compressive Strength

UCS, Tensile, and compressive strength are calculated using emperical equations and are best when calibrated to core

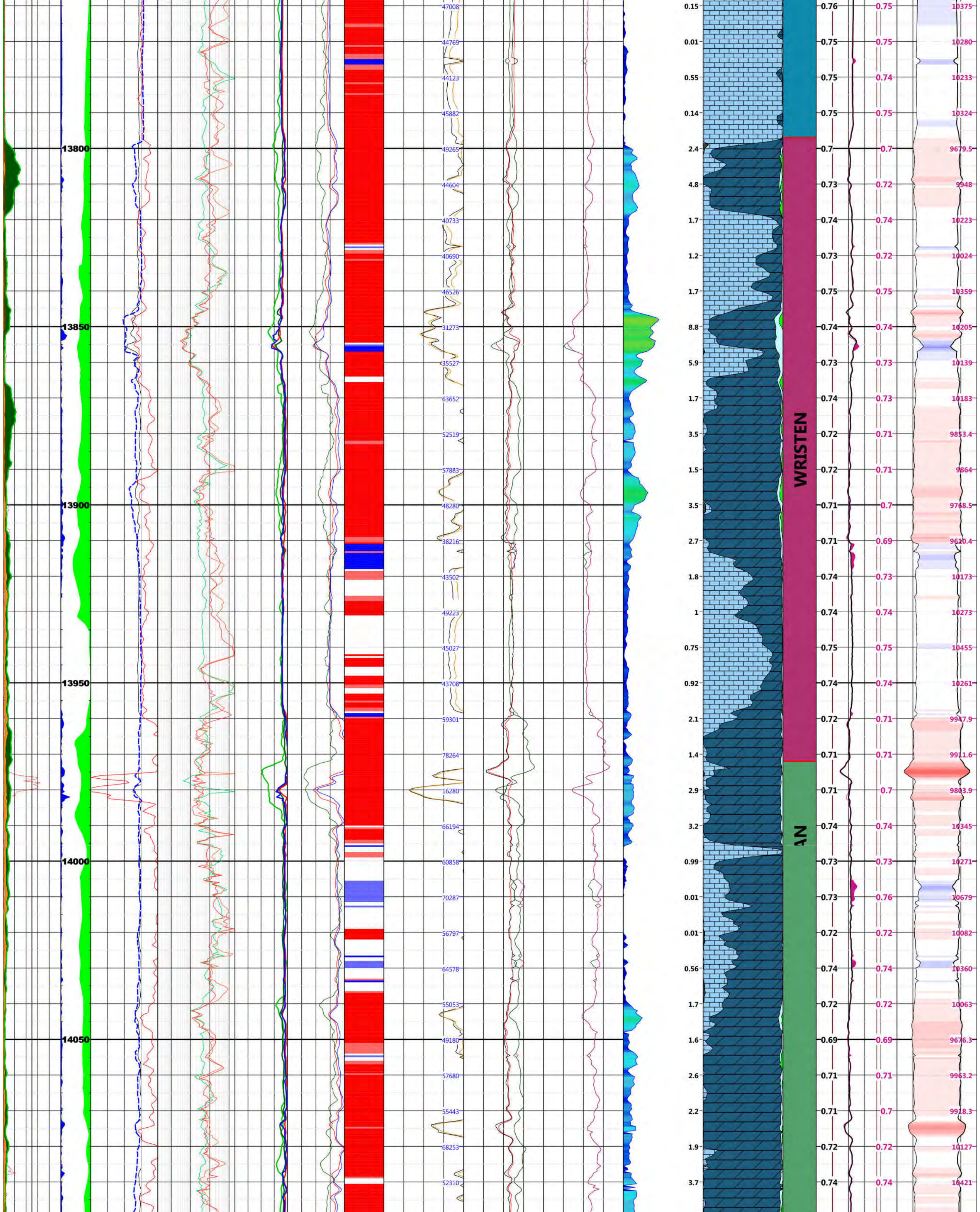
Track 8: Poisson's Ratio

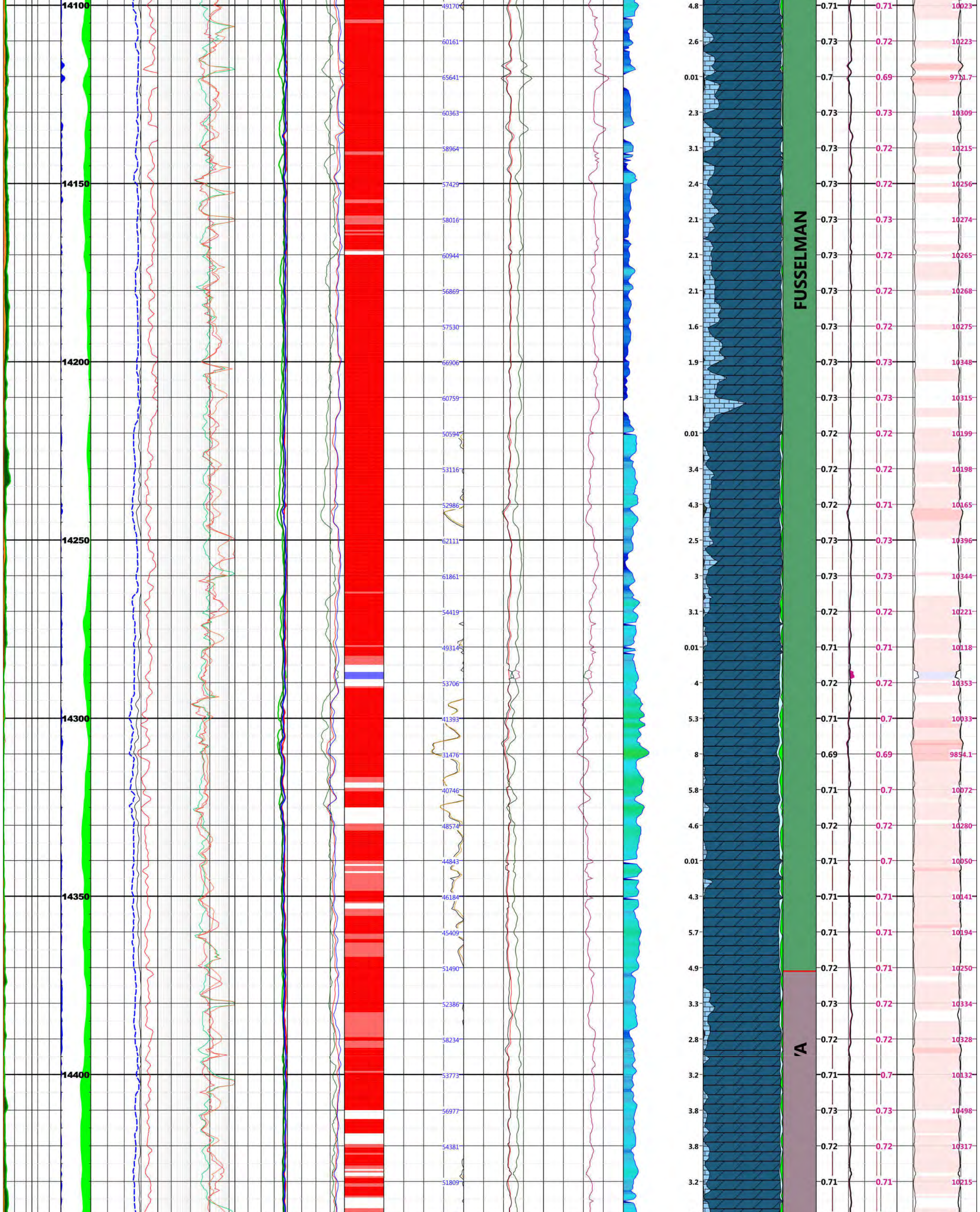
PR\_VERT\_SSA\_DYN - dynamic vertical Poisson's ratio from anisotropic model  
PR\_HORIZ\_SSA\_FSA\_DYN - dynamic horizontal Poisson's ratio from anisotropic model  
YME\_VERT\_DYN - dynamic vertical Young's moduls from anisotropic model  
YME\_HORIZ\_SSA\_DYN- dynamic horizontal Young's moduls from anisotropic model

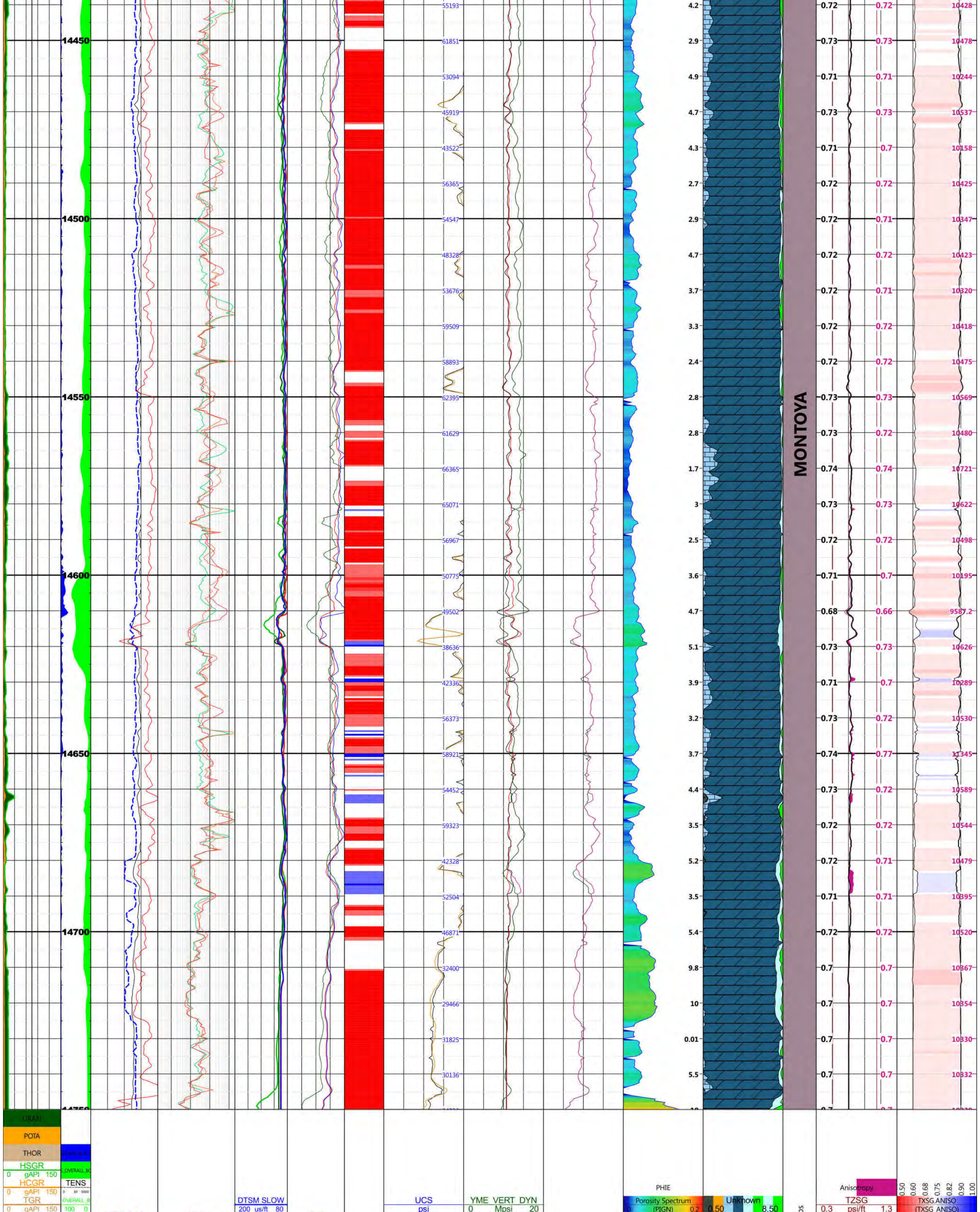
Track 9: Young's Modulus

YME\_HORIZ\_SSA\_STA - static vertical Young's moduls from anisotropic model  
YME\_VERT\_STA- static horizontal Young's moduls from anisotropic model



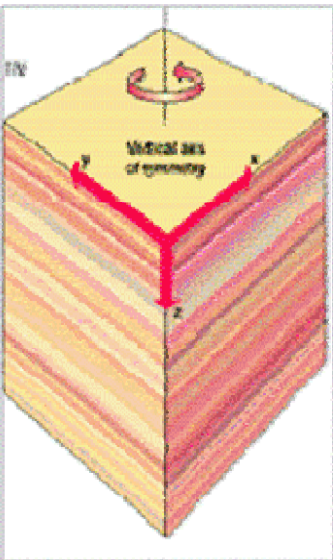




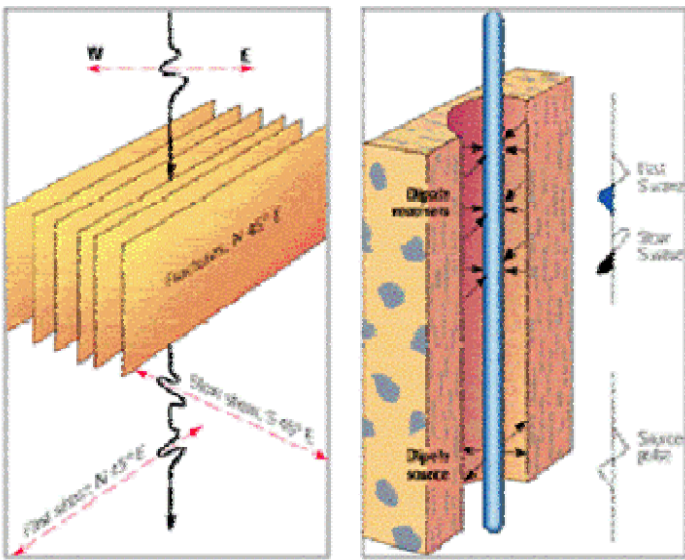


|          |          |                  |                |              |          |                   |                      |                   |                |                                                                              |                |                |
|----------|----------|------------------|----------------|--------------|----------|-------------------|----------------------|-------------------|----------------|------------------------------------------------------------------------------|----------------|----------------|
| BS       | LOAN_BCR | DPHI LIM         | AT90           | DTSM FAST    | C66      | TSTR              | YME HORIZ SSA DYN    | PIGN              | Volumetric QE  | To                                                                           | PPGI           | TXSG ANISO     |
| 6 in 16  | 0 75     | 0.3 ft3/ft3 -0.1 | 0.2 ohm.m 2000 | 200 us/ft 80 | 0 Mpsi 6 | 0 psi 5000        | 0 Mpsi 20            | 0                 | 0 (v/v) 1      |                                                                              | 0.3 psi/ft 1.3 | 0.5 psi/ft 1.5 |
| HD2 PPC1 |          | TNPH             | AT60           | DTCO         | C55      | Cohesive Strength | PR HORIZ SSA FSA DYN | YME HORIZ SSA STA | PHIE           |                                                                              | TXSG ISO       | TXSG ANISO     |
| 6 in 16  |          |                  | 0.2 ohm.m 2000 | 120 us/ft 40 | 0 Mpsi 6 | 0 psi 10000       | 0 0.5                | 0 Mpsi 20         |                |                                                                              | 0.3 psi/ft 1.3 | 1.5 psi/ft 0.5 |
| HD1 PPC1 |          | SPHI             | AT30           | STRVP DTS    | C44      | Compress Strength | PR VERT SSA DYN      | YME VERT STA      | PIGN           |                                                                              | TXSG ANISO     | TXSP ANISO     |
| 6 in 16  | 1:240    | 0.3 v/v -0.1     | 0.2 ohm.m 2000 | 200 us/ft 80 | 0 Mpsi 6 | 0 psi 50000       | 0 0.5                | 0 Mpsi 20         | 0 ft3/ft3 0.25 | illite<br>Bound W<br>Calcite<br>Dolomite<br>XWater<br>XOil<br>UWater<br>UOil | 0.3 psi/ft 1.3 | psi            |
|          |          |                  |                |              |          |                   |                      |                   |                | ZIA AGI D2 Trip8                                                             |                |                |

TIV ANISOTROPY

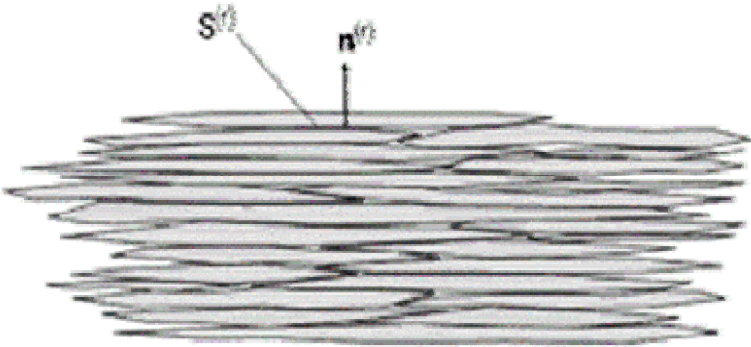


TIH ANISOTROPY



From the Promise of Elastic Anisotropy, Schlumberger oilfield Review, oct 1994

Layered media often exhibits TIV anisotropy. Properties measured in the vertical direction are different than properties measured in the horizontal direction.



Figures courtesy of Sayers and Suarez-Rivera

Poro Elastic Horizontal Strain Model with isotropy

$$\sigma_h - \alpha \sigma_{pp} = \frac{\nu}{1 - \nu} (\sigma_v - \alpha \sigma_{pp}) + tectonics$$

Poro Elastic Horizontal Strain Model for TIV anisotropy

$$\sigma_h - \alpha \sigma_{pp} = \frac{E_h}{E_v} \frac{\nu_v}{1 - \nu_h} (\sigma_v - \alpha \sigma_{pp}) + tectonics$$

$\sigma_h$  = Minimum horizontal stress

$\sigma_{pp}$  = Pore Pressure

$\sigma_v$  = Overburden stress

$\alpha$  = Poro – Elastic constant

$E_h$  = Horizontal Young's Modulus

$E_v$  = Vertical Young's Modulus

$\nu_h$  = Horizontal Poisson's Ratio

$\nu_v$  = Vertical Poisson's Ratio

From Thiercelin and Plumb, SPE 21847

COMPANY: DCP Midstream LP  
WELL:ZIAAGI D2 Trip8  
FIELD:AGI Devonian Exploration  
COUNTY:Lea  
STATE:New Mexico  
COUNTRY: USA

Schlumberger

API No.: 30-025-42207

Date Processed: 1/13/2017