

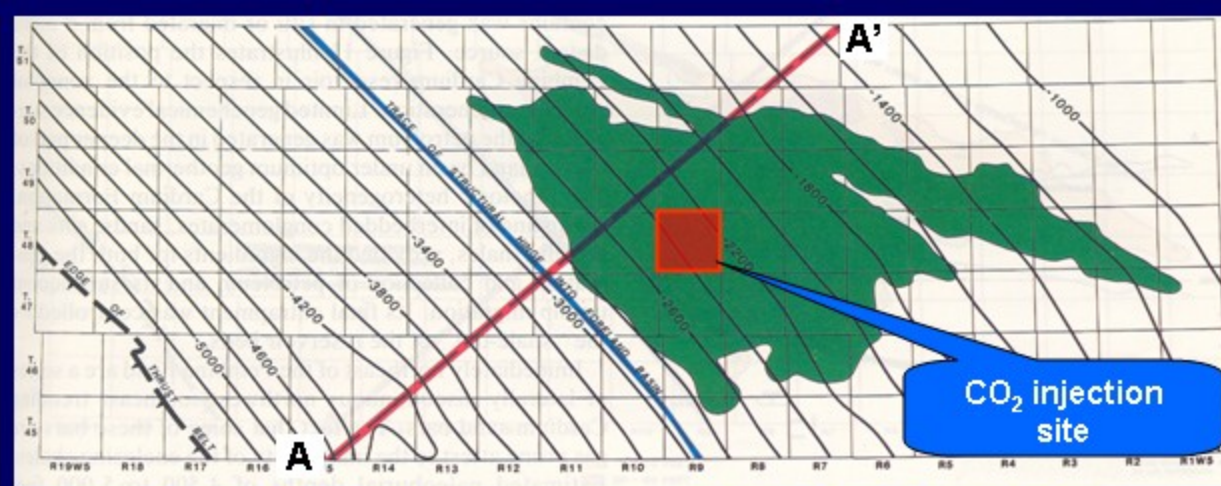
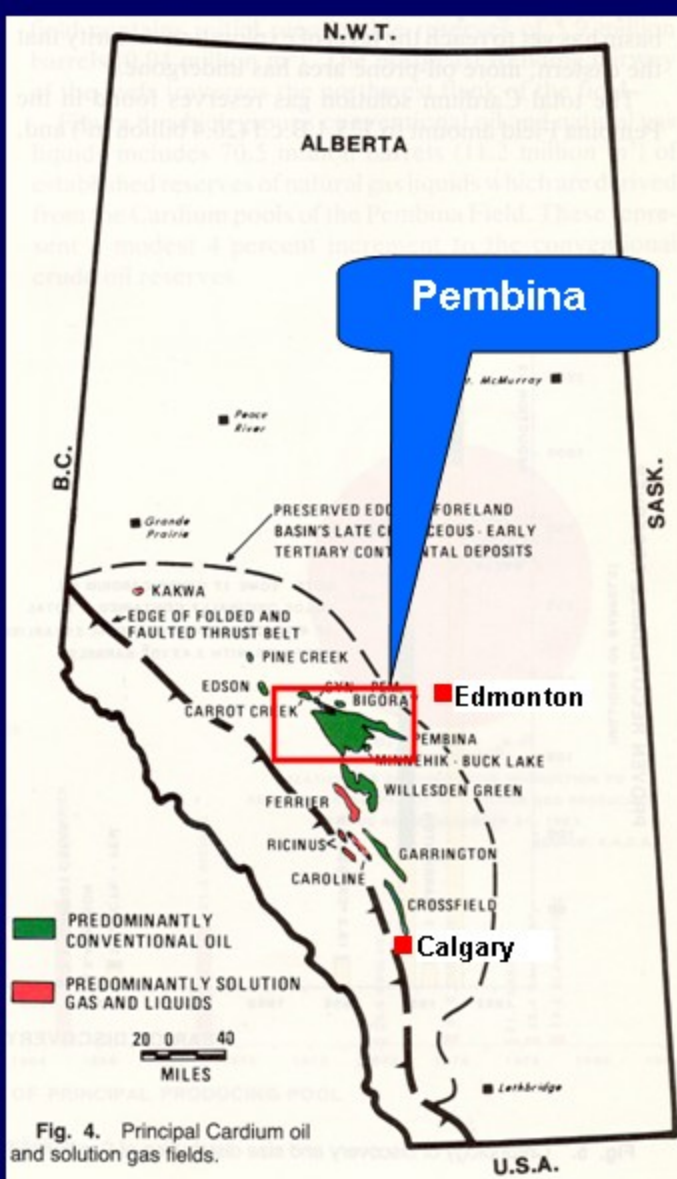


**Interpretation of baseline surface seismic
data at the Violet Grove CO₂ injection site,
Alberta**

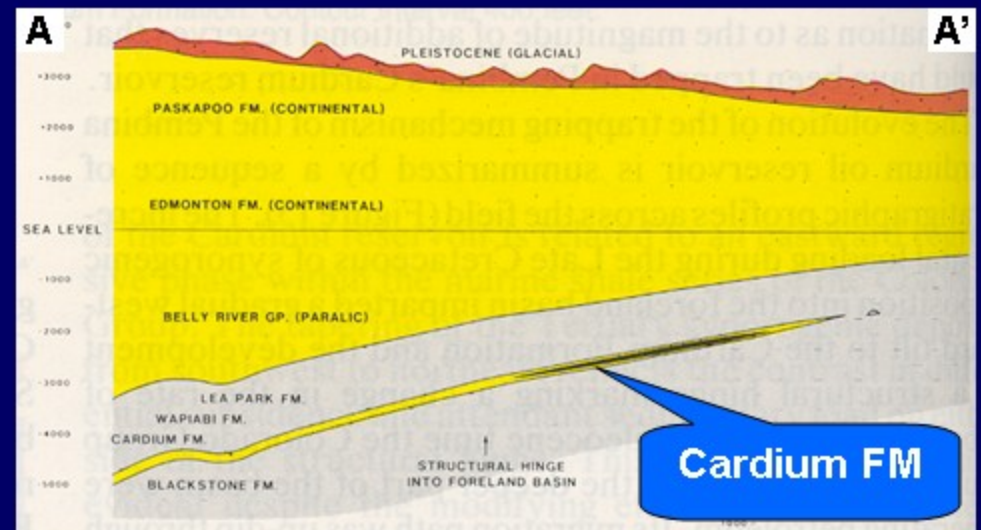
**Fuju Chen and Don Lawton
December 2, 2005**

Outline

- **Introduction**
- **Synthetic seismogram and Interpretation**
- **Rock Properties and impedance Inversion**
- **Conclusions and future work**
- **Acknowledgements**



Pembina Field structure map of Cardium Formation. Contour interval 200 feet (Nielsen, 1984)

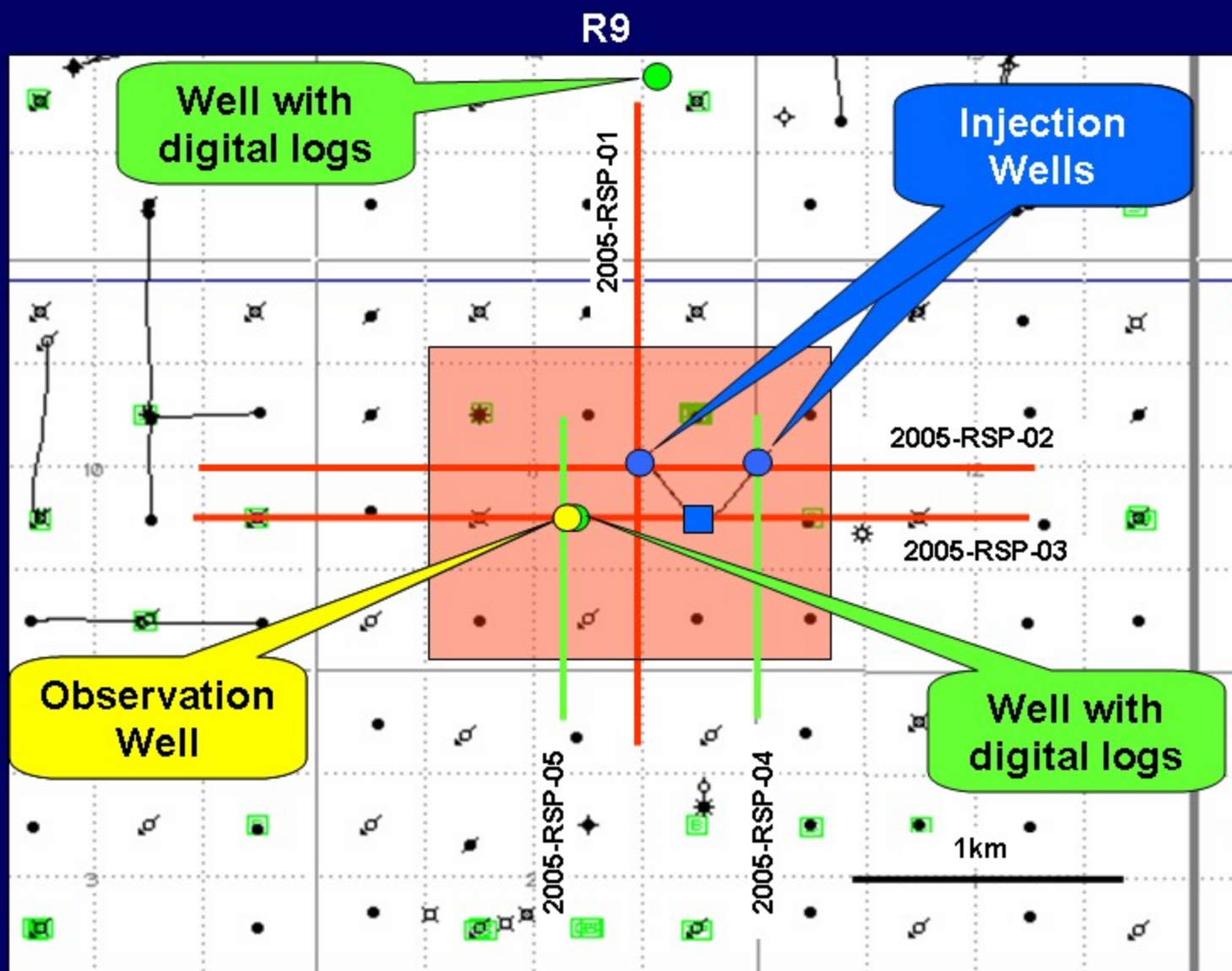


Cross section of Pembina Field (Nielsen, 1984)

CO₂ injection Formation: Cardium Sand at depth of 1650m

Formation pressure and temperature: 19 MPa, 50 °C

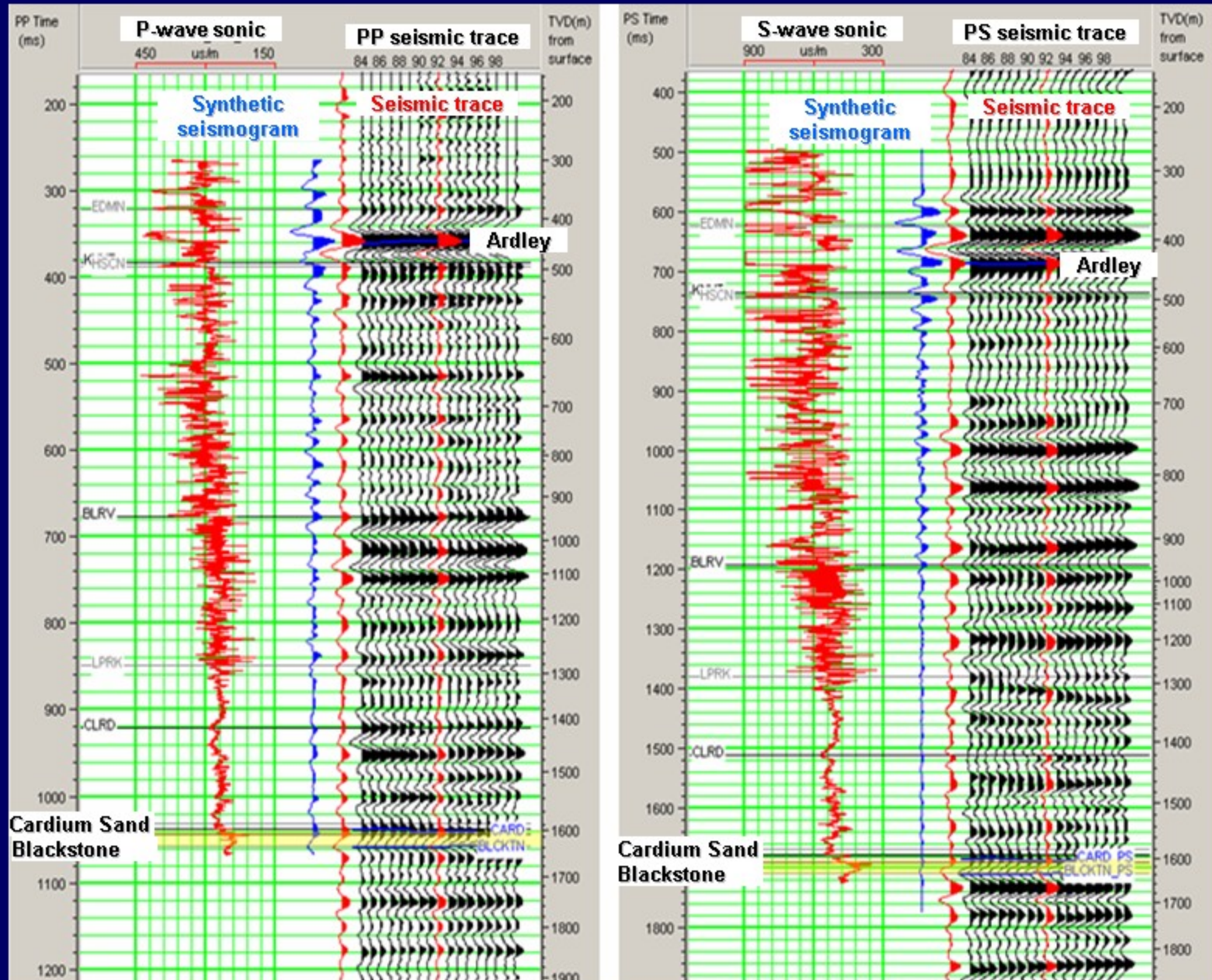
Produced oil: conventional oil (40 API)



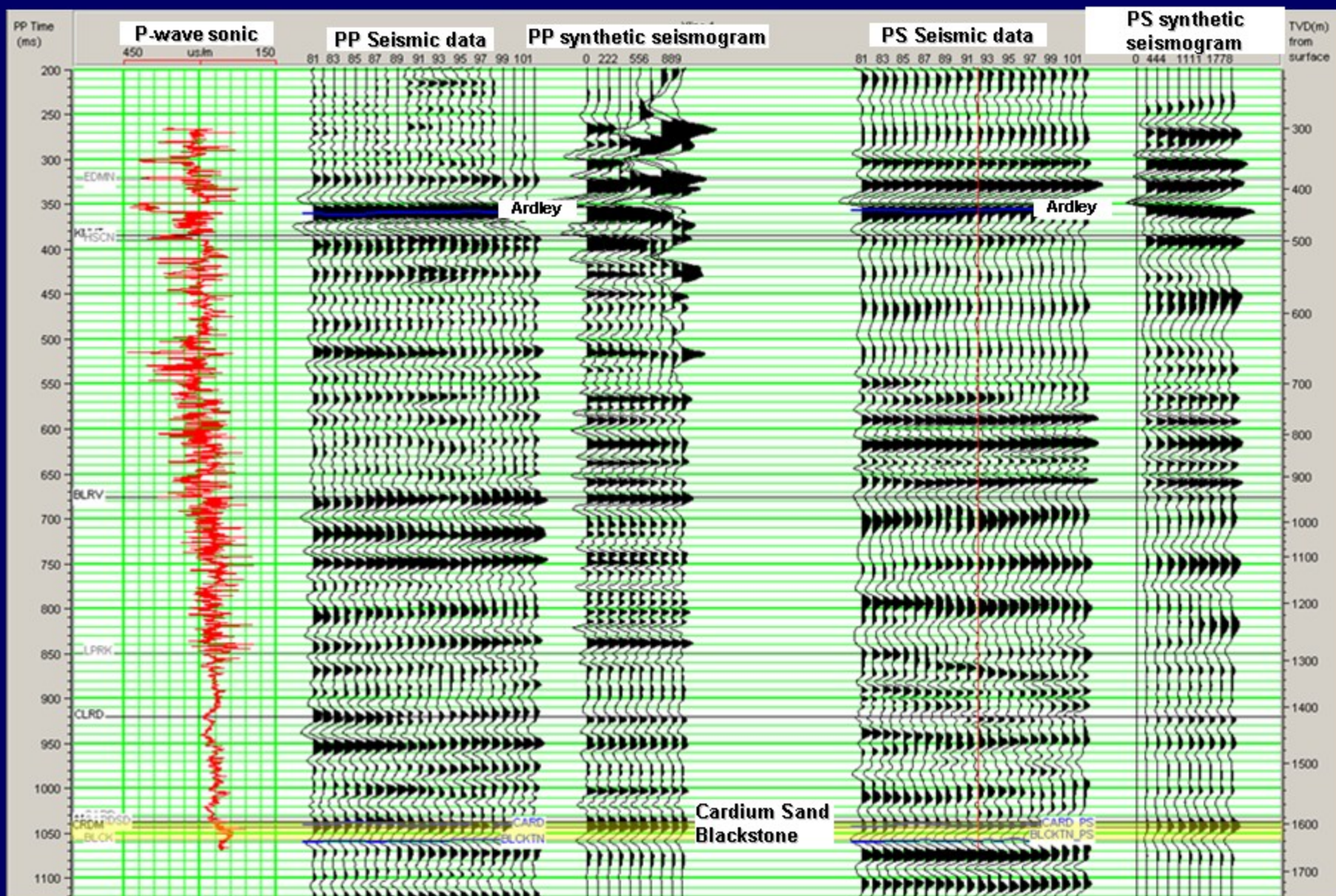
Map showing the Penn West CO₂ injection site

Outline

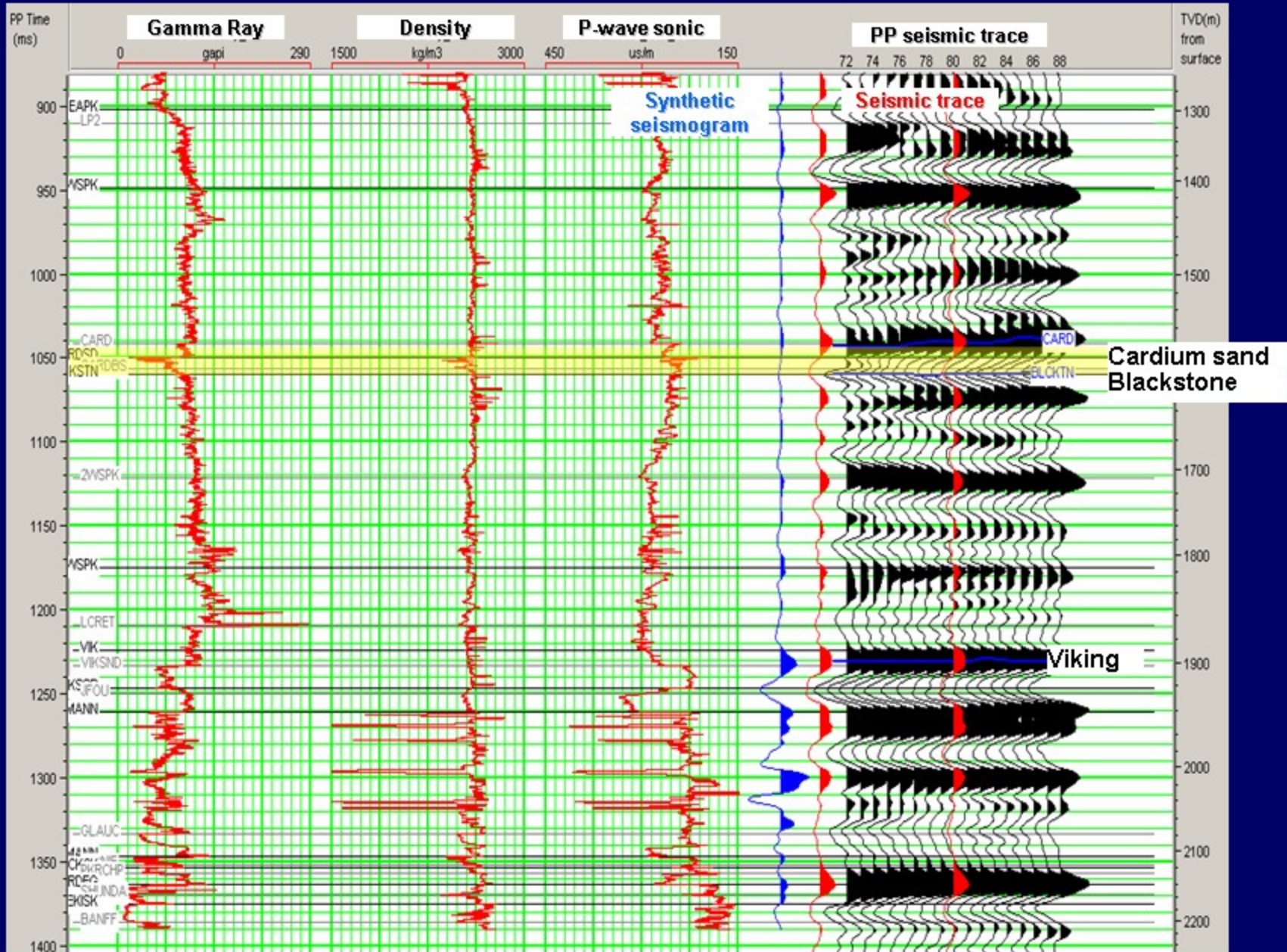
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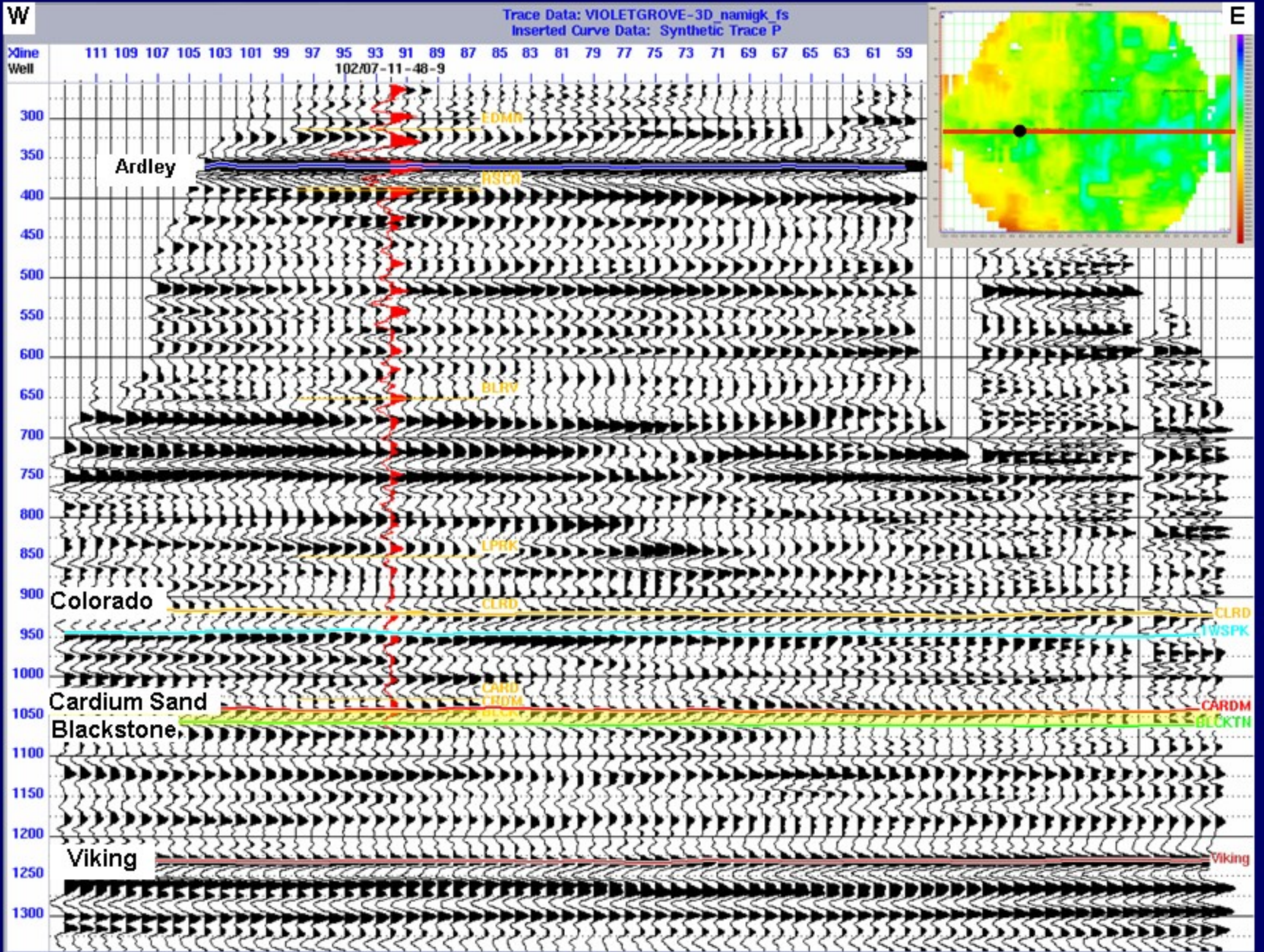
PP (left) and PS (right) seismic correlation at well 102/7-11-48-9



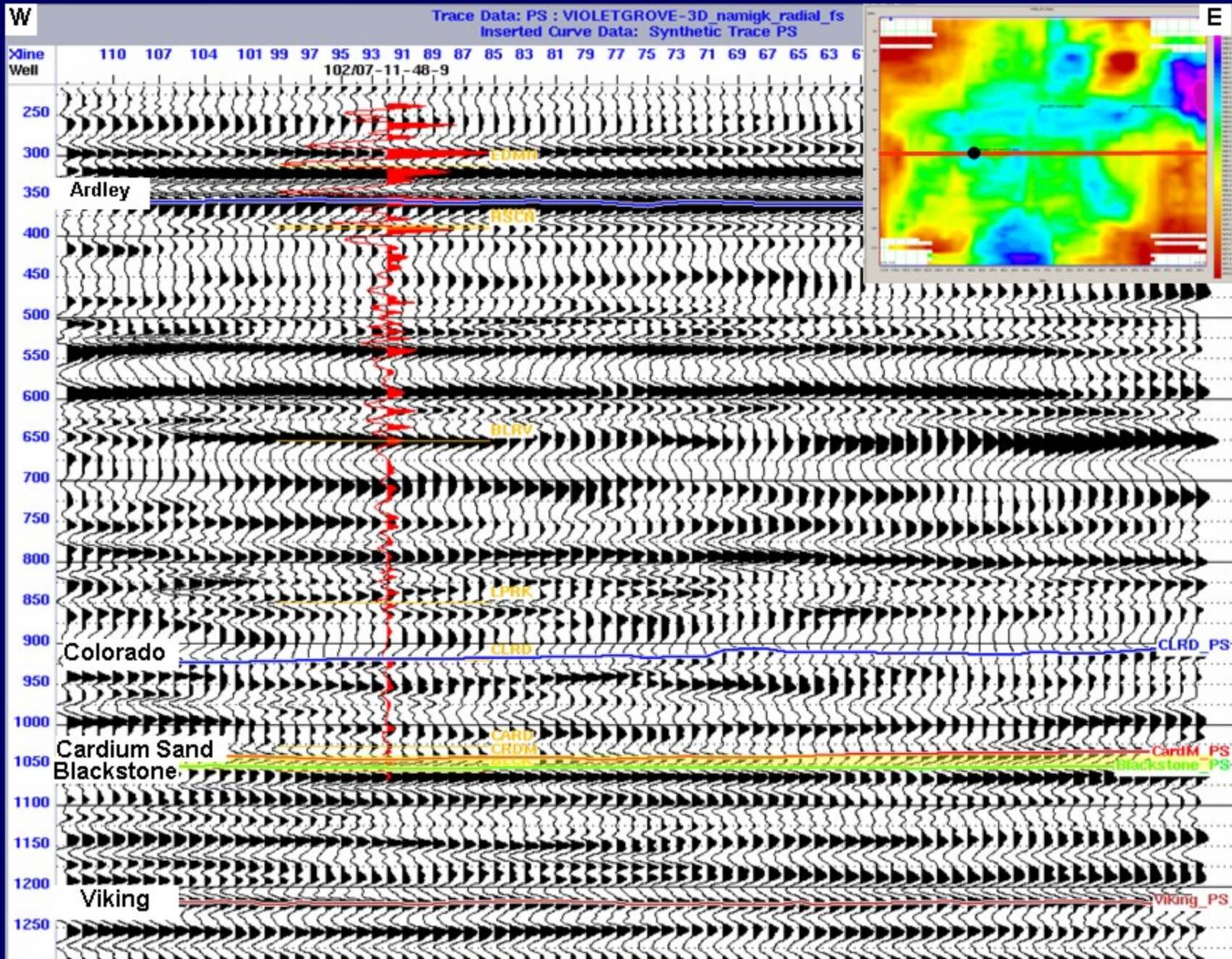
PP and PS synthetic seismogram at well 102/7-11-48-9



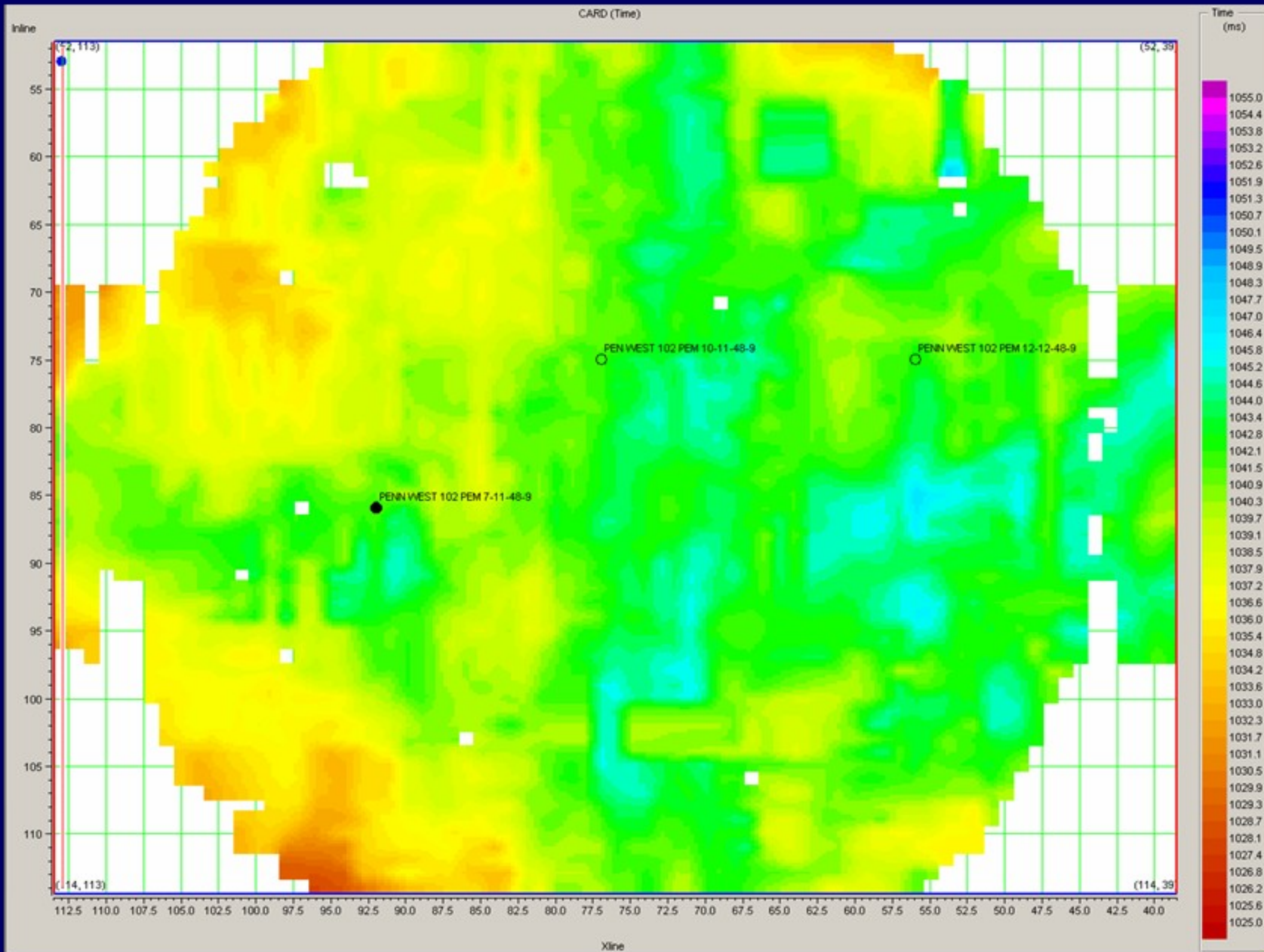
PP seismic correlation at well 102/08-14-48-9W5/0



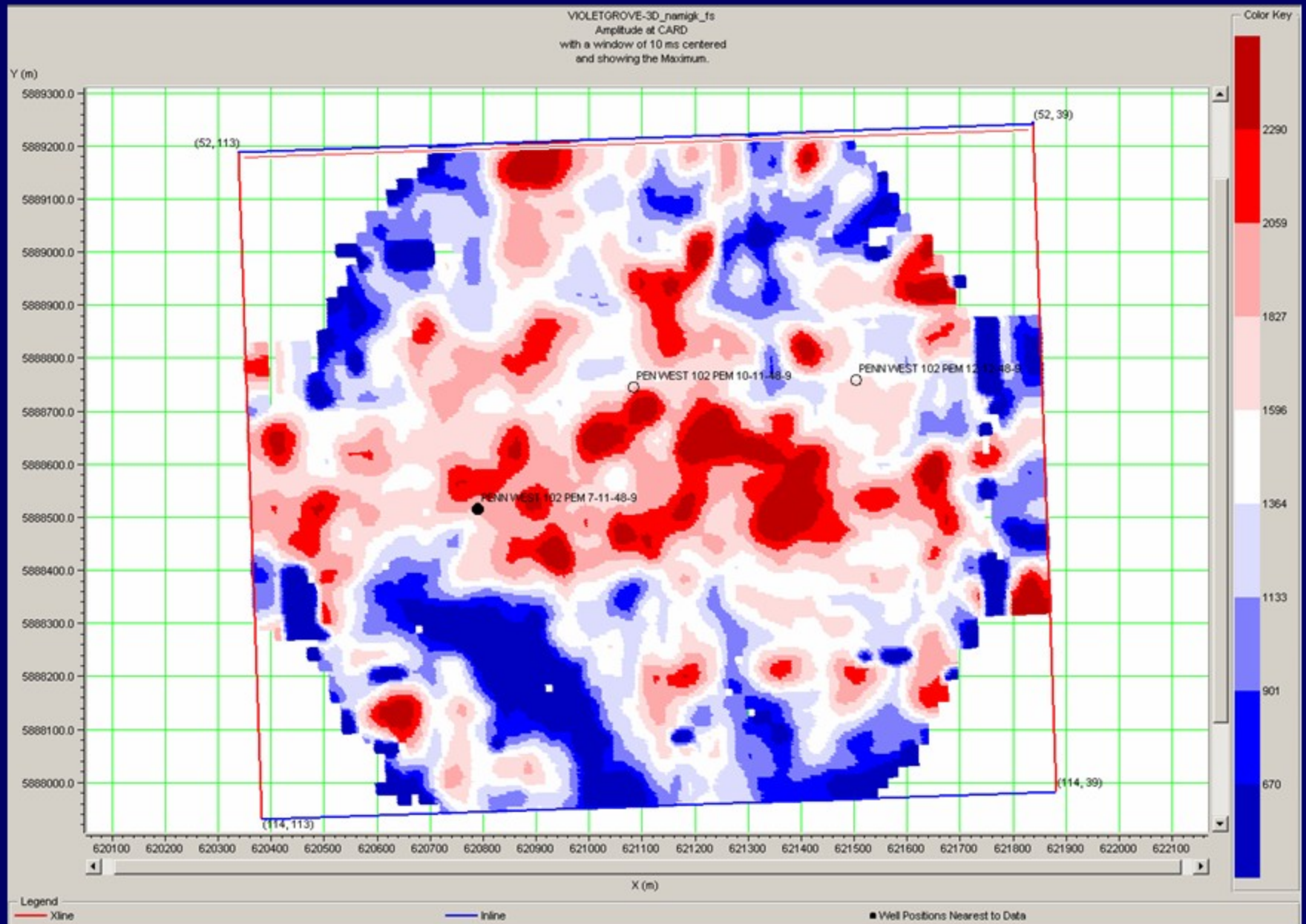
Inline 86 of PP data



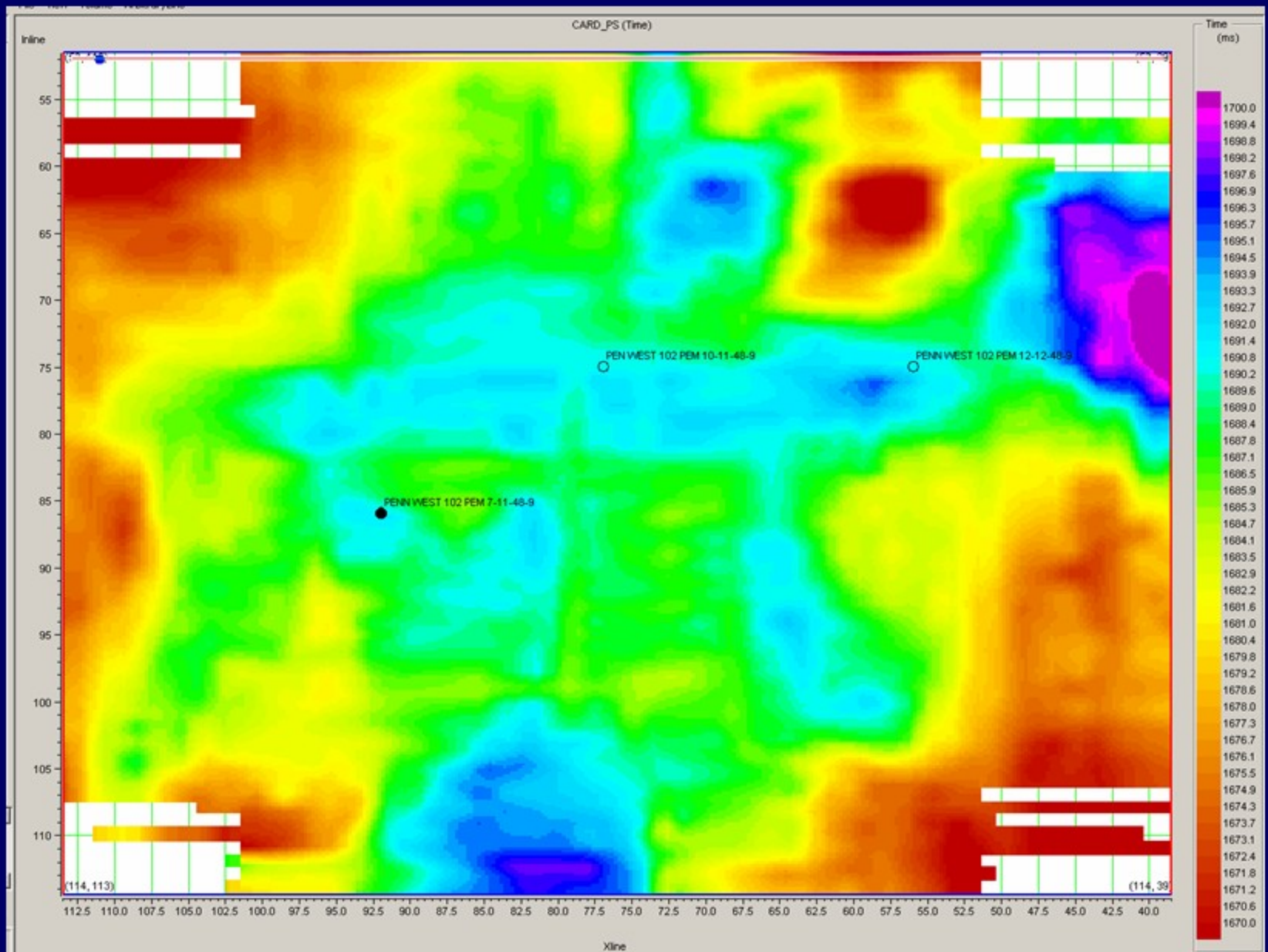
Inline 86 of PS data shown in the PP domain



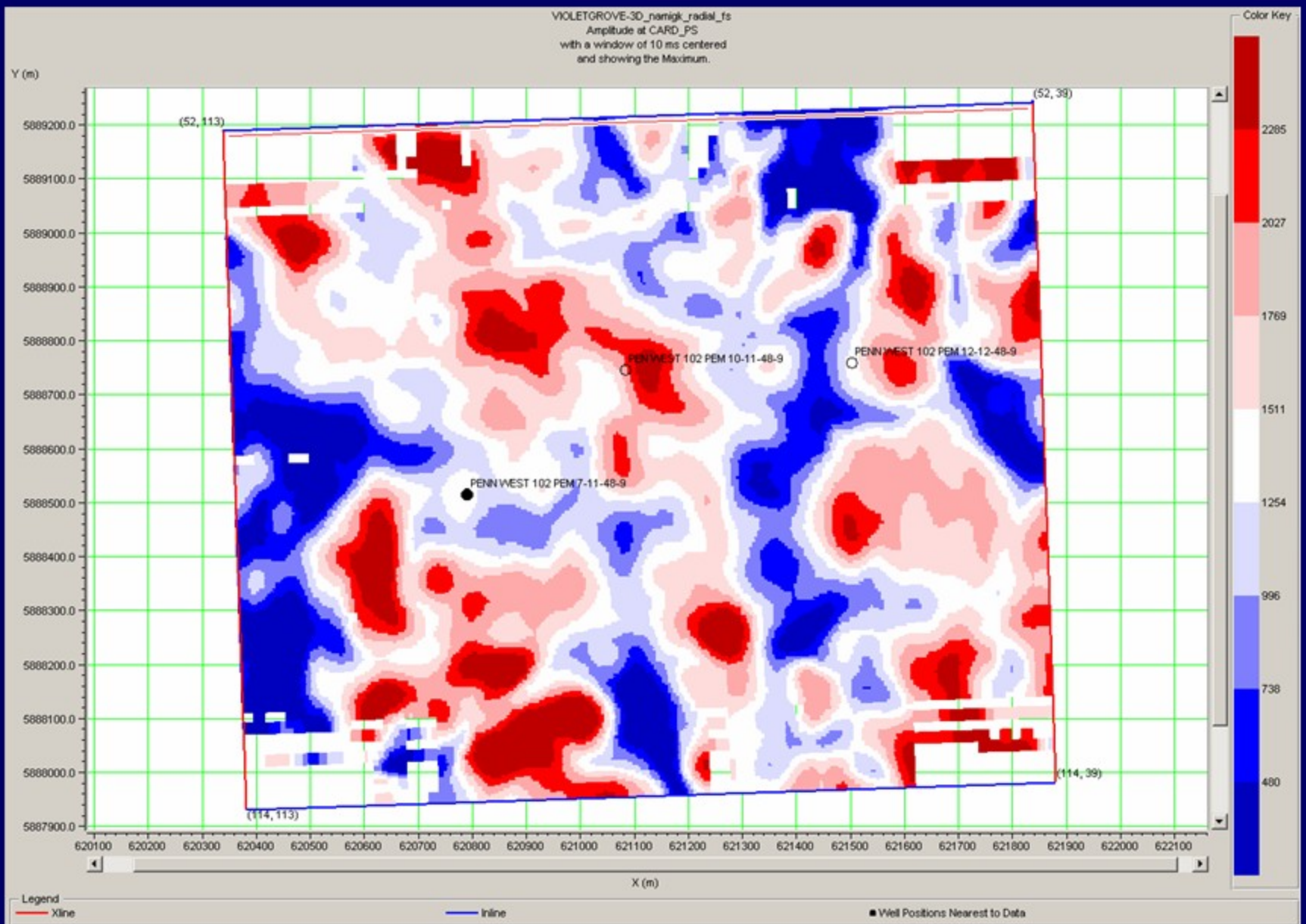
Time structural map of the Cardium horizon in PP data



Maximum amplitude of the Cardium horizon in PP data
(10ms time gate centered at Cardium horizon)



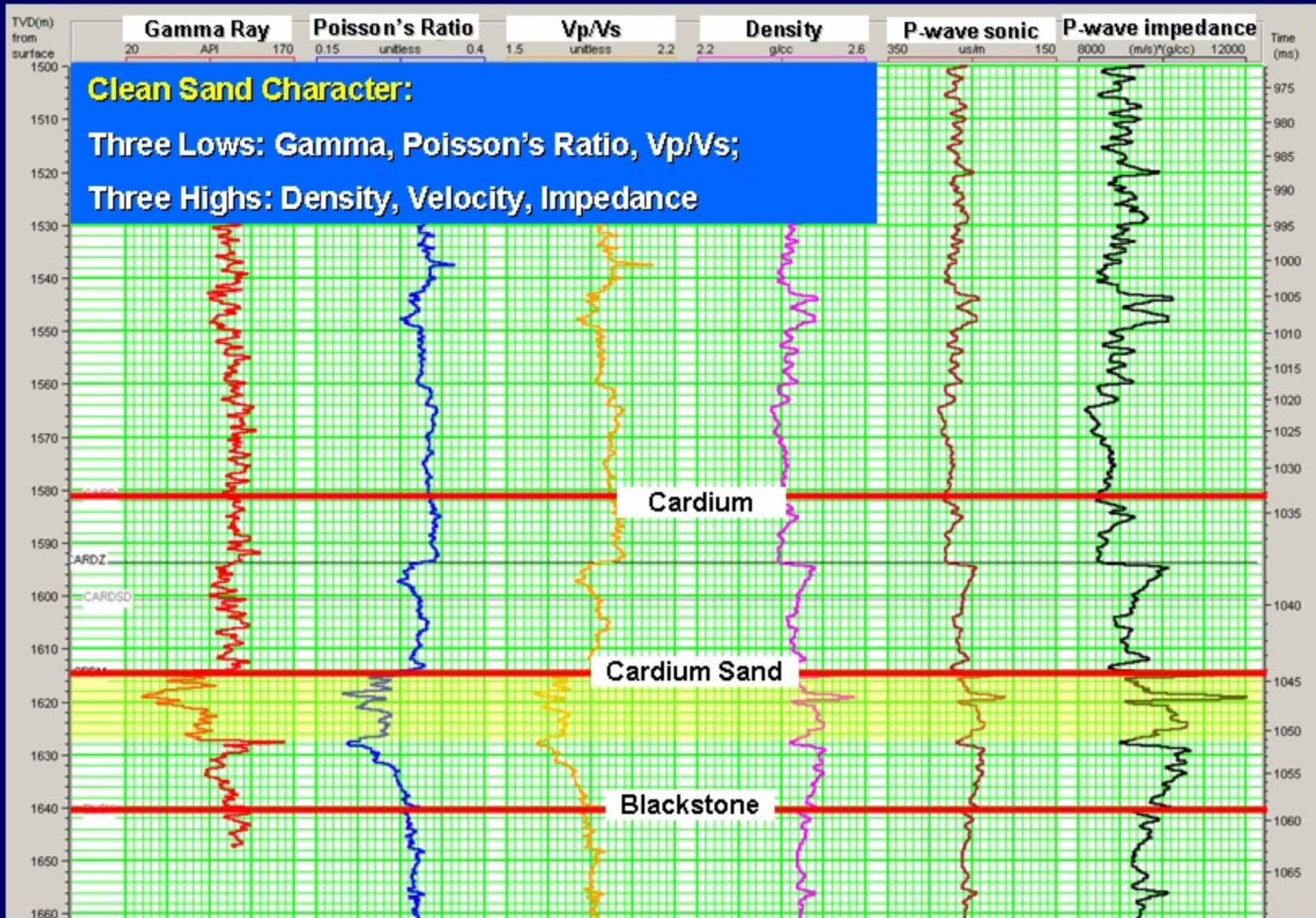
Time structural map of the Cardium horizon in PS data



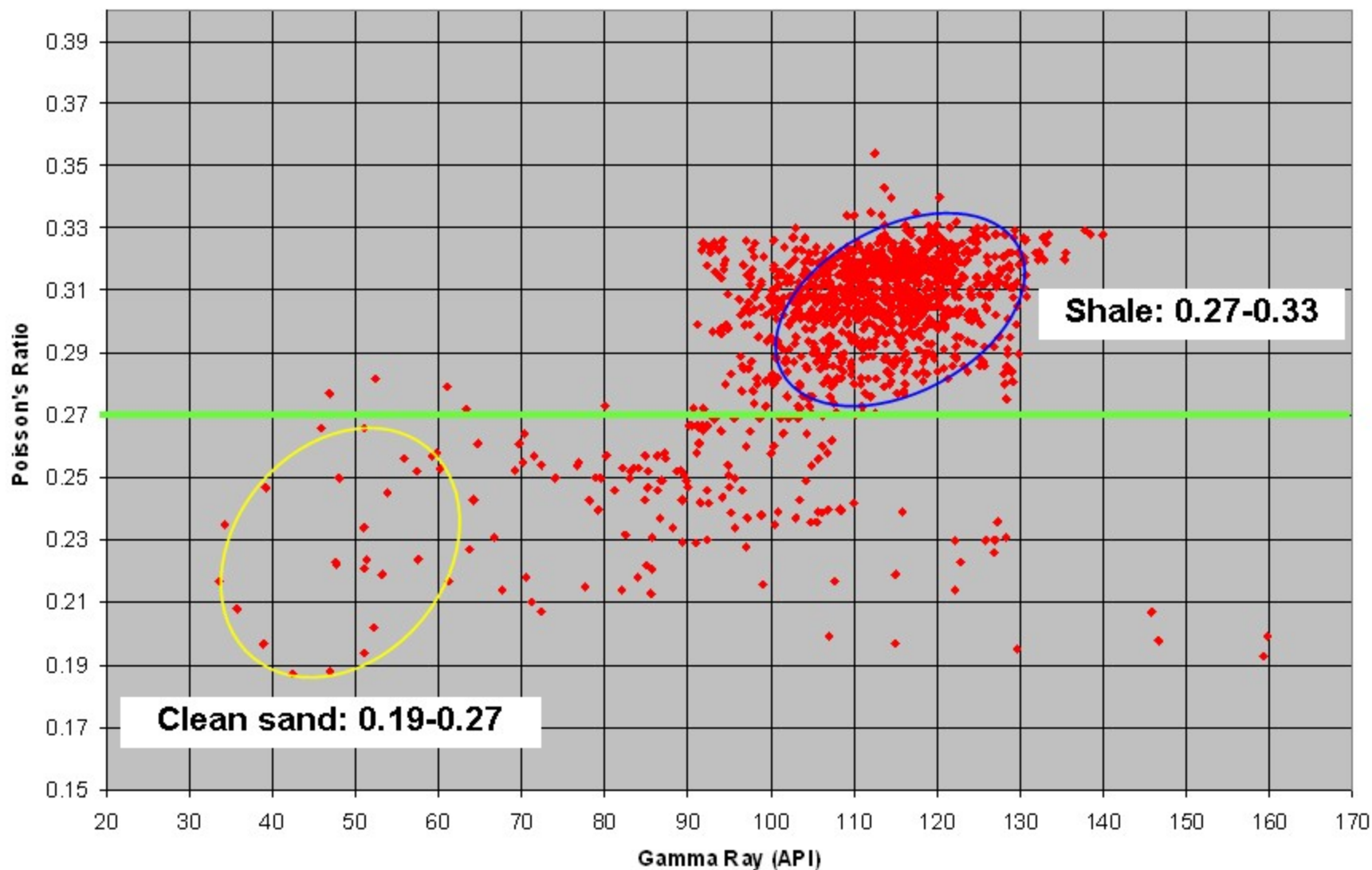
**Maximum amplitude of the Cardium horizon in PS data
(10ms time gate centered at Cardium horizon)**

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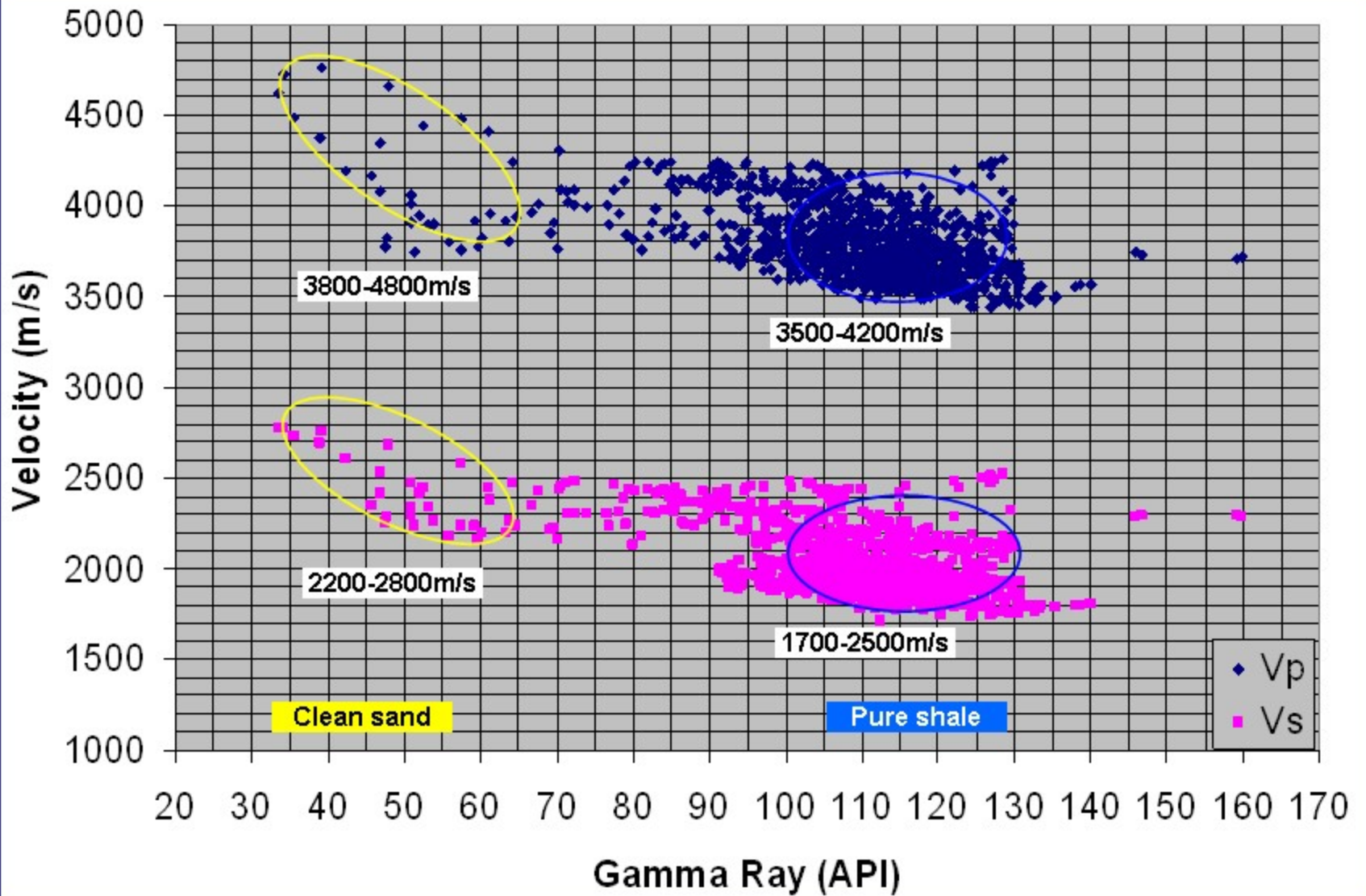
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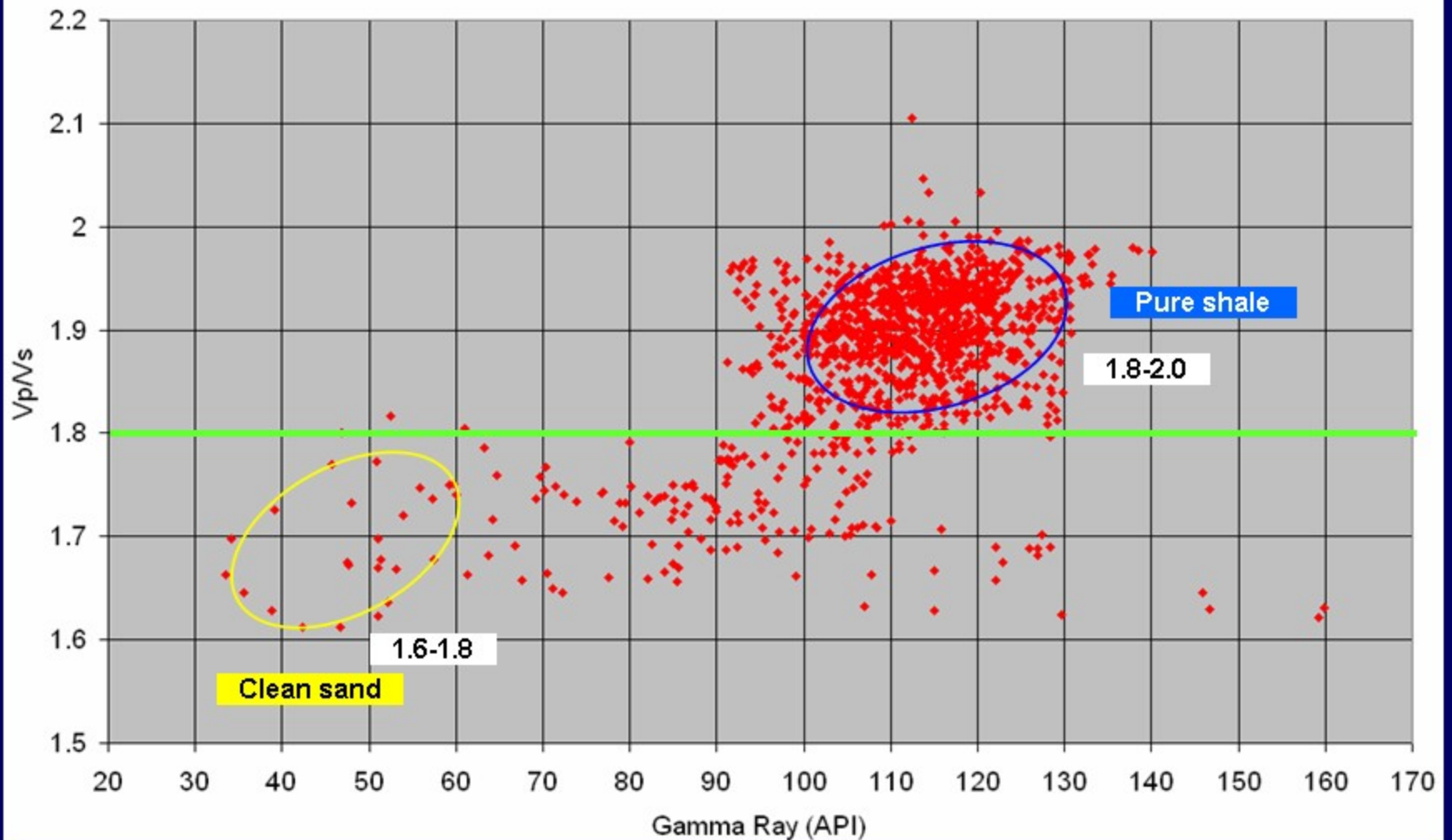
Logs from well 102/7-11-48-9



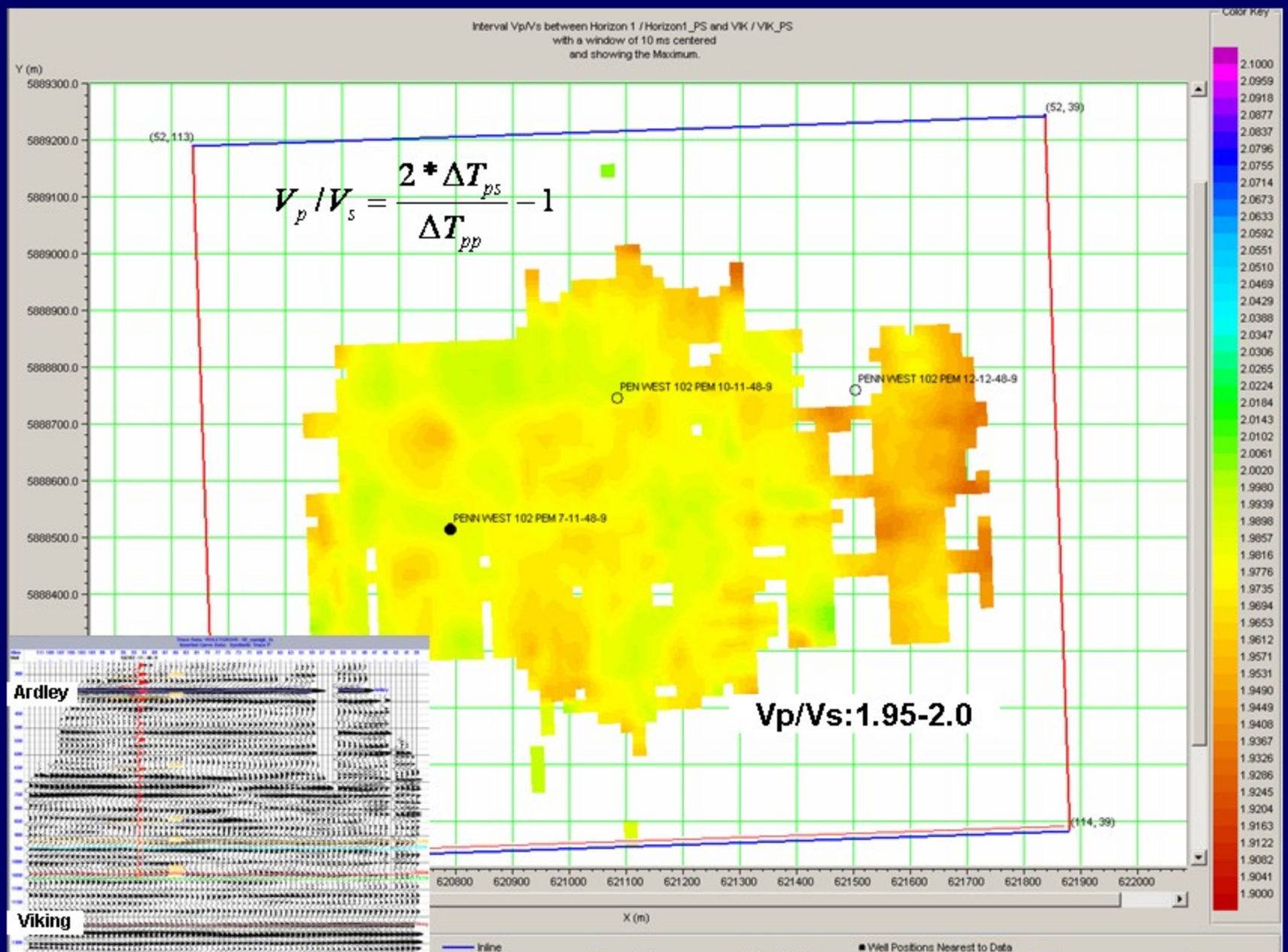
Cross plot map of gamma ray value and Poisson's ratio of well 102/07-11-048-09W5/0 (interval from 1500 to 1660m)



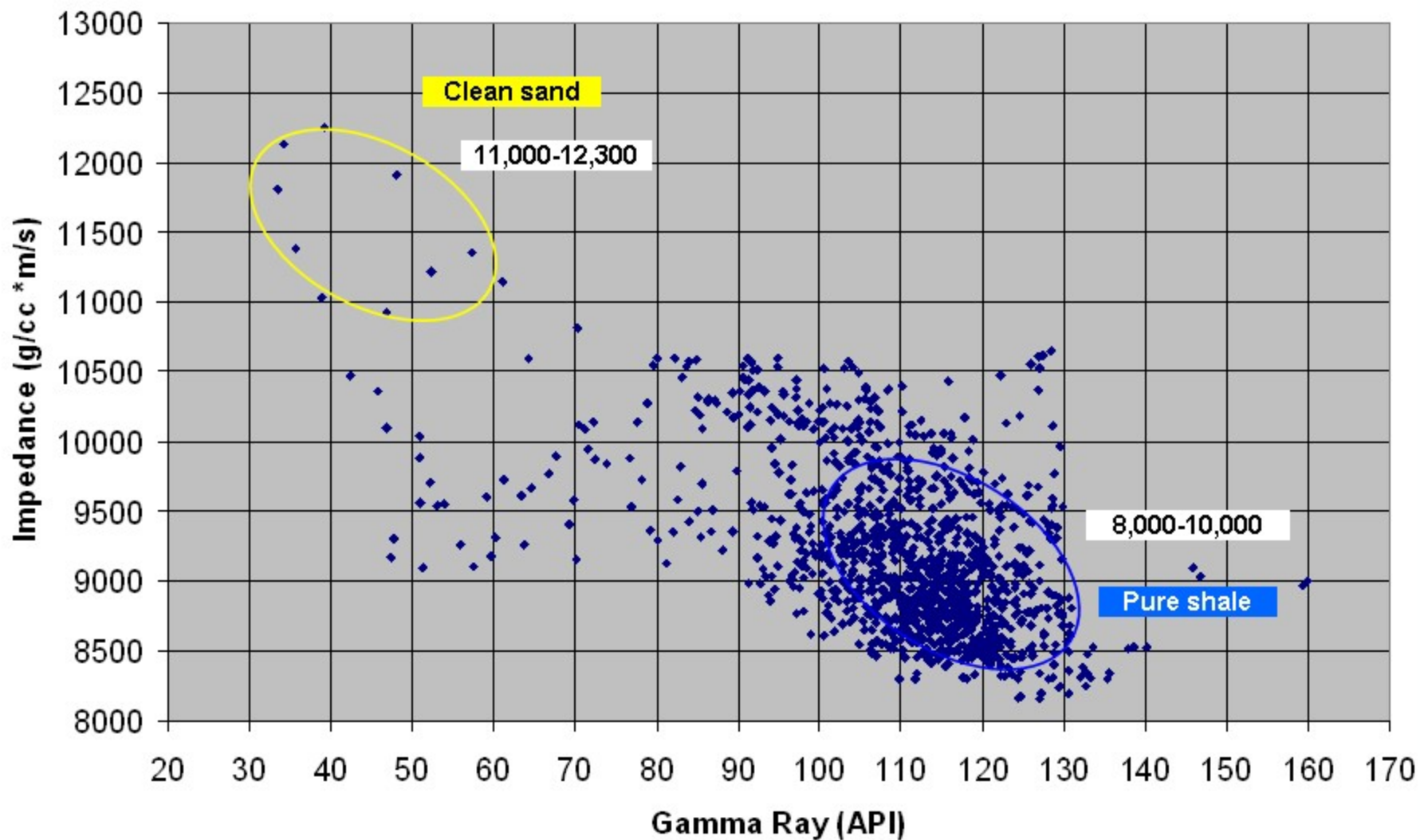
Cross plot map of gamma ray value and velocity of well 102/07-11-048-09W5/0 (interval from 1500 to 1660m)



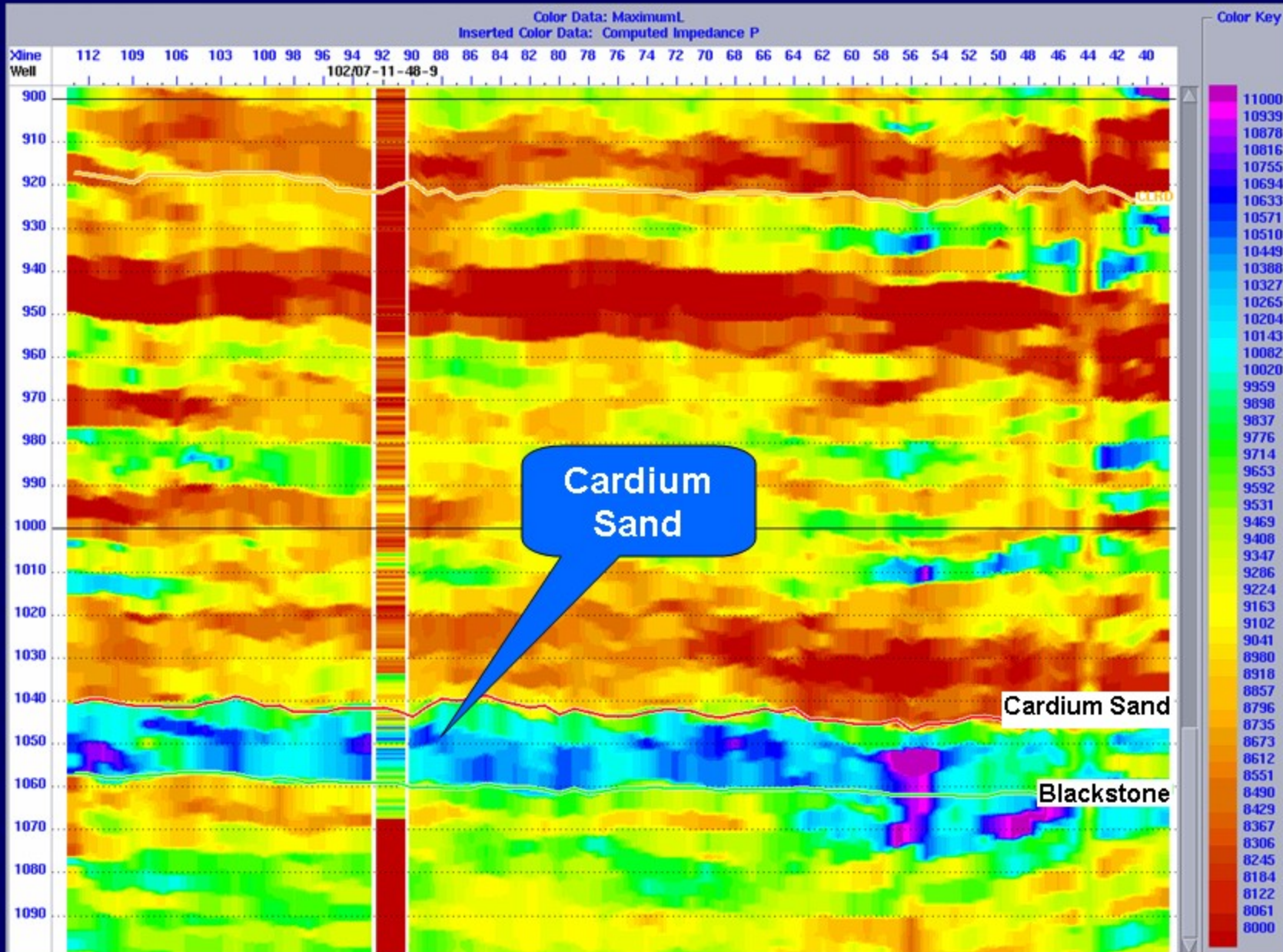
Cross plot map of gamma ray versus V_p/V_s over the interval from 1500 to 1660 m of well 102/7-11-48-9



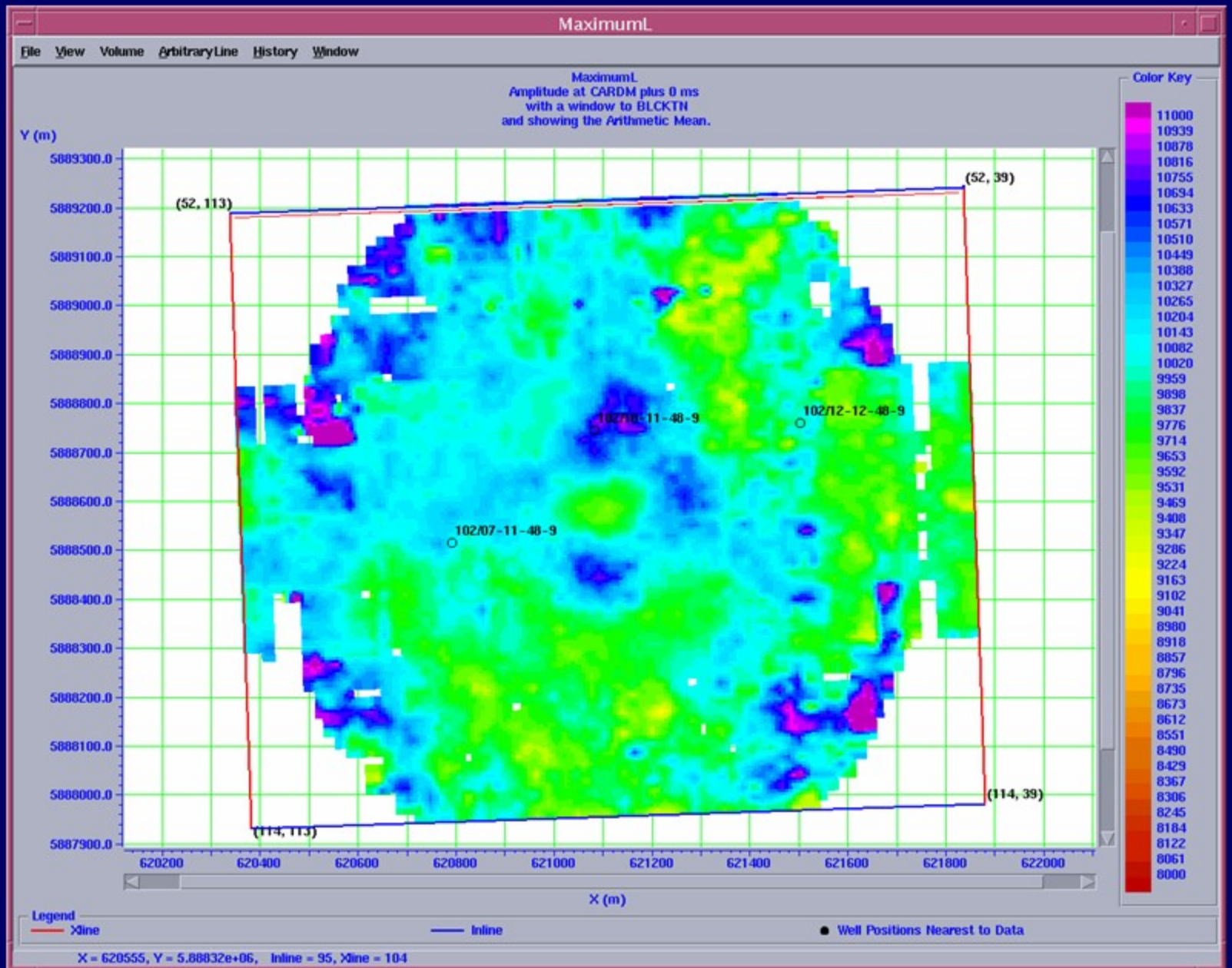
Average Vp/Vs map between Ardley and Viking horizons. The gaps in the map were caused by absence of data



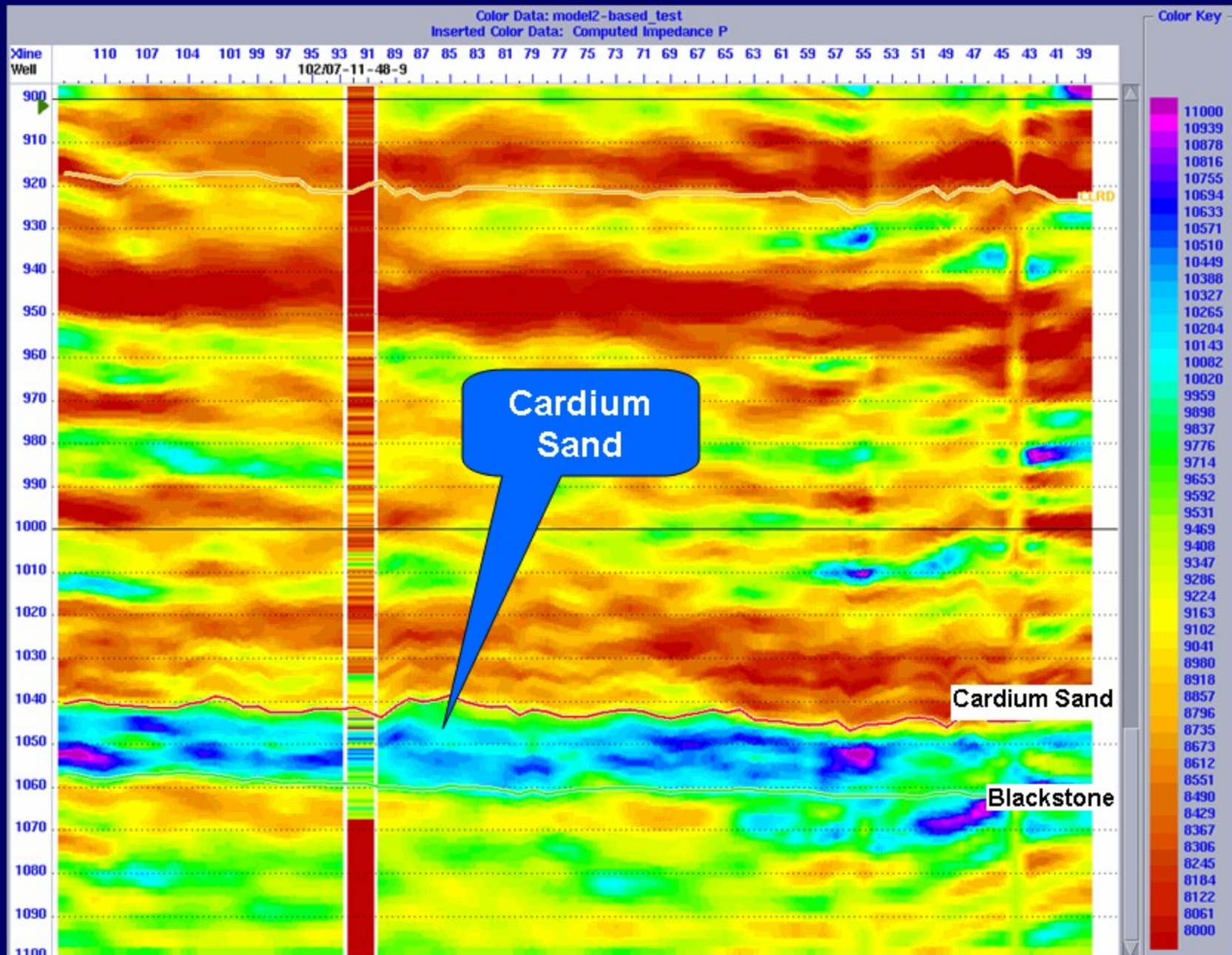
Cross plot map of gamma ray versus P-wave acoustic impedance over the interval from 1500 to 1660 m of well 102/7-11-48-9



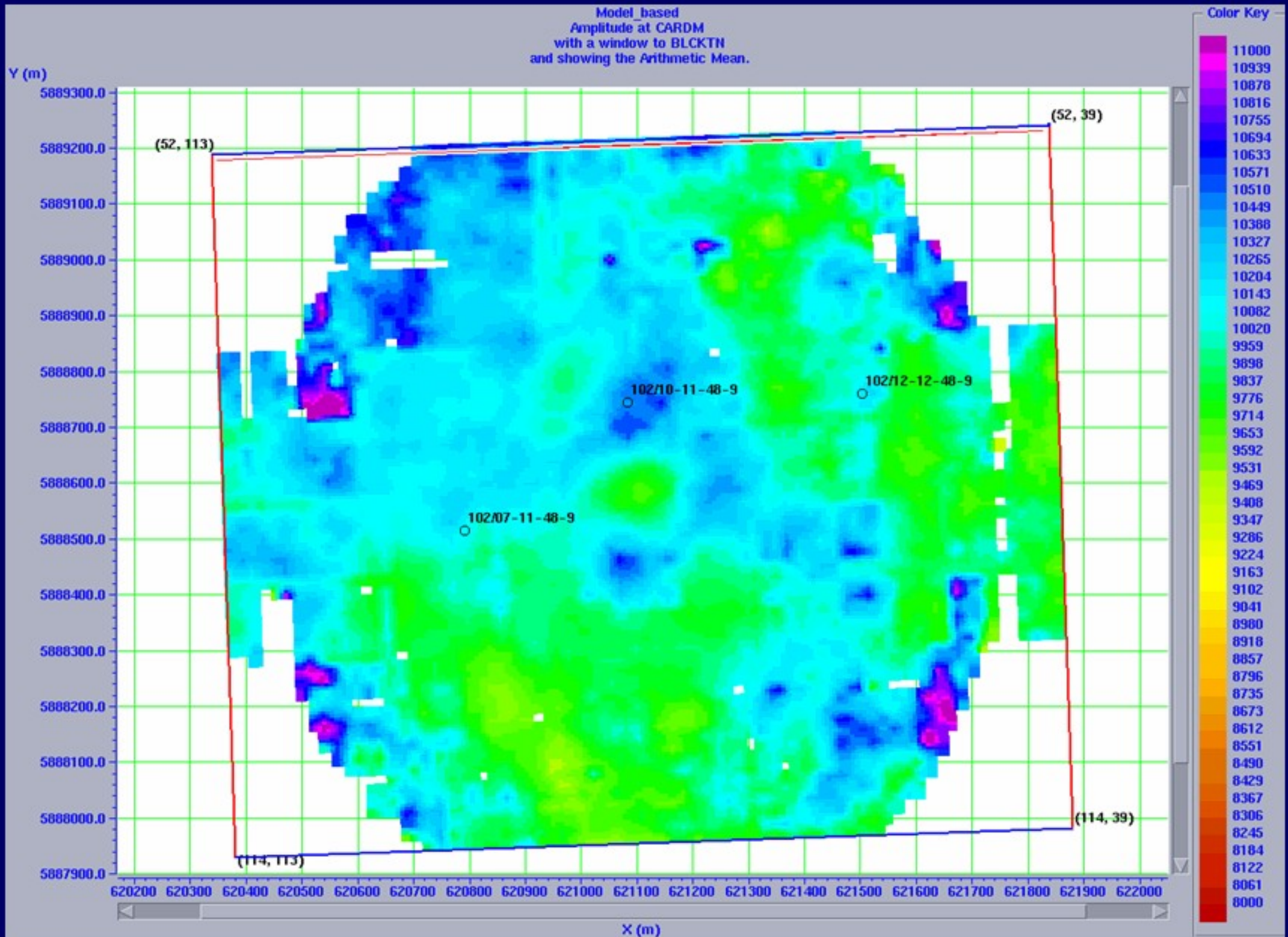
P-wave acoustic impedance inversion section (Inline86, ML sparse spike method used)



Mean impedance between Cardium sand and Blackstone (Sparse-spike ML



Acoustic impedance inversion section (Inline86, model based)



Mean impedance between Cardium sand and Blackstone (model based)

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Conclusions:

- The synthetic seismograms correlate well with the surface seismic data;
- All the horizons are very flat, and there exists a small amplitude anomaly in the Cardium reservoir around the injection pad in the PP data;
- The clean sands have the following characters: three highs (Density, Velocity, Impedance) and three lows (Gamma, Poisson's Ratio, V_p/V_s);
- Model based and ML sparse spike impedance inversion methods show results with higher resolution than other methods.

Future work:

- AVO inversion method will be tested on the baseline data;
- Since April 2005, tons of CO₂ has been injected into the reservoir; In early 2006, the first monitor survey will be shot and processed;
- The monitor survey will be interpreted and compared with the baseline survey to monitor the movement of CO₂.

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