

KMS Technologies - KJT Enterprises Inc.

Presentation

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2000

**High Resolution Electromagnetics for
Enhancement of Seismic Data**

Society of Exploration Geophysicists,
Annual Meeting, Calgary, Invited paper in
workshop "Recent Advances and Road ahead
session"



Eni Agip Division - GEBA

HIGH RESOLUTION ELECTROMAGNETICS FOR ENHANCEMENT OF SEISMIC DATA

SEG/Calgary 2000, August 6-11

Outline

- The imaging problem
- High resolution MT
- The advances
- What's next?
- Marine MT: commercial breakthrough
- Summary

Imaging issues

- The problem
 - Thrusting & messy structure
 - Heavy statics in seismic
 - Topography
- The solution approach
 - Seismic data need drives choice of method & path of integration
 - Use independent; integrate w/seismic; redo combined (No magic bullet)
- Re-engineer support systems
 - Select methods complementary to seismic (physics & commercial benefits)
 - Redesign entire system from seismic view

Background

- Southern Apennines thrust belt, Italy: prolific petroleum province
- First discovery in Costa Molina, Monte Alpi area with advanced Geophysics
- Since 1990 MT imaging where seismic is noisy

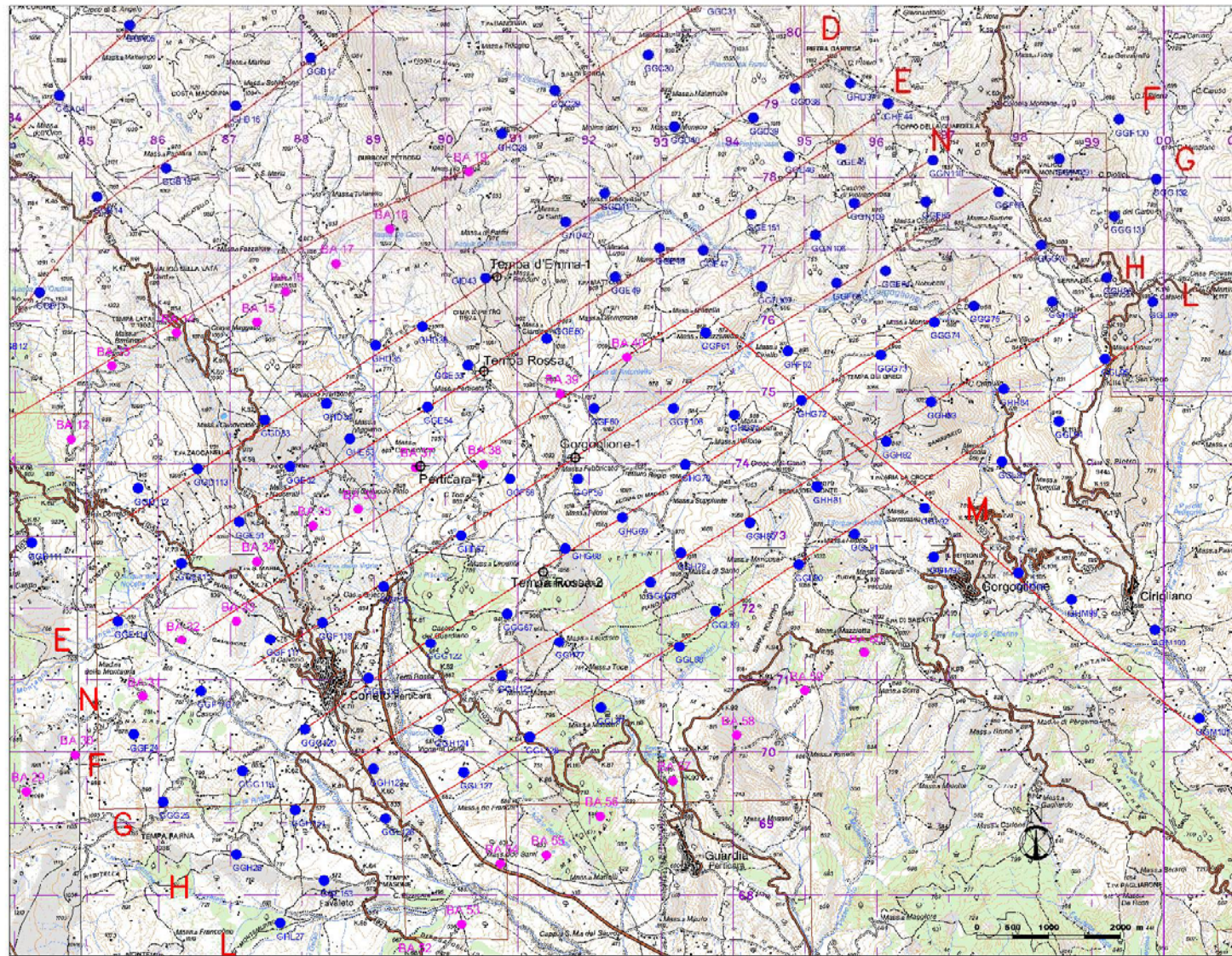
SATB petroleum province



ENI - Agip MT success story

- Higher data quality
- Cost-effective 3D high-density coverage
- Improved quantitative link between seismic and MT
- Significantly better imaging of complex geology
- Verification of the integrated models by the drill

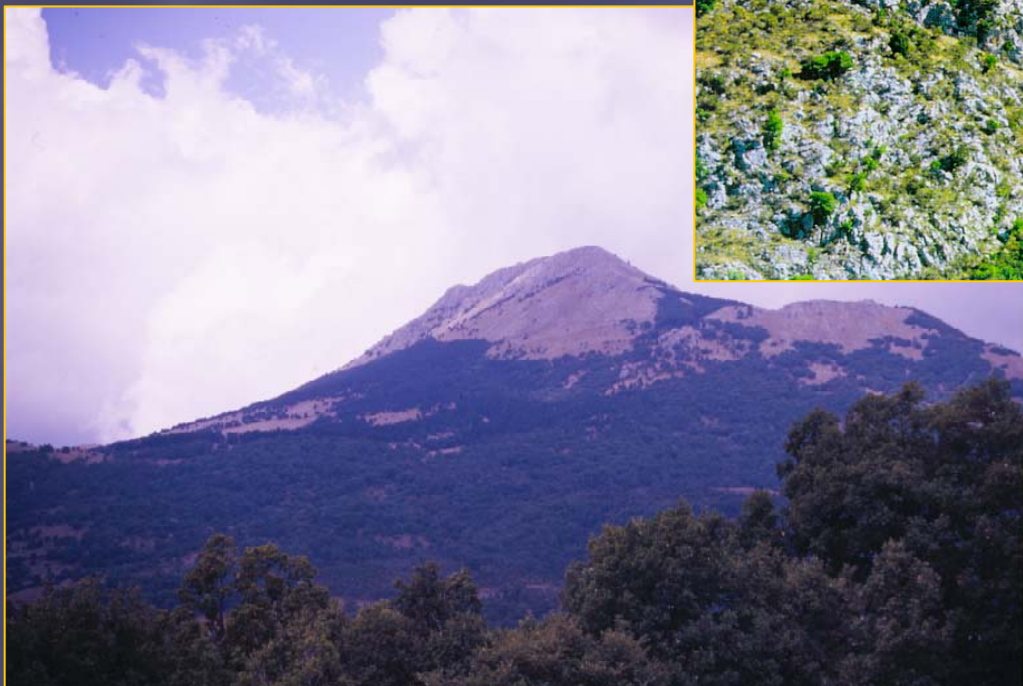
High-density 3D MT coverage



The Imaging Problem

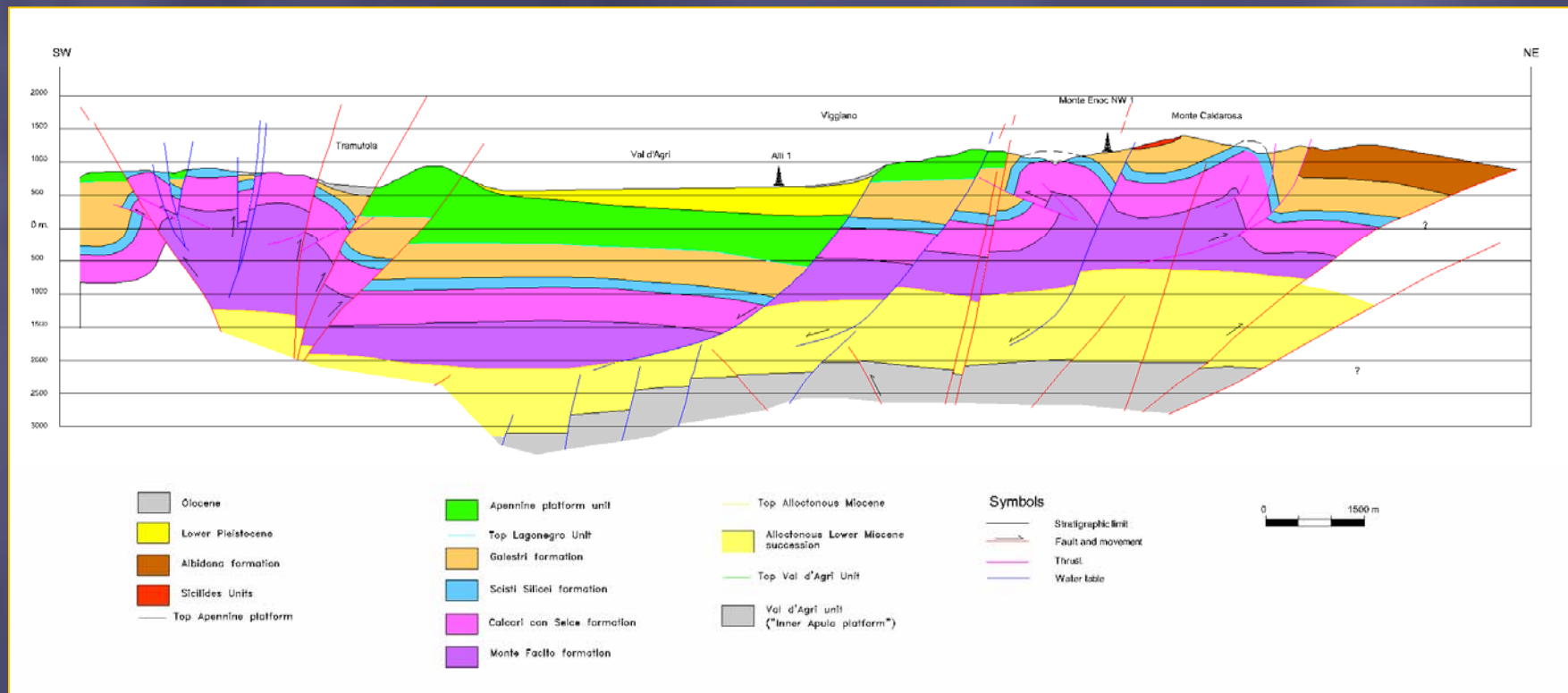
- Degradation of primary reflections
- Generation of high-amplitude scattered waves

Rough topography

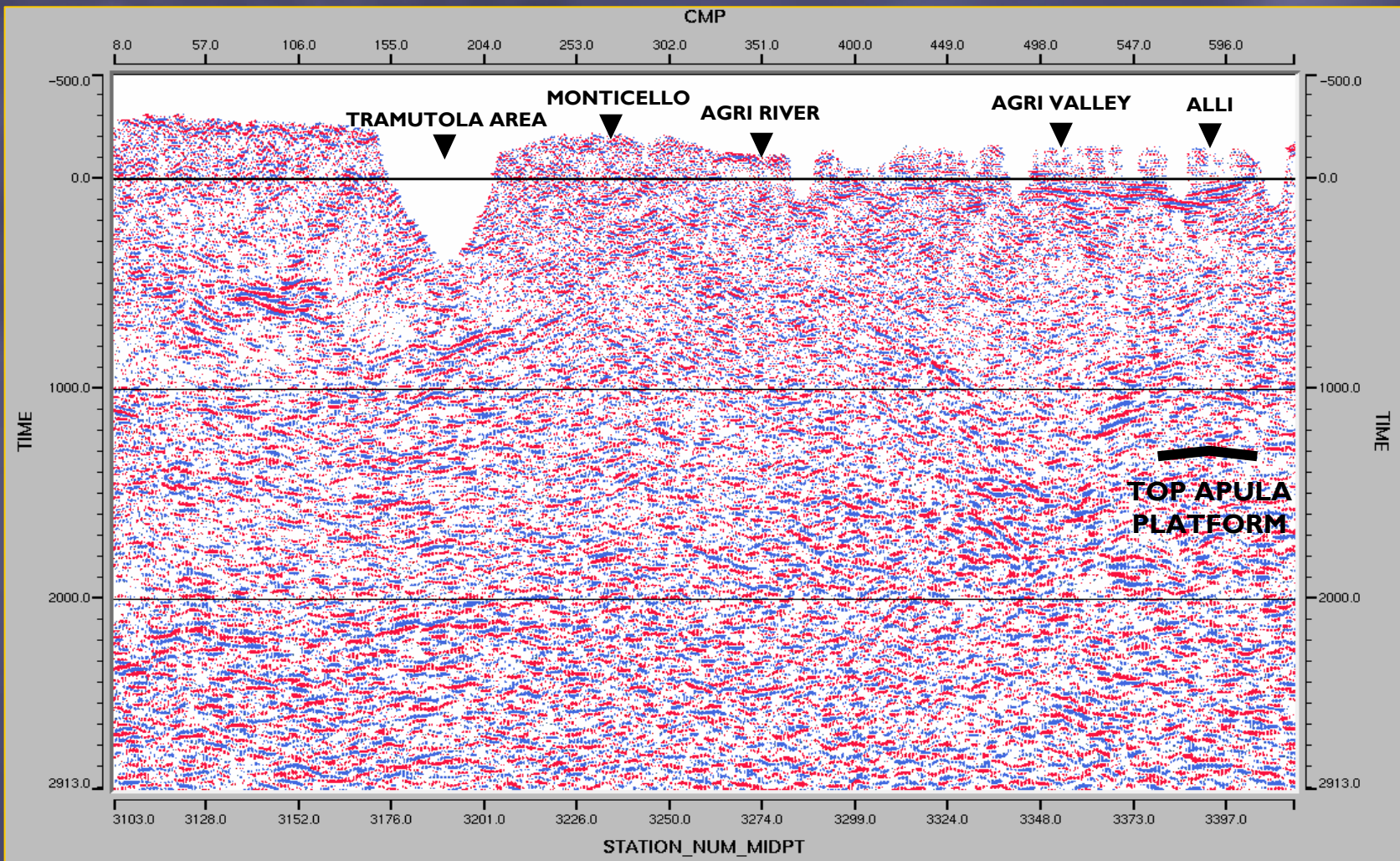


Madonna di
Viggiano
1727 m

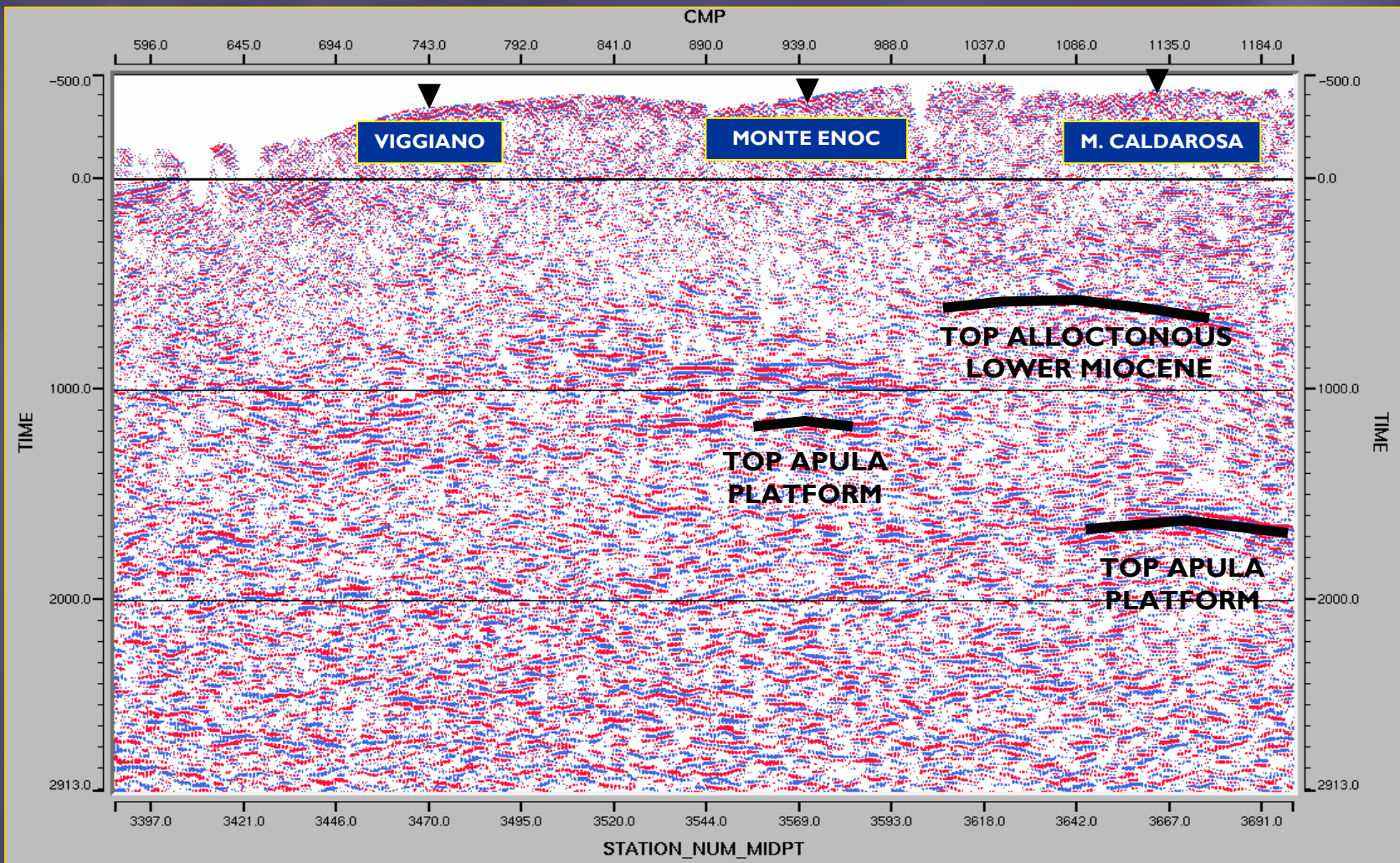
Complex geology



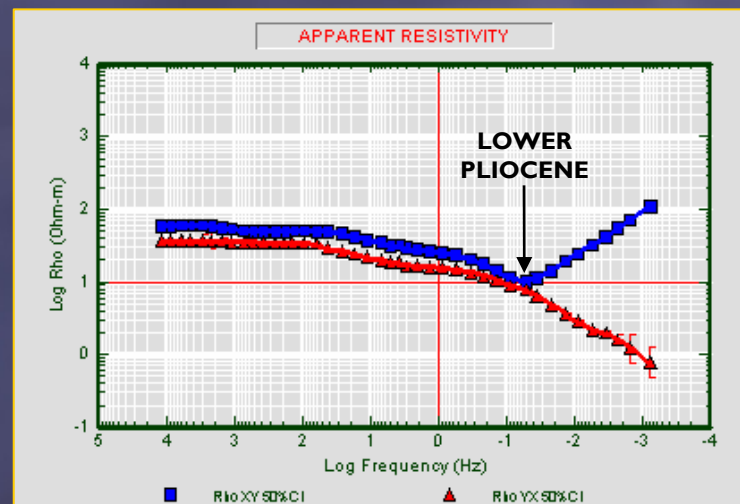
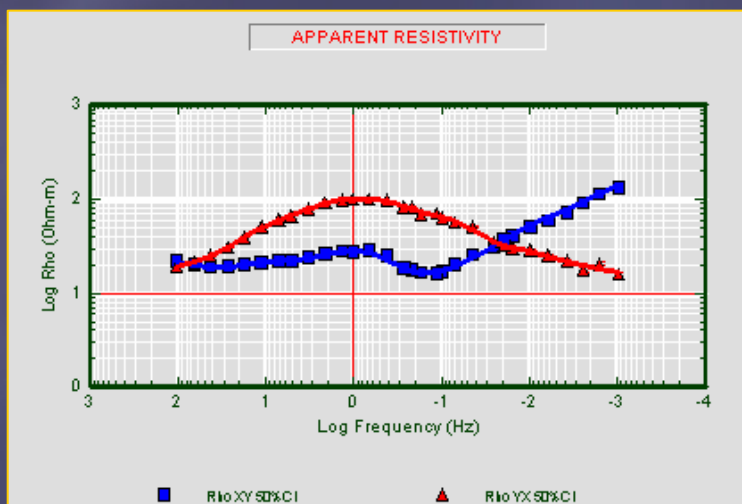
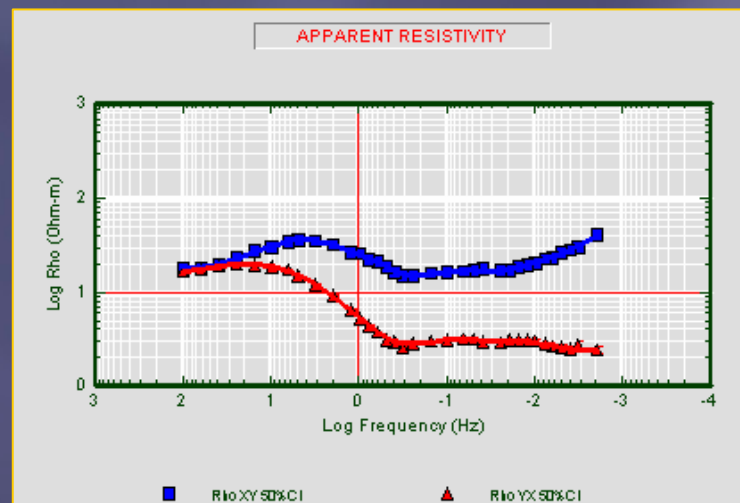
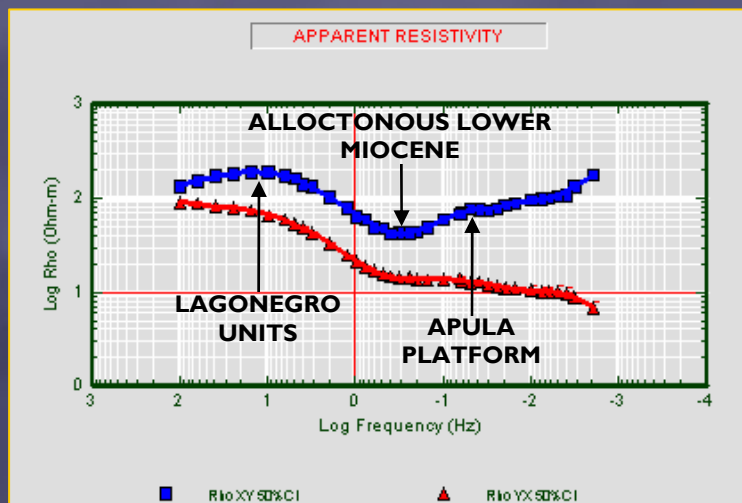
Noisy seismic data example



Noisy seismic data example



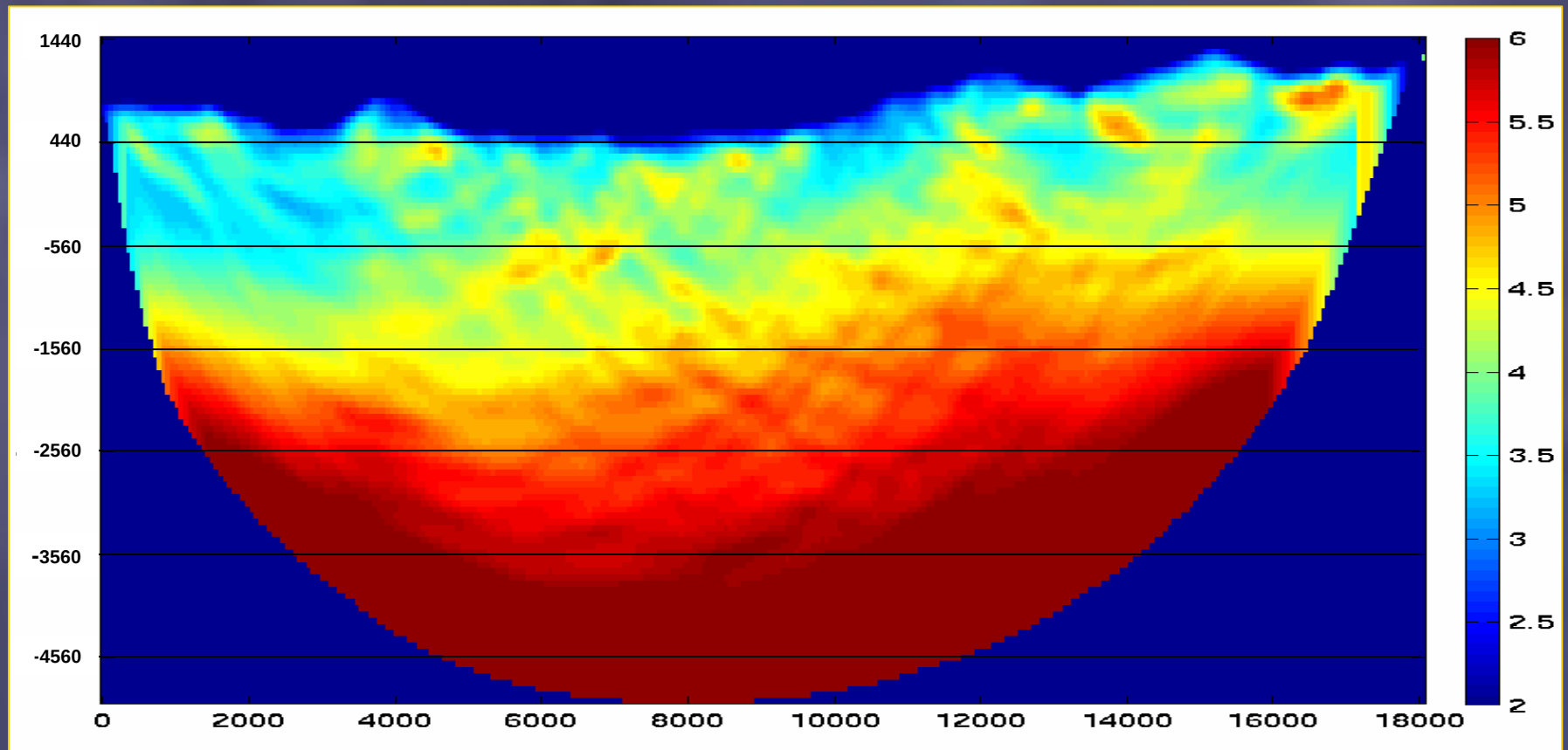
SATB MT data



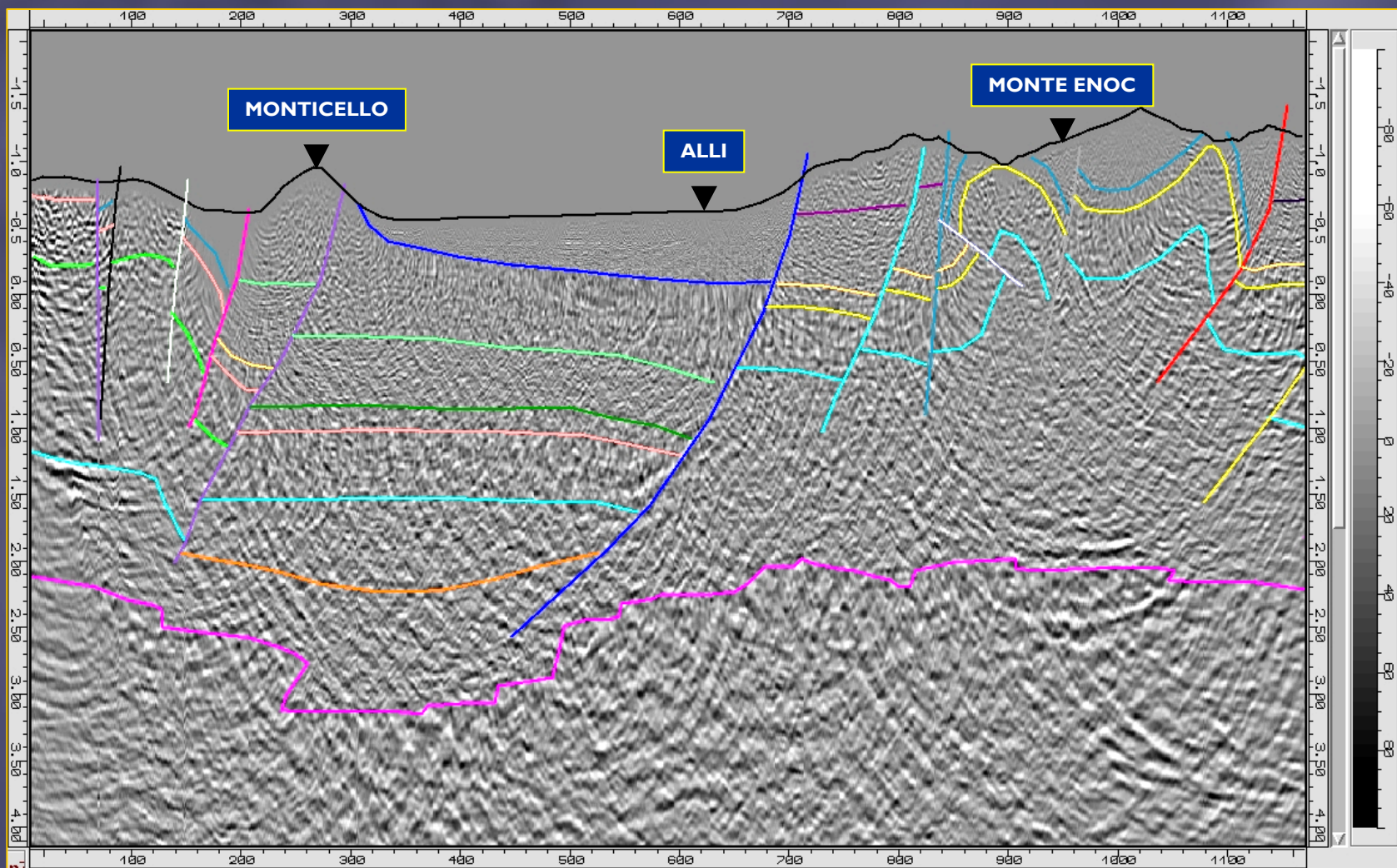
High frequency shallow

Low frequency deep

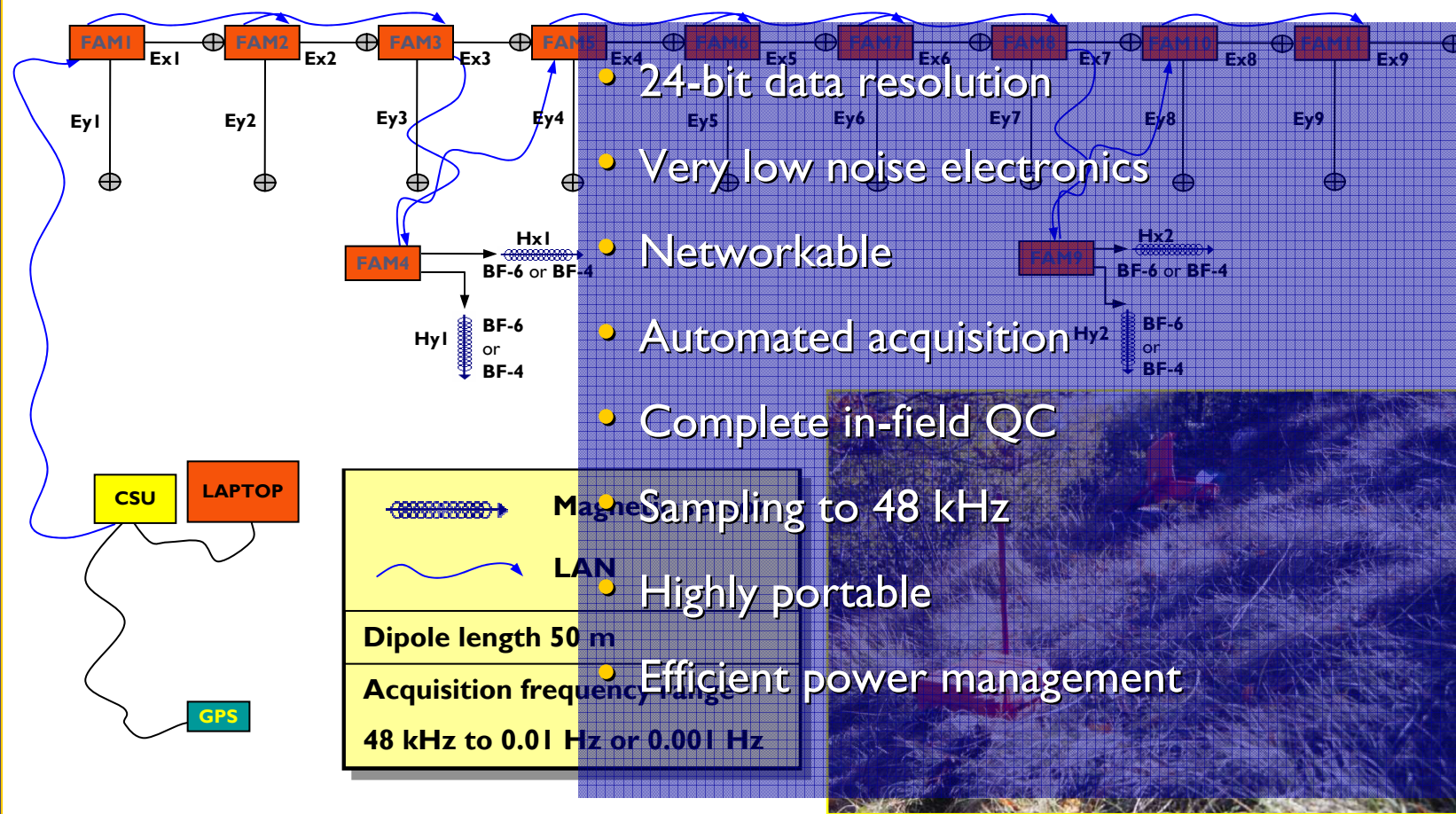
2D P-wave tomography



Depth image



High resolution MT

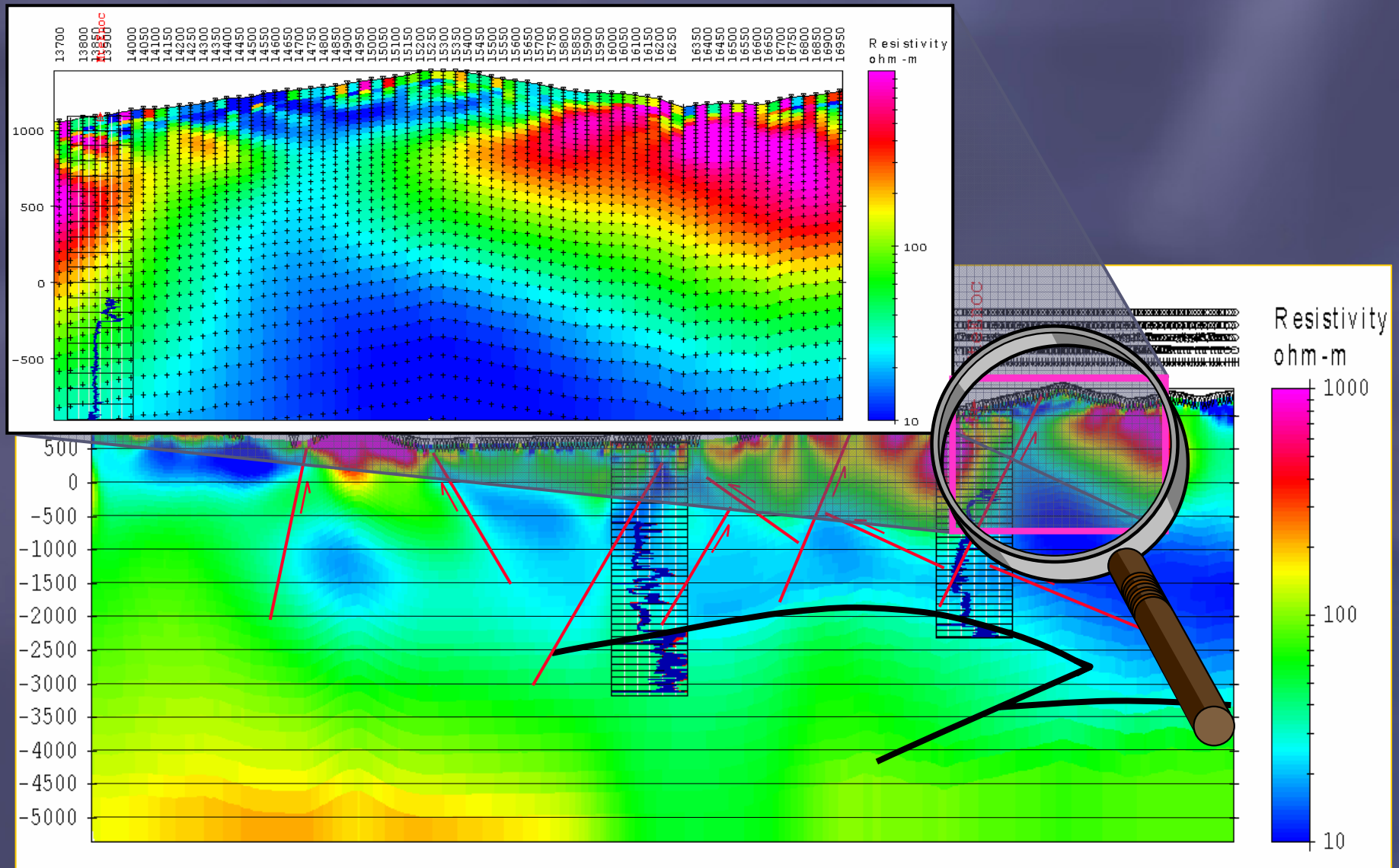


- 24-bit data resolution
- Very low noise electronics
- Networkable
- Automated acquisition
- Complete in-field QC
- Sampling to 48 kHz
- Highly portable
- Efficient power management

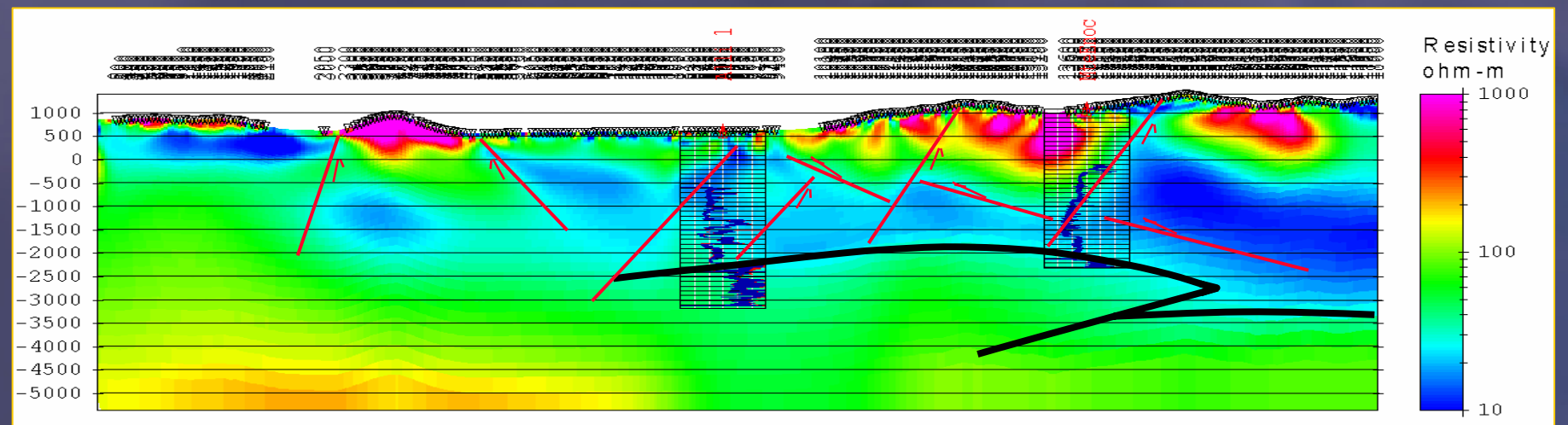
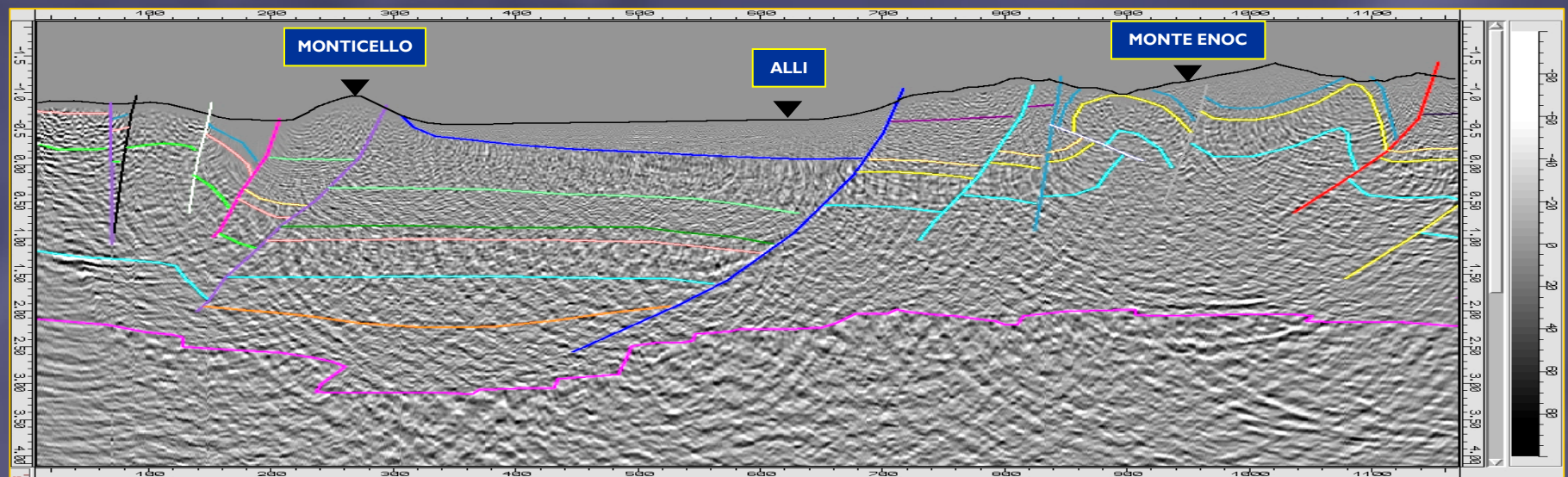
High resolution MT

- Remote referenced data acquired at two locations by independent crews
- New processing tools developed for huge data flow & strong noise

2D MT depth image



Synergy



Achievements

- Far better exploration tool
- More accurate depth imaging
- Far lower costs
- Quicker turn around times
- Less cost for the environment

Next steps

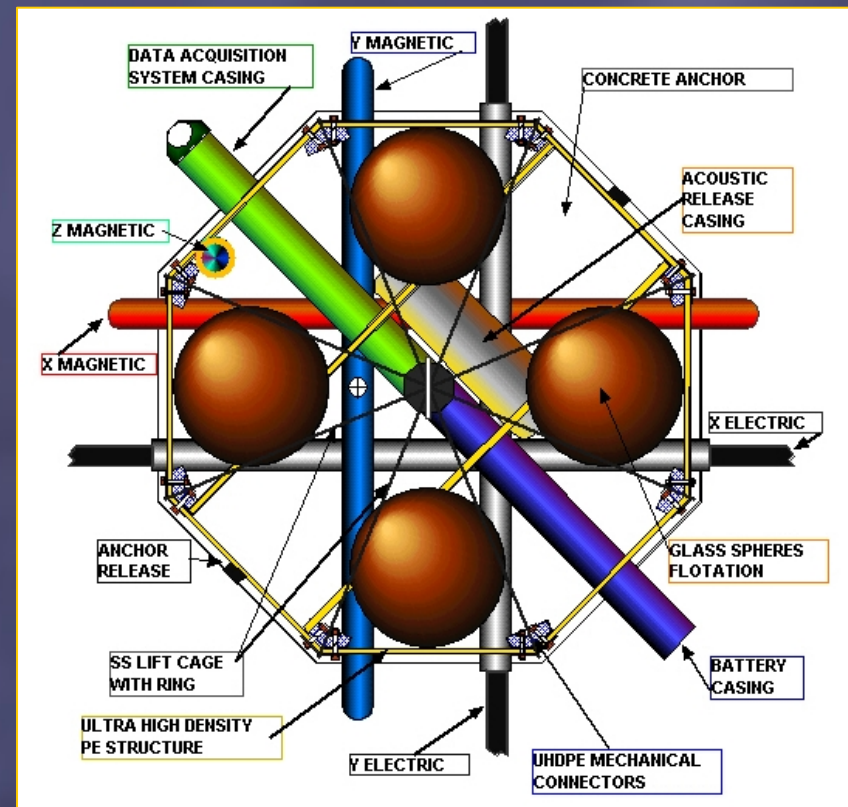
- Commercialize technology (critical mass!!)
- Use HRS at selected locations to calibrate resistivity / seismic
- Apply joint modeling & inversion tools for near-subsurface velocity model
- Use high resolution model to image “low-frequency” seismic data

Marine MT is emerging



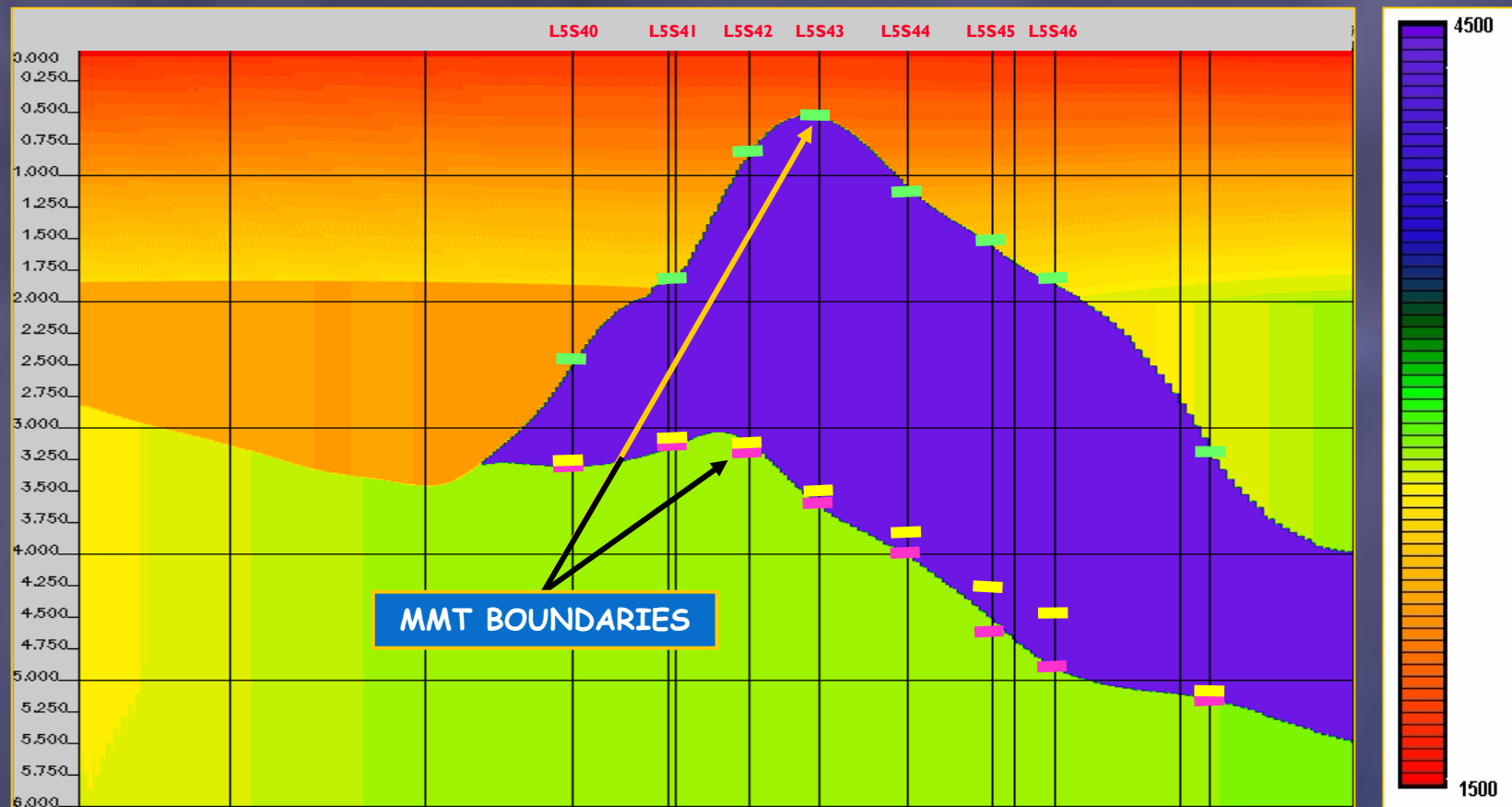
MMT-24 system

- 6-km water depth
- 200-hours of operation
- 6-24-bit channels
- 3-component accelerometer
- Electronic orientation
- Flash memory 192 Mb
- Acoustic release
- Ocean depth marine sensors
- Upgradable to record OBS
- Modular frame



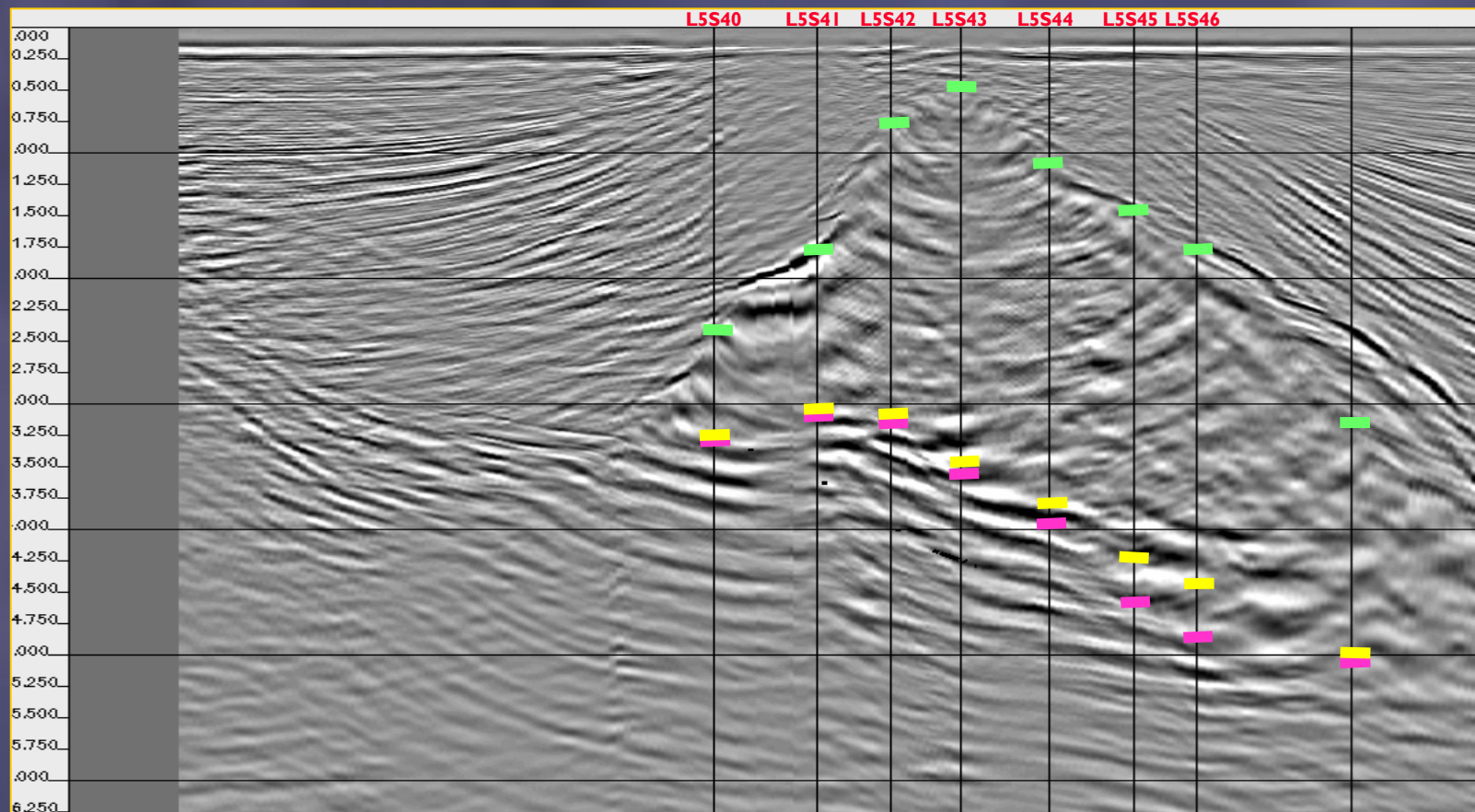
GOM data

MMT - derived velocity model



GOM data

3D PreSDM from MMT - derived velocity model



Summary

- All case histories successful
 - Helped to improve seismic data
 - Gave additional value
- Technology aligned with seismic
 - Acquisition
 - Processing
 - Interpretation

Acknowledgments

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