Marquis Biocarbon Project
Seismic Program Synopsis

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December 9, 2022

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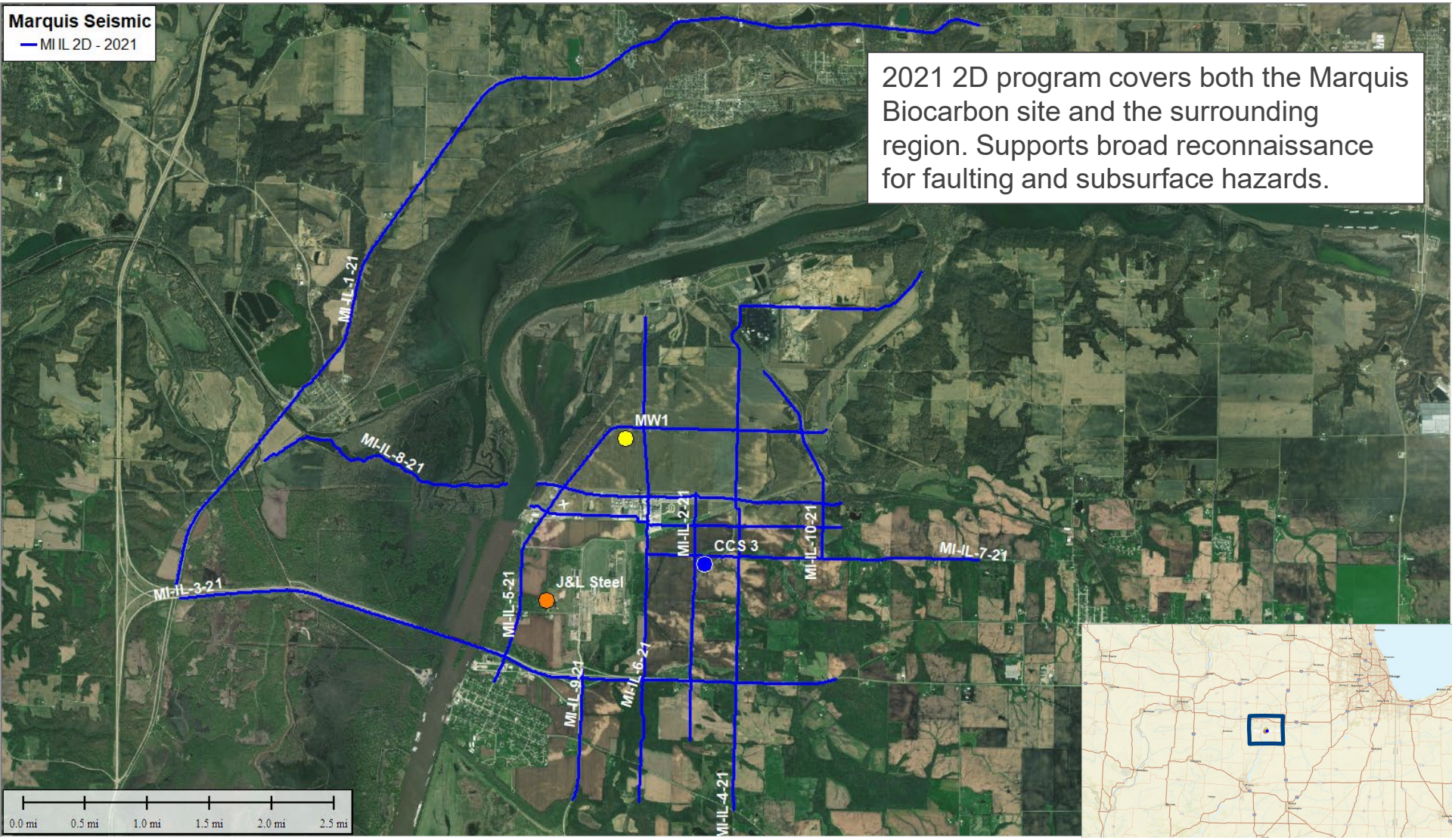
Seismic Data Collection Objectives

- Acquire seismic over site for detailed mapping of structure and stratigraphy of key formations and identification of potential subsurface hazards
- Confirm absence of major faulting or subsurface hazards over the site and regionally around the site with acquisition of 2D seismic
- Use 2D seismic response to design 3D seismic survey and assess applicability of time-lapse 3D seismic for site monitoring
- Acquire high-density, high-resolution 3D seismic over the core site for improved structural and stratigraphic mapping and subsurface hazard identification
- Incorporate detailed mapping of structure and stratigraphy from the 3D seismic volume into solid earth model (SEM) to refine the framework
- Establish 3D baseline seismic response for generation of future time-lapse seismic measurements to map plume growth over time

2021 2D Survey Locations



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2021 2D Acquisition Parameters

	Client: MARQUIS Prospect: Marquis_21_2D	
	Contractor: Precision Geophysical Crew #: 1	Manager: Roberts Observer: CALEY
2D: 1 BOL: 1101 EOL: 1675	RX Point Interval: 82.00 Ft Line Length: 47,438 ft.....	SX Point Interval: 165.00 Ft Max # Traces: 0
Spread was variable	Low Flag Live Traces: 180 / Gap: 0 / High Flag Live Traces: 180	Near Offset:0 Far Offset:25000
Instrument SPS Code: I4 Sample Rate: 1 ms Low Cut: 3 Hz High Cut: 205 Hz Preamp Gain: 30 dB	Serial Number: sp2040 Record Length: 5000 ms Media Format: Media Type:	Aux Traces 1-PTB 2-TREF 3-WREF 4-ACOR
Source Type SPS Code: V1 Manufacturer: Mertz Model: Hemi 44 Unit Weight: 48000 lb. Number of Vibes: 2	Shooting System: Seismic Source Universal Enc (1) Sweep Type\Freq: Linear 10-120 Hz Sweep Length: 10000 ms Sweep Tapers: Cos Squared 500-300 ms Source Array: 2 Over 80 Ft	Energy Source: Vibroseis Correlation: POSTSTACK Noise Burst Edit: Diversity Stack: 128 ms Comment:
Receiver SPS Code: G1 Manufacturer: Geo Space Corp. Model: GS-32CT	Receiver Table: Land Geo String/Station: 1 Receiver Array: 6 Over 83 Ft	Receiver Interval: 10 Ft Receiver Freq: 10 Hz Comment: 10 Hz Close Tolerance Geophone

Total 'Uncorr. Stack' Files:	0
Total Test Files:	0
Total Omit Files:	10
Total No Files:	0
Total Shots:	2075
Total Profiles Recorded:	2085
Total Tapes Used:	0

Comments

Sources 3264-3348 Sources offset north 125 feet. SEE ATTACHED DATA SHIFT PAGE

2021 2D – 11 Line Program

Date Acquired	Line Name	BOL	EOL	RCV Interval in ft	SCR interval in Ft	Length in ft	Length In miles
Tuesday, July 13, 2021	MI-IL-1-21	1101	1675	82.5	165	47,355.00	8.97
Tuesday, July 06, 2021	MI-IL-2-21	2134	2559	82.5	165	35,062.50	6.64
Friday, June 18, 2021	MI-IL-3-21	3102	3447	82.5	165	28,462.50	5.39
Wednesday, July 07, 2021	MI-IL-4-21	4102	4456	82.5	165	29,205.00	5.53
Monday, June 28, 2021	MI-IL-5-21	5105	5369	82.5	165	21,780.00	4.13
Friday July 16 2021	MI-IL-6-21	6117	6351	82.5	165	19,305.00	3.66
Friday July 16 2021	MI-IL-7-21	7101	7272	82.5	165	14,107.50	2.67
Thursday, June 24, 2021	MI-IL-8-21	8126	8410	82.5	165	23,430.00	4.44
Friday July 16 2021	MI-IL-9-21	9101	9168	82.5	165	5,527.50	1.05
Friday, June 18, 2021	MI-IL-10-21	10101	10206	82.5	165	8,662.50	1.64
Friday July 16 2021	MI-IL-11-21	11107	11261	82.5	165	12,705.00	2.41
Total linear 2D mileage :						**245,602.50**	**46.52**
Total linear 2D mileage :						**245,602.50**	**46.52**
Friday, July 02, 2021	MI-IL_SWATH_6-2-4-21	**Number Inlines 4 Number Crosslines 467 2.086 sq miles**					
Tuesday, July 06, 2021	MI-IL-CDP_6-2-21	14117	14259	82.5	165	10,642.50	2.02
Tuesday, July 06, 2021	MI-IL-CDP_2-4-21	13129	13258	82.5	165	10,642.50	2.02
Friday, July 16, 2021	MI-IL_SWATH_7-11-8-21	**Number of inlines 4 number of cross lines 460 1.415 sq miles**					
Friday July 16 2021	MI-IL-CDP_11-8-21	19680	19835	82.5	165	12,787.50	2.42
Friday July 16 2021	MI-IL-CDP_7-11-21	19103	19229	82.5	165	10,395.00	1.97
Total swath linear mileage in 2D :						**44,467.50**	**8.42**
Total 2D and swath linear mileage :						**290,070.00**	**54.94**

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2021 2D Processing Flow

North

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LINE: MI-IL-9-21
SP: 9101-9168
PUTNAM COUNTY, ILLINOIS

FINAL STACK

FIELD PARAMETERS

ACQUIRED FOR	BATTELLE
ACQUIRED BY	PRECISION GEOPHYSICAL
DATE RECORDED	JUNE 2021
ENERGY SOURCE	VIBROSEIS
INSTRUMENTS	ARAM ARIES
NUMBER SOURCES	2 VIB OVER 80 FEET
SWEEP	10 SECONDS 10-120 Hz
FIELD FILTERS	3/205 HZ
GEOPHONES	GS-32CT
GEOPHONE ARRAY	6 PHONES OVER 83 FEET
NUMBER OF CHANNELS	68 CHANNELS
RECORD LENGTH	5 SECONDS
SAMPLE RATE	1 MS
SOURCE INTERVAL	82.5 FEET
GROUP INTERVAL	165 FEET

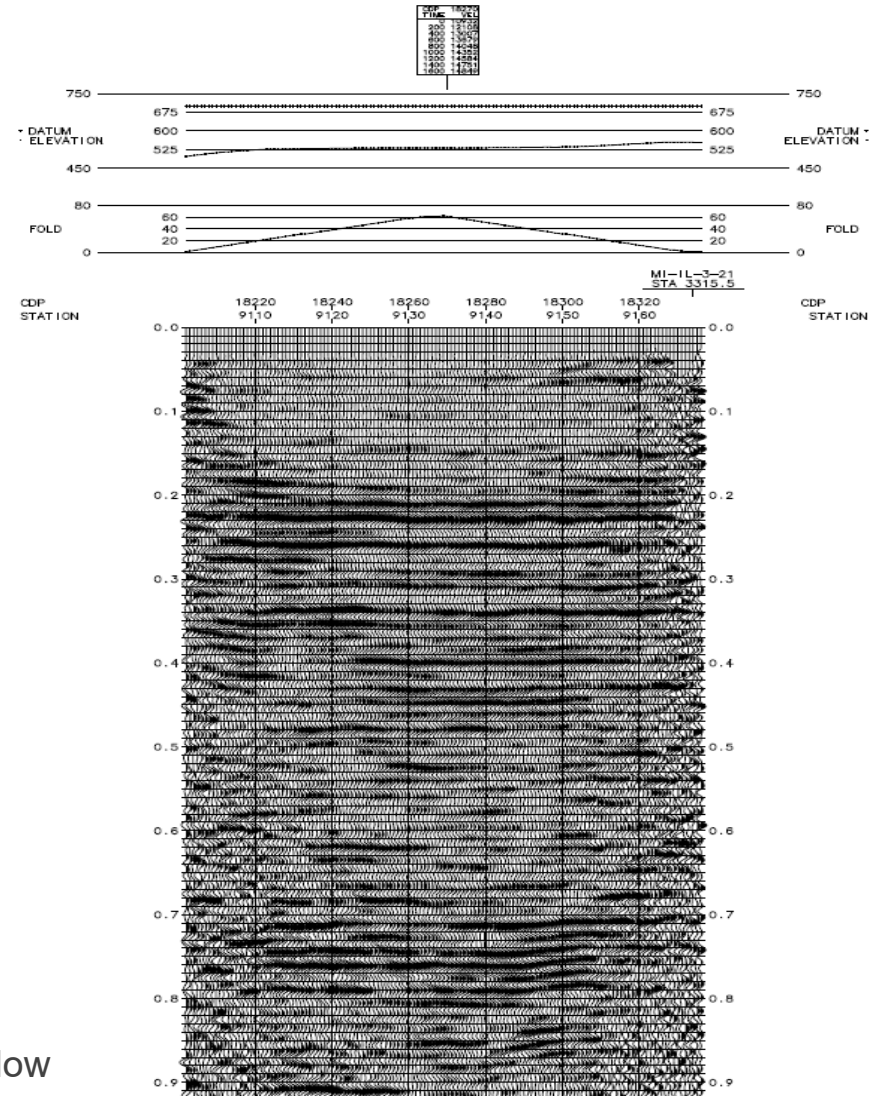
PROCESSING SEQUENCE

INPUT SEG-Y RECORDS (STANDARD SEG)
GEOMETRY DEFINITION
RECORD AND TRACE EDIT
REFRACTION STATICS
  Datum Plane: 700 FT
  Vr: 9,500 FT/SEC
MINIMUM PHASE CORRECTION
180 DEGREE PHASE SHIFT
EXPONENTIAL GAIN RECOVERY
SURFACE CONSISTENT DECONVOLUTION
  120 MS OPERATOR
SPECTRAL WHITENING
  10-120 Hz
STATICS TO FLOATING DATUM
INTERACTIVE VELOCITY ANALYSIS
SURFACE CONSISTENT RESIDUAL STATICS
INTERACTIVE VELOCITY ANALYSIS
SURFACE CONSISTENT RESIDUAL STATICS
NORMAL MOVEOUT
STATICS TO FLAT DATUM
CDP CONSISTENT STATICS
TRACE EQUALIZATION
CDP STACK
SPECTRAL WHITENING
  10-100 HZ
TIME VARIANT BANDPASS FILTER
  20/25-90/100 HZ 0-500 MS
  12/18-70/85 HZ 800-3000 MS
FX PREDICTIVE FILTER
FK POWER FILTER
SURFACE WAVE NOISE ATTENUATION
TIME VARIANT SCALING

ANOKA GEOPHYSICAL LLC

DISPLAY PARAMETERS

Tue Aug 17 15:37:15 2021
Traces/Inches = 18
Bias Percent = 0
Gain Set = 0.72
Gain Constant = 720
Static Shift = 0
Inches/Second = 15
Clip Limit = 2.5
RMS Amplitude = 1



Line 9 shown as example processing flow

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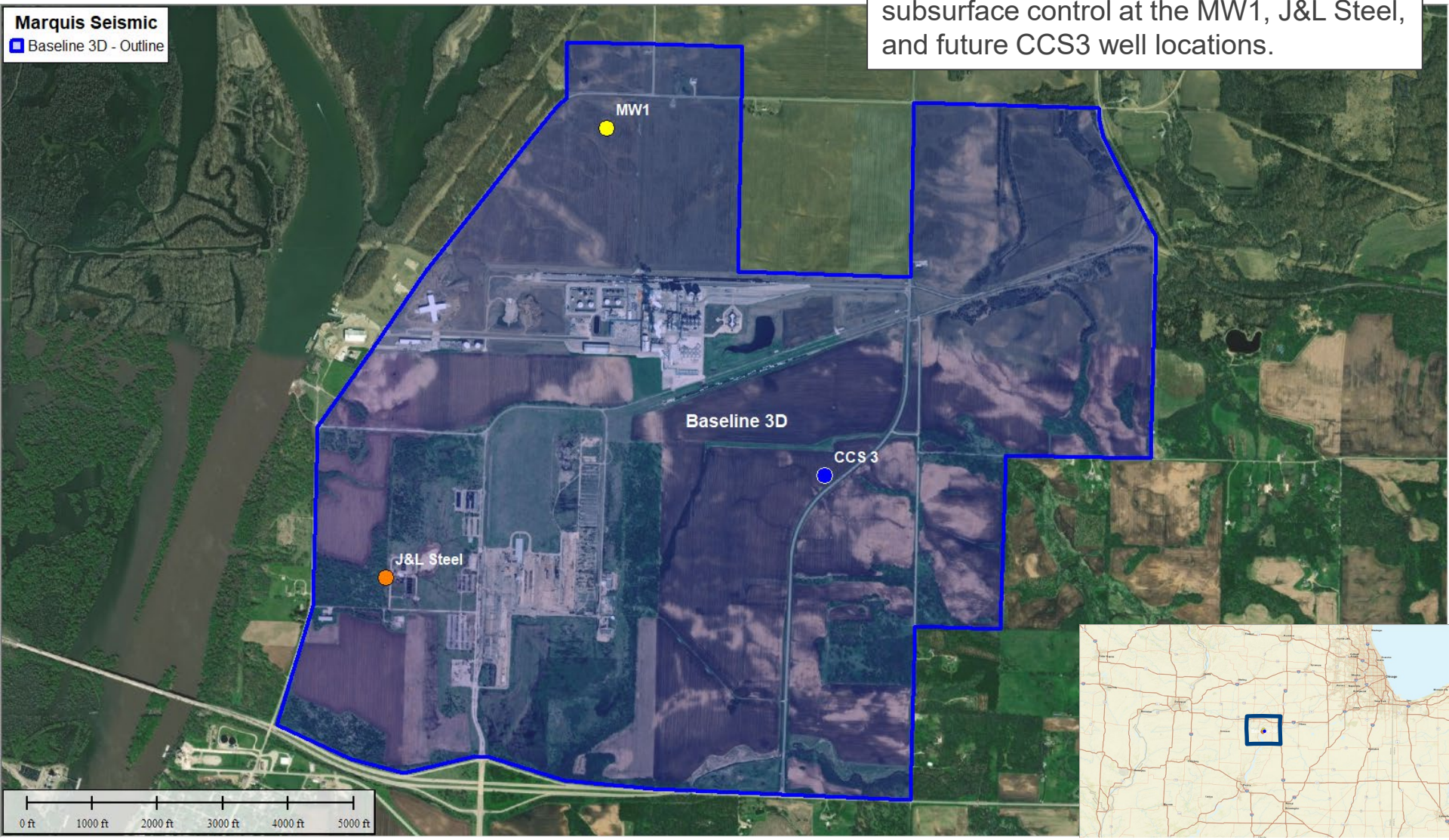
2022 “Baseline” 3D Survey

Baseline 3D covers the Marquis Biocarbon core area including all primary subsurface control at the MW1, J&L Steel, and future CCS3 well locations.



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Baseline 3D Acquisition Parameters

Hardware

RECORDING SYSTEM		
Instrument Type	OYO Geospace GSX	
Firmware Version	Version 3.101	
GeoReaper Version	GeoReaper (Ver. 3.2.0.155)	
Geomerge Version	GeoMerge (Ver. 3.2.0.155)	
File Format	External USB Hard Drive/SEG D	
Energy Type	**VIBROSEIS**	**DYNAMITE**
AUX Channel 1	True reference	N/A
AUX Channel 2	Radio reference	N/A
AUX Channel 3	Time break	N/A
AUX Channel 4	Wireline reference	N/A
AUX Channel 5	N/A	N/A
AUX Channel 6	N/A	N/A
GEOPHONES		
Type/Model	SM24	
Frequency	10 hz.	
Pattern	Circular	
Pattern Spacing	15' - Centered on Receiver	
Phones/Group	6 per string	
Wired Configuration	1X6 configuration	

Source Parameters

SOURCE PARAMETERS			
Energy Type	Vibroseis		100%
VIBRATORS			
Type/Model	AHV-IV Commander 364		
Instruments	Seismic Source Force 3		
Hold Down Weight	60,000		Pounds
Drive Level	70%		or allowable
Phase Lock	Ground Force		
Force Control	Fundamental Ground Force		
Number of Vibrators	**2**		**Per Point**
Pattern	35' center on stake		
Hold Down Weight	60,000		Pounds
SWEEP PARAMETERS			
Number of Sweeps	**6**		
Move Up	No		
Start Frequency	2	Hz.	
End Frequency	128	Hz.	
Sweep Length	**8**	**Seconds**	
Sweep Type	LINEAR		
Start Taper	0.3		ms
End Taper	0.3		ms

Recording Parameters

RECORDING PARAMETERS		
Sample Rate	2	ms
Low Cut Filter/slope	1	Hz
Anti-Alias Filter	207.5	Hz .83 Nyquist
Preamp Gain	36	db
Noise Edit	Diversity Stack	
Data Type	Correlated After Stack	
Record Length	2	Seconds
Line Type	3D	
Active Lines	Static	
Active Channels/Line	9,532	
Maximum Active		
Roll On/Off	N/A	
Receivers Sq/Linear M		
Receiver Line Intv.	100	
Receiver group Intv.	100	
Total Receiver Lines	132	
Total Receivers	9,532	
Receiver Orientation	North/South	
Sources Sq/Linear Mi.		
Source Line Intv.	200	
Source group Intv.	100	
Total Source Lines	69	
Total Sources	5,098	
Source Orientation	East/West	
Total Sq/Linear Miles	3.72	

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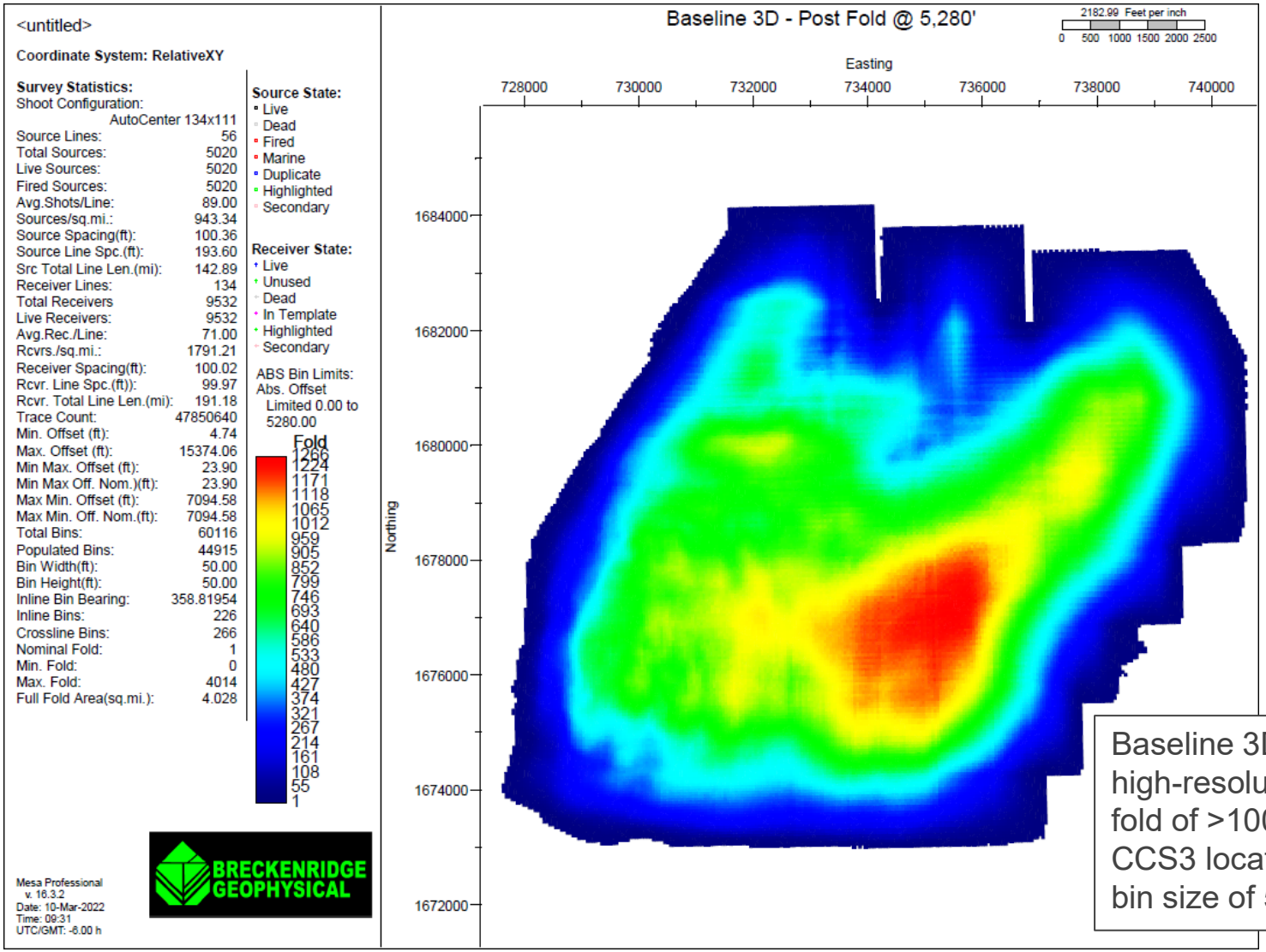
Baseline 3D Fold – 0’-5280’ Offset



Baseline 3D is high-density, high-resolution (HDHR) with fold of >1000 over the CCS3 location and a native bin size of 50ft x 50ft.

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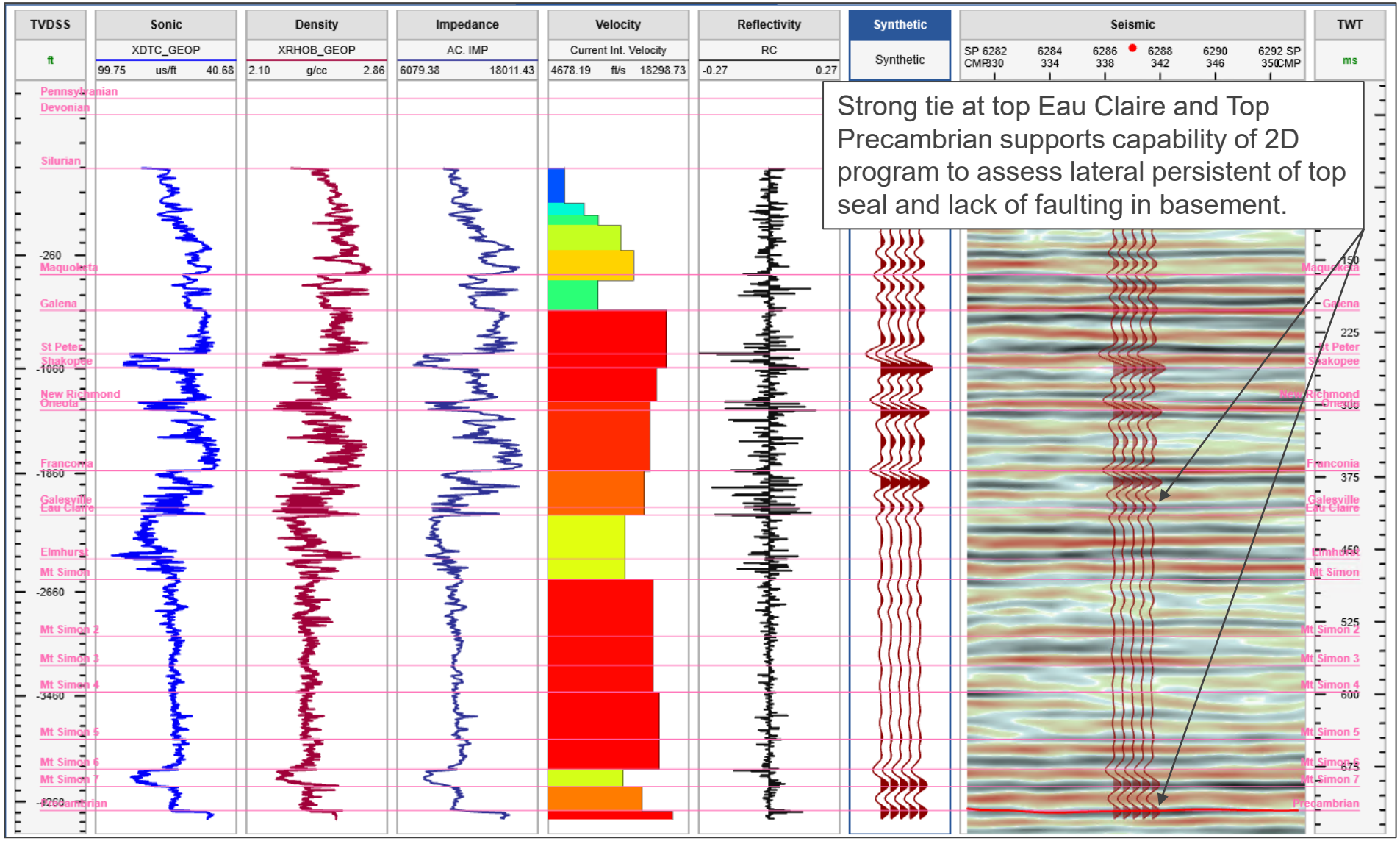
Baseline 3D Processing Flow

1. 3D Geometry Survey Input and Edit
2. Refraction / Elevation / Datum(floating) Statics Application
3. Trace Editing
4. True Amplitude Gain Recovery
5. Surface Consistent Amplitude Equalization
6. Surface Consistent Deconvolution (160ms Operator, 0.1% White Noise)
7. Spectral Balance 0-10-120-130 HZ
8. Velocity Picking - 1 per 1/2 sq mi
9. NMO / Mute / Surface Consistent Statics
10. Flex Binning
11. FDNS Noise Attenuation
12. Velocity Picking - 1 per 1/4 sq mi
13. NMO / Mute / Surface Consistent Statics
14. OVT Sort
15. 5D Interpolation
16. Sort to Offset Bins
17. Kirchhoff PrSTM
18. PrSTM Velocity Analysis - 1 per 1/4 sq mi
19. Residual Velocity Analysis - 1 per 1/4 sq mi
20. CDP Stack
21. Final Datum Statics
22. FXY Deconvolution
23. SWNA

MW1 Synthetic Tie to 2021 2D - Line 6



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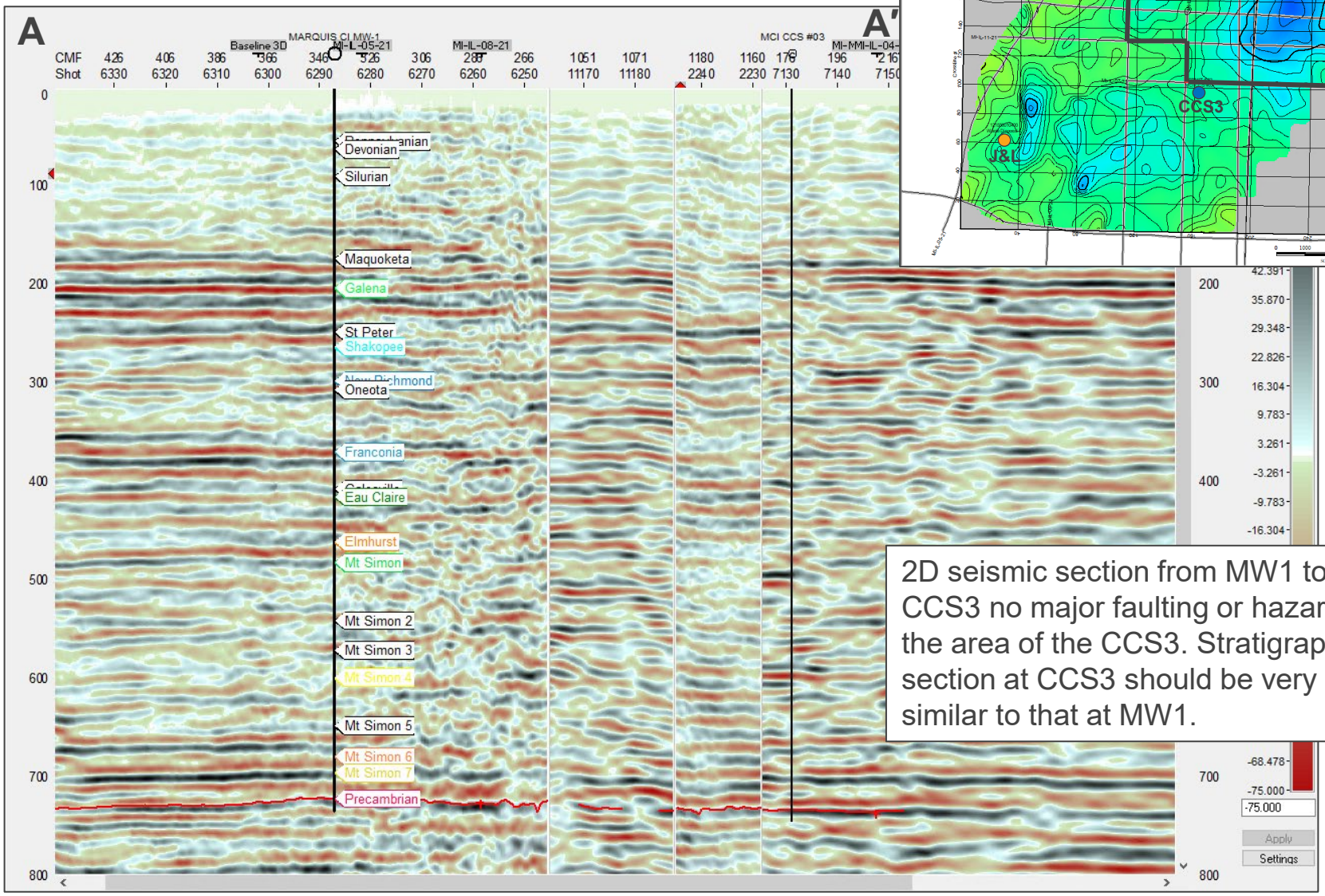
2021 2D Seismic – MW1 to CCS3



2D seismic section from MW1 to CCS3 no major faulting or hazards in the area of the CCS3. Stratigraphic section at CCS3 should be very similar to that at MW1.

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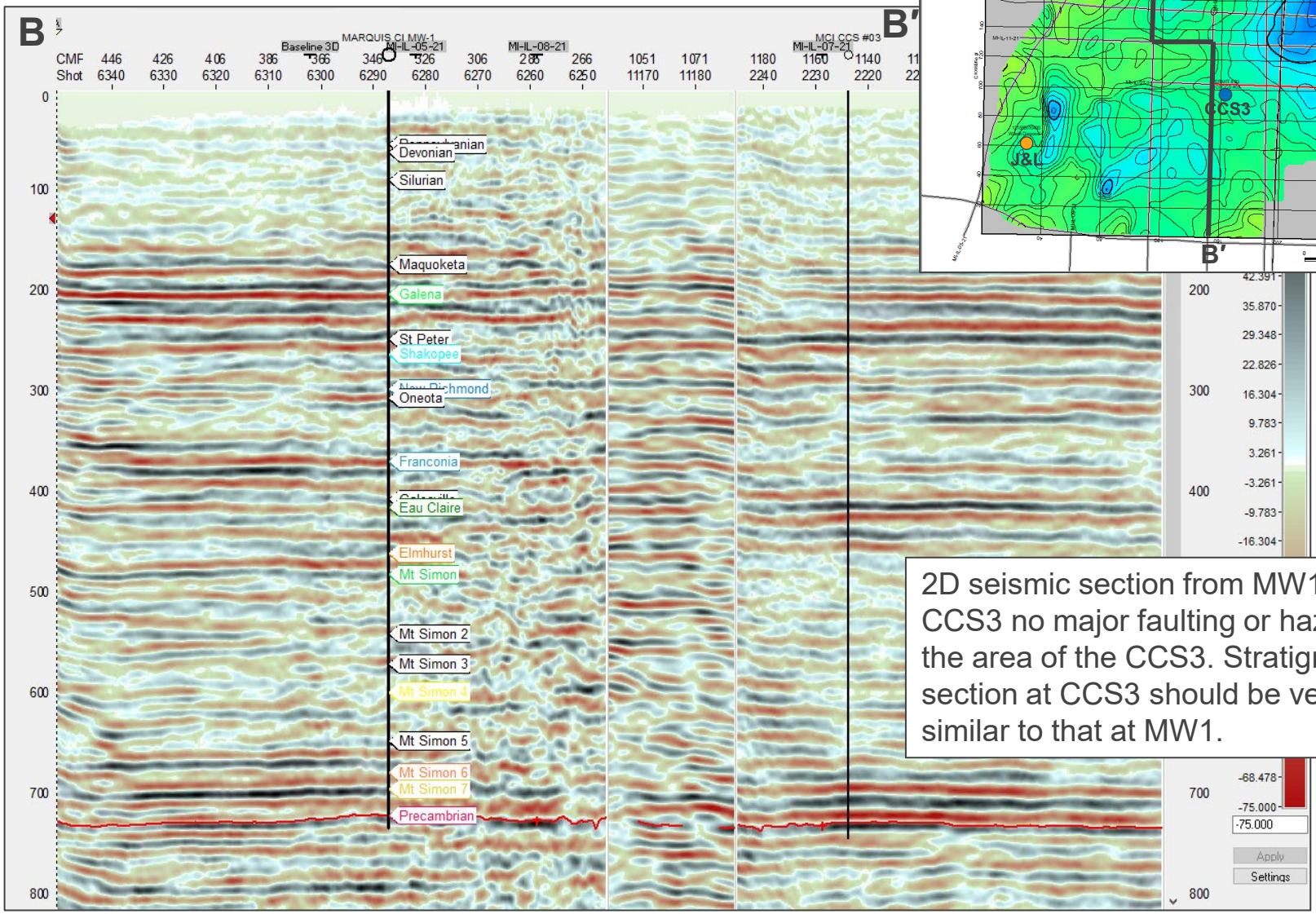
2021 2D Seismic – MW1 to CCS3



2D seismic section from MW1 to CCS3 no major faulting or hazards in the area of the CCS3. Stratigraphic section at CCS3 should be very similar to that at MW1.

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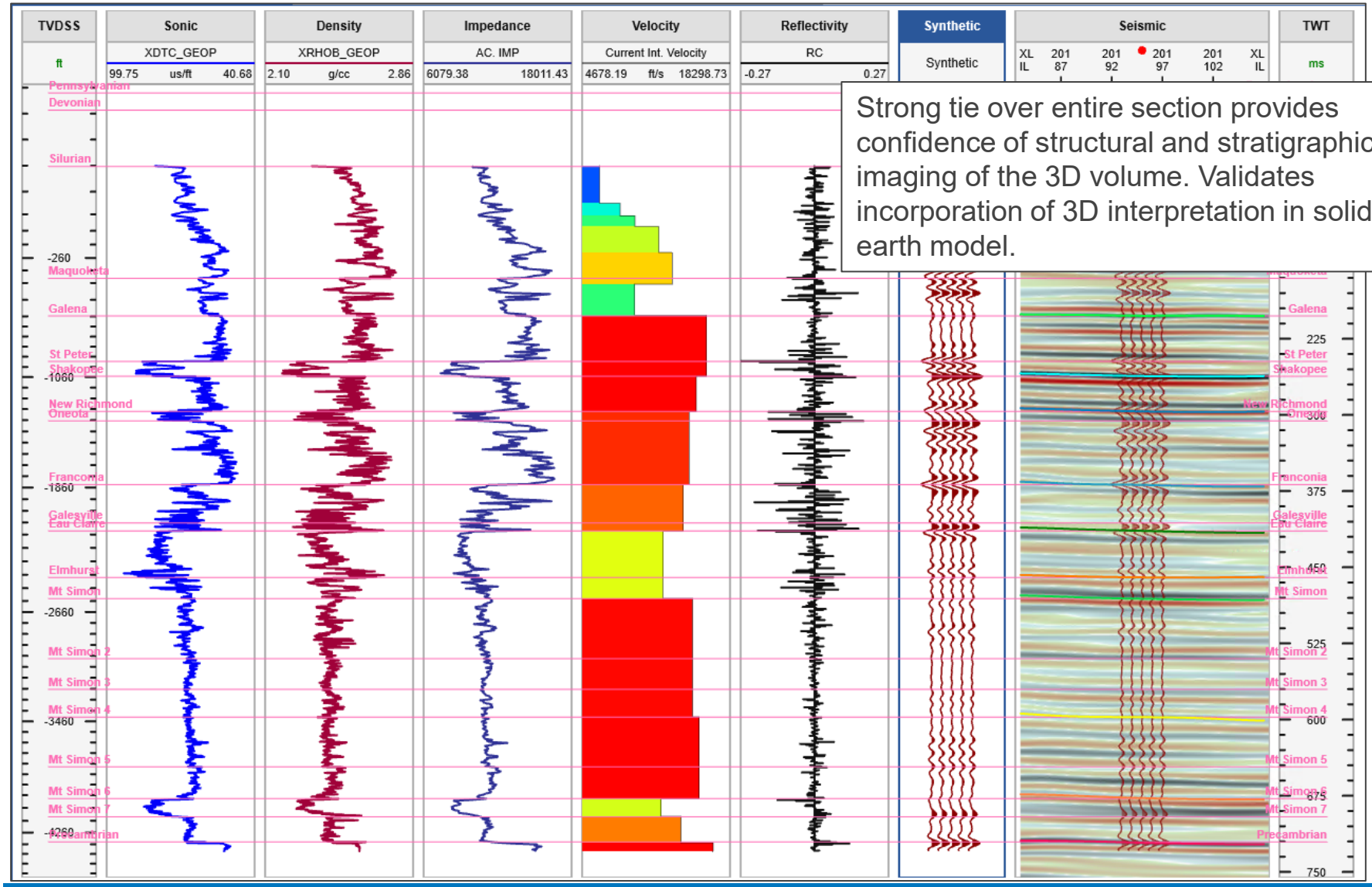
MW1 Synthetic Tie to Baseline 3D



Strong tie over entire section provides confidence of structural and stratigraphic imaging of the 3D volume. Validates incorporation of 3D interpretation in solid earth model.

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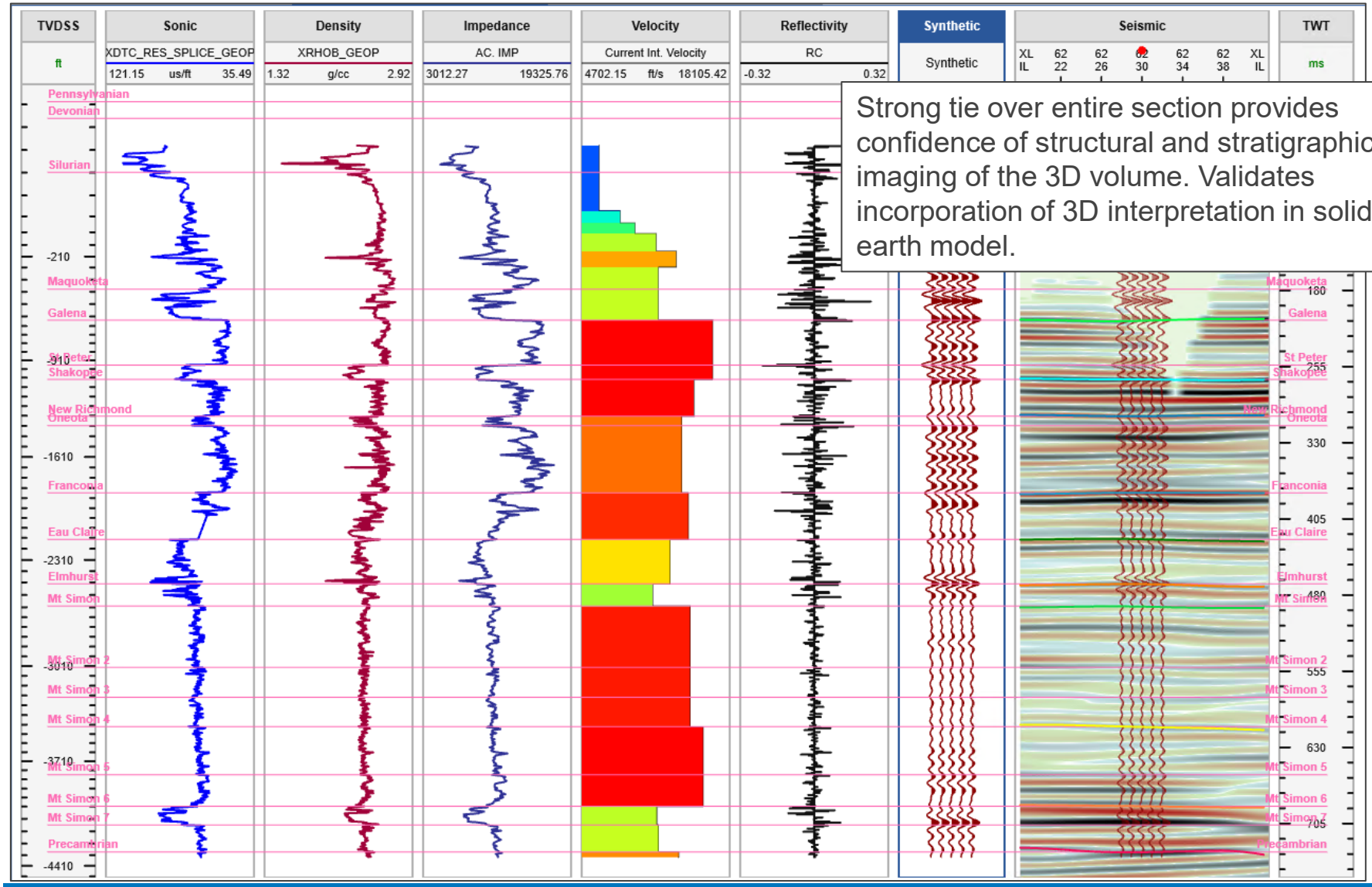
J&L Steel Synthetic Tie to Baseline 3D



Strong tie over entire section provides confidence of structural and stratigraphic imaging of the 3D volume. Validates incorporation of 3D interpretation in solid earth model.

15

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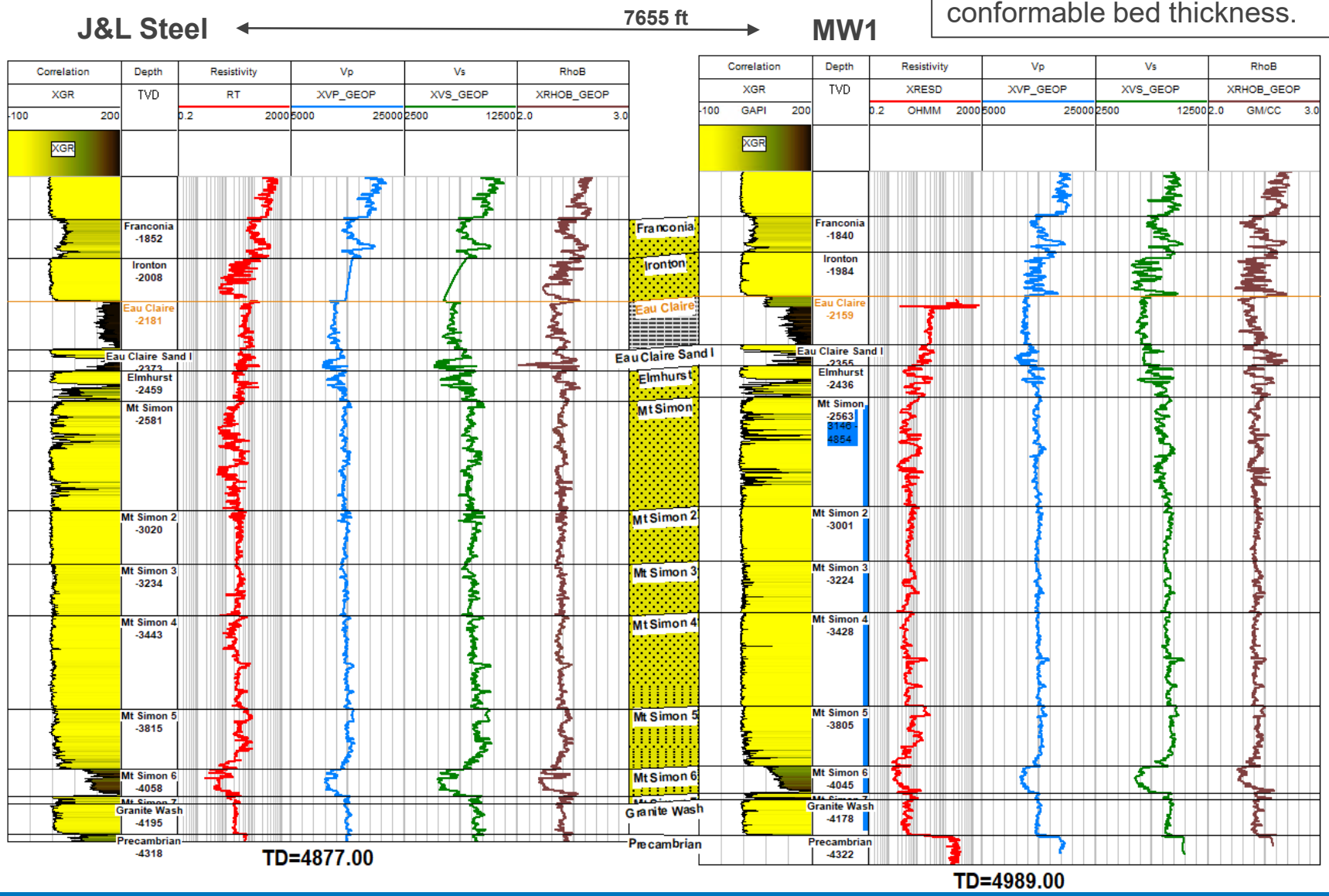
Cross Section - J&L Steel to MW1

Cross section from MW1 to J&L Steel shows little structure and conformable bed thickness.



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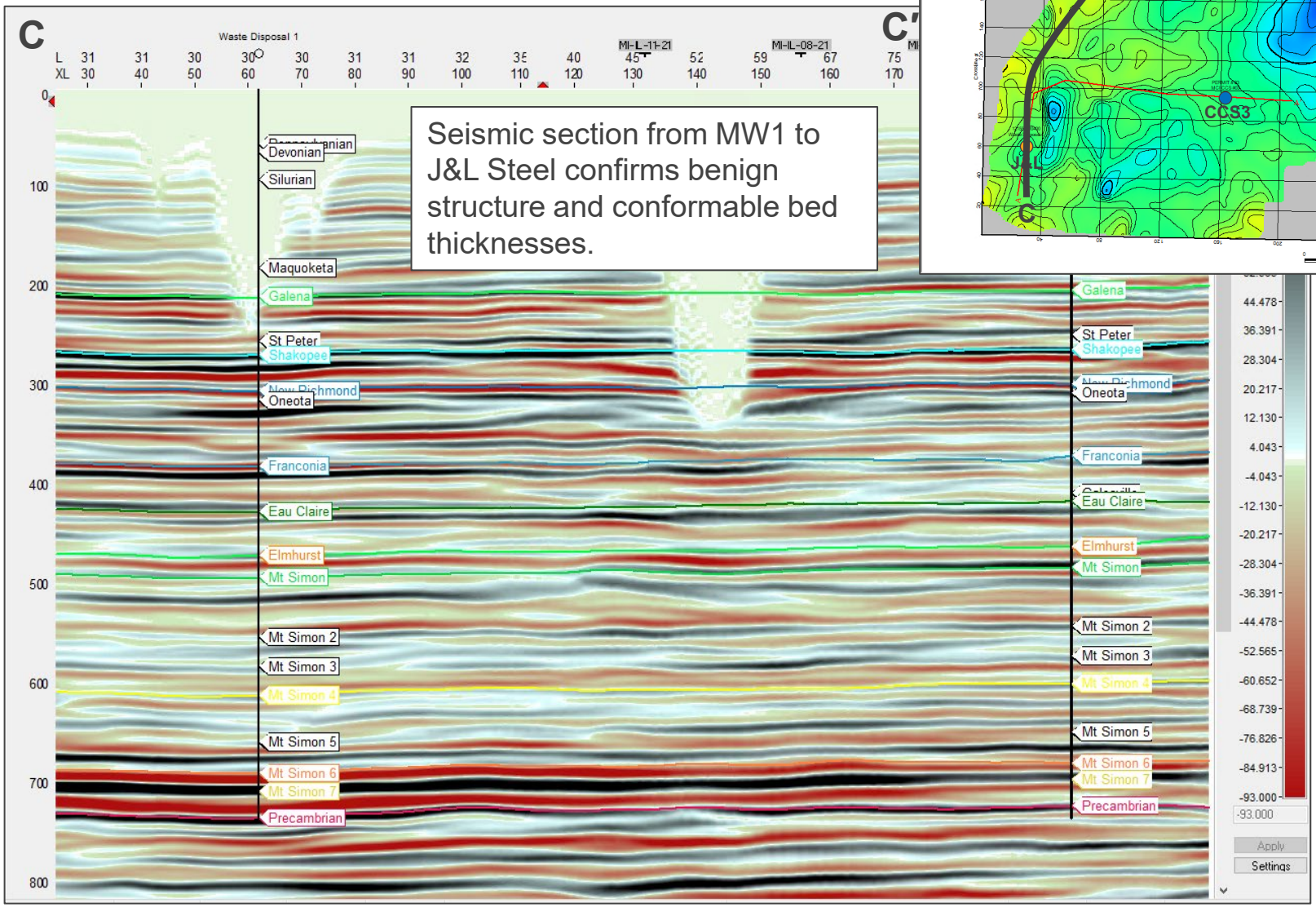
Baseline 3D – J&L Steel to MW1



Seismic section from MW1 to J&L Steel confirms benign structure and conformable bed thicknesses.

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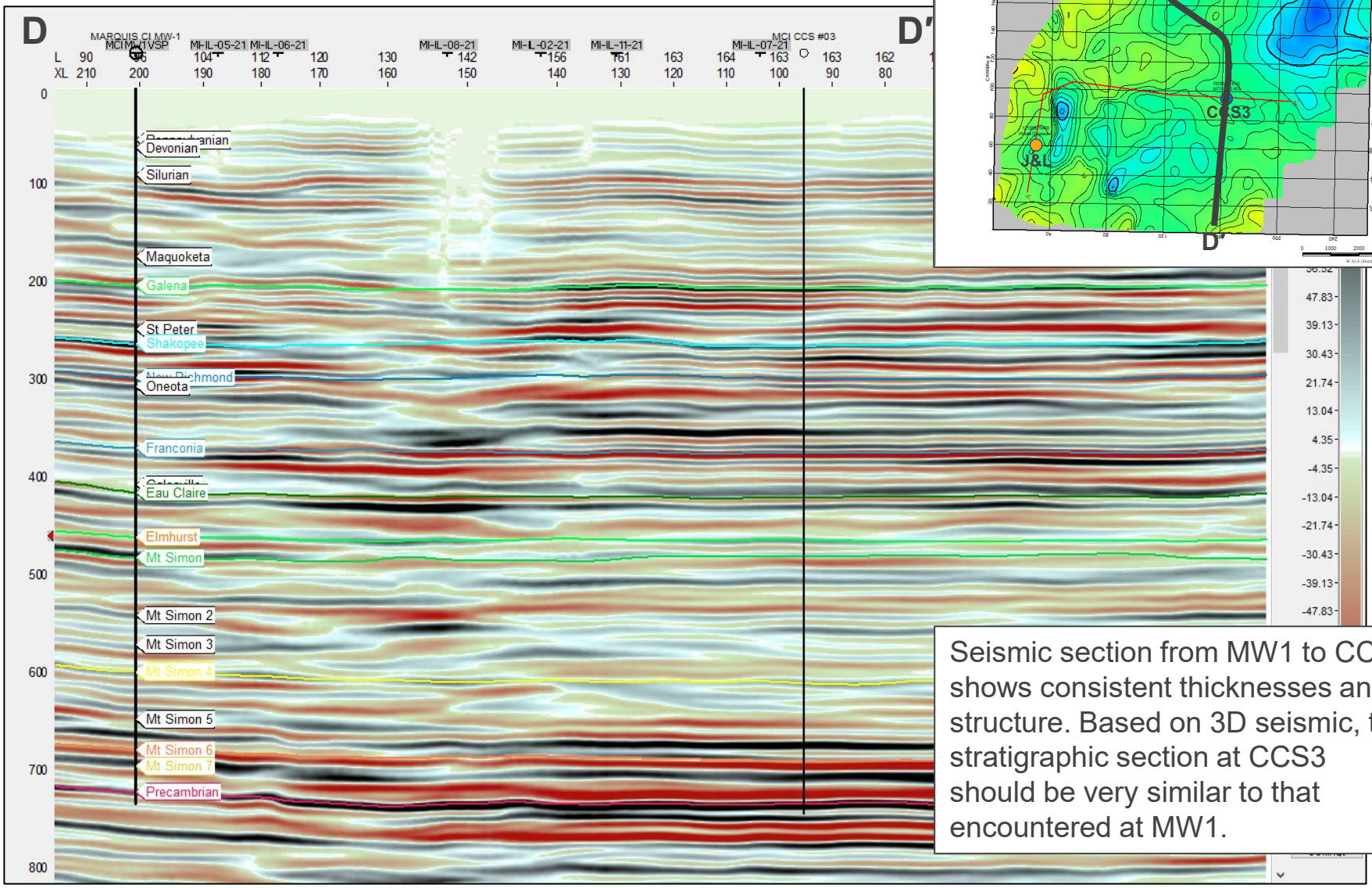
Baseline 3D – MW1 to CCS3



Seismic section from MW1 to CCS3 shows consistent thicknesses and structure. Based on 3D seismic, the stratigraphic section at CCS3 should be very similar to that encountered at MW1.

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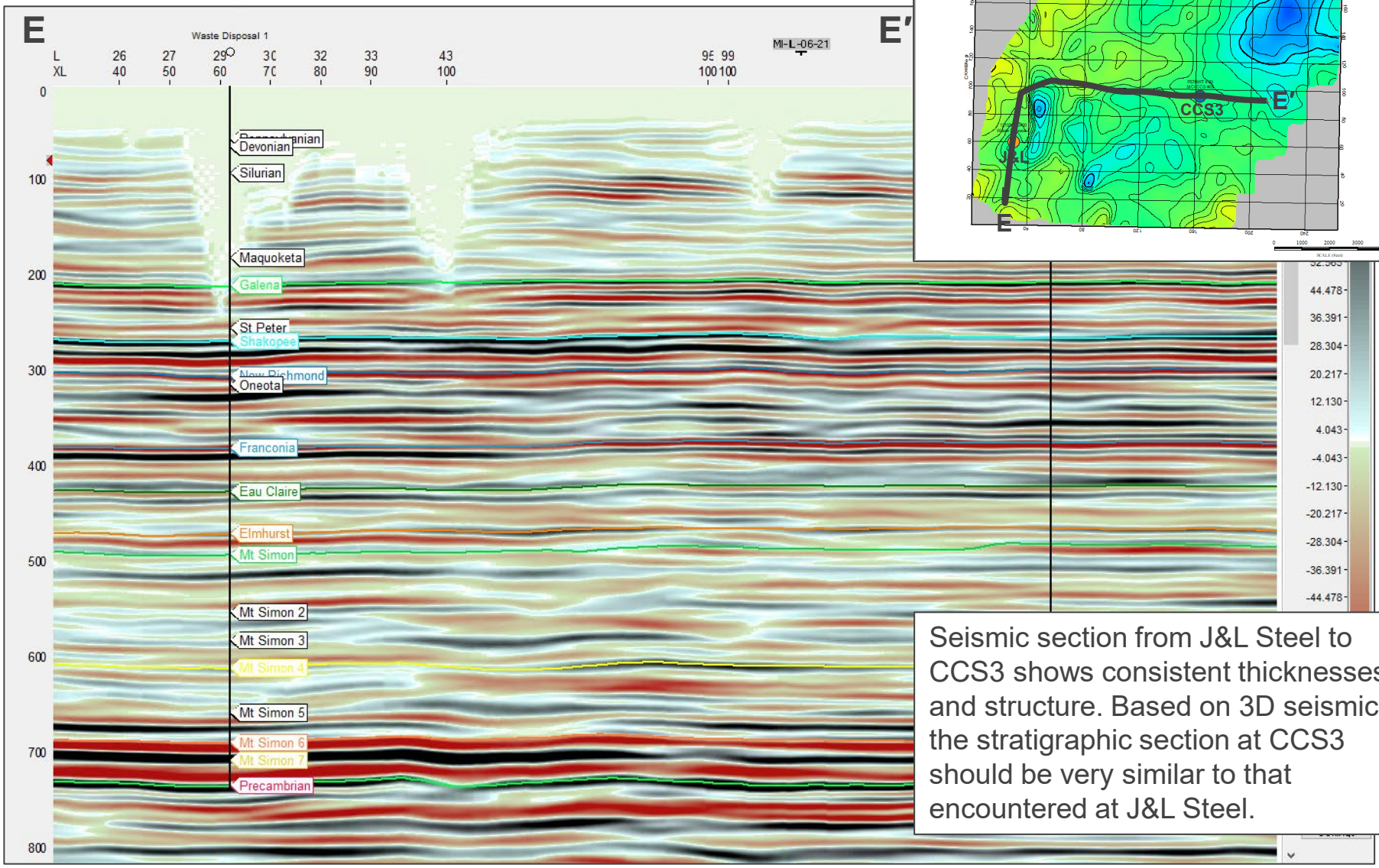
Baseline 3D – J&L Steel to CCS3



Seismic section from J&L Steel to CCS3 shows consistent thicknesses and structure. Based on 3D seismic, the stratigraphic section at CCS3 should be very similar to that encountered at J&L Steel.

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It can be done

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