

Geologic Structure and Seismic Analysis

Kentucky Geological Survey

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Trenton Black-River Research Consortium

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Pittsburgh, PA



Structure and Seismic Analysis

- Basement structure
 - Map
 - Major structural features (esp. those affecting dolomitization)
- Structure and isopach maps
 - Basal Sandstones (needed for dolomitization of T-BR?)
 - Knox Unconformity
 - Ordovician (top)
 - Trenton
 - Black River
- Integration of gravity and magnetic data
- Evaluate zones of potential hydrothermal dolomite development

Industry Partner Support: Seismic Data

- All sponsors e-mailed February 2004
- Telephone contact with all except for one company
- Face to face visits with the following:
 - Seneca Resources (Scott Gorham)
 - Seismic Exchange Inc. (Jeff Lester)
 - GeoData (Biff Rummerfield)
 - EXXON (Pinar Yilmaz)
 - Abarta Oil and Gas (Bernie Miller, representing Abarta)
 - North Coast Energy (David Cox)
- Enervest (CGAS): 3-D data at Saybrook (Bill Grubaugh)



Industry Partner Support, cont.

■ Data in house from:

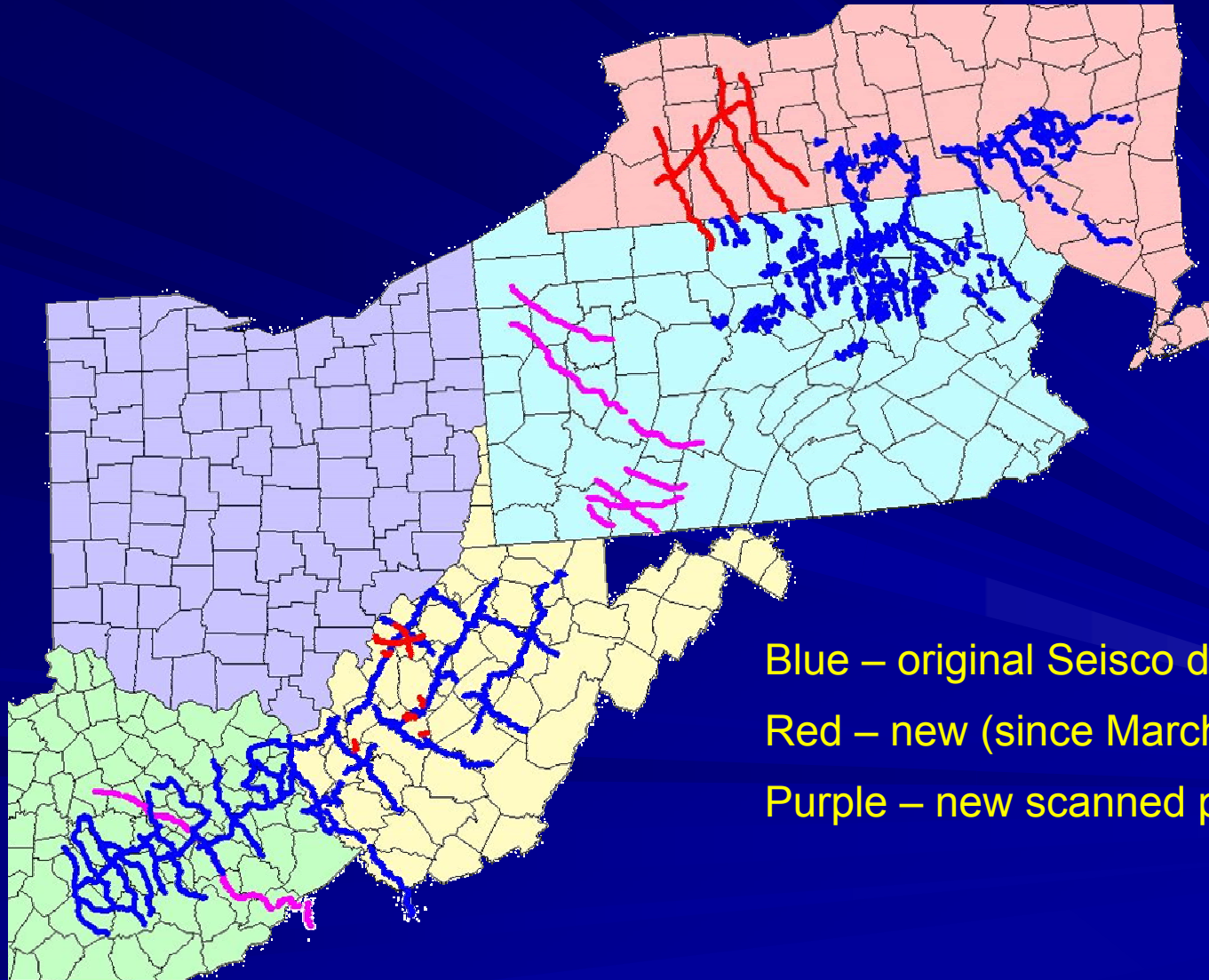
- Seisco: covers KY, WV and parts of PA and NY
- New York State Museum: SEI data covers W NY
- Pennsylvania Survey data: part of western PA
- North Coast Energy: covers small parts of WV (Evans and Paragon data)
- USGS: part of Rome Trough Kentucky

■ Data Pending:

- Petro Evaluation: part of Muskingum County, OH and possibly some other data
- EXXON: seismic data proposal through GeoData
- Abarta: part of Rome Trough Kentucky
- Ohio Geological Survey: Class I-well areas of Ohio; COCORP



Current Seismic Data Available



Blue – original Seiseco digital data

Red – new (since March) digital data

Purple – new scanned paper data

Industry Partner Support, cont.

■ Concerns

- SEI now is brokering most of the major's seismic data and negotiations with them are difficult
- Fear of confidentiality violation (3rd party consultants)
- Fear of sharing even derivative data with other members of the consortium
- Currently, focus on US; no overtures yet made to Ontario
- Currently, focus on seismic data only; no gravity and magnetic data

For Discussion

- Our ability to provide an adequate structural framework with the available data?
 - Especially for the deeper stratigraphic horizons
 - Basement
 - Basal sand
 - Additional seismic data from industry sponsors?
- Gravity and magnetic data?
 - Integration
 - Industry sponsors
- Availability of new well data/logs?
 - Newly drilled wells PA/NY

Newly Loaded Data

- Eleven new analog (paper copies) of regional seismic lines have been scanned and loaded into PetraSeis™ software
- Five new digital (SEG-Y) regional seismic lines from western New York state have been loaded into Kingdom Suite™ software
- Nine new digital (SEG-Y) regional and field scale seismic lines from central West Virginia have been loaded into Kingdom Suite™ software, including 2-3 processed versions of each (enhanced stack, migrated, etc.)

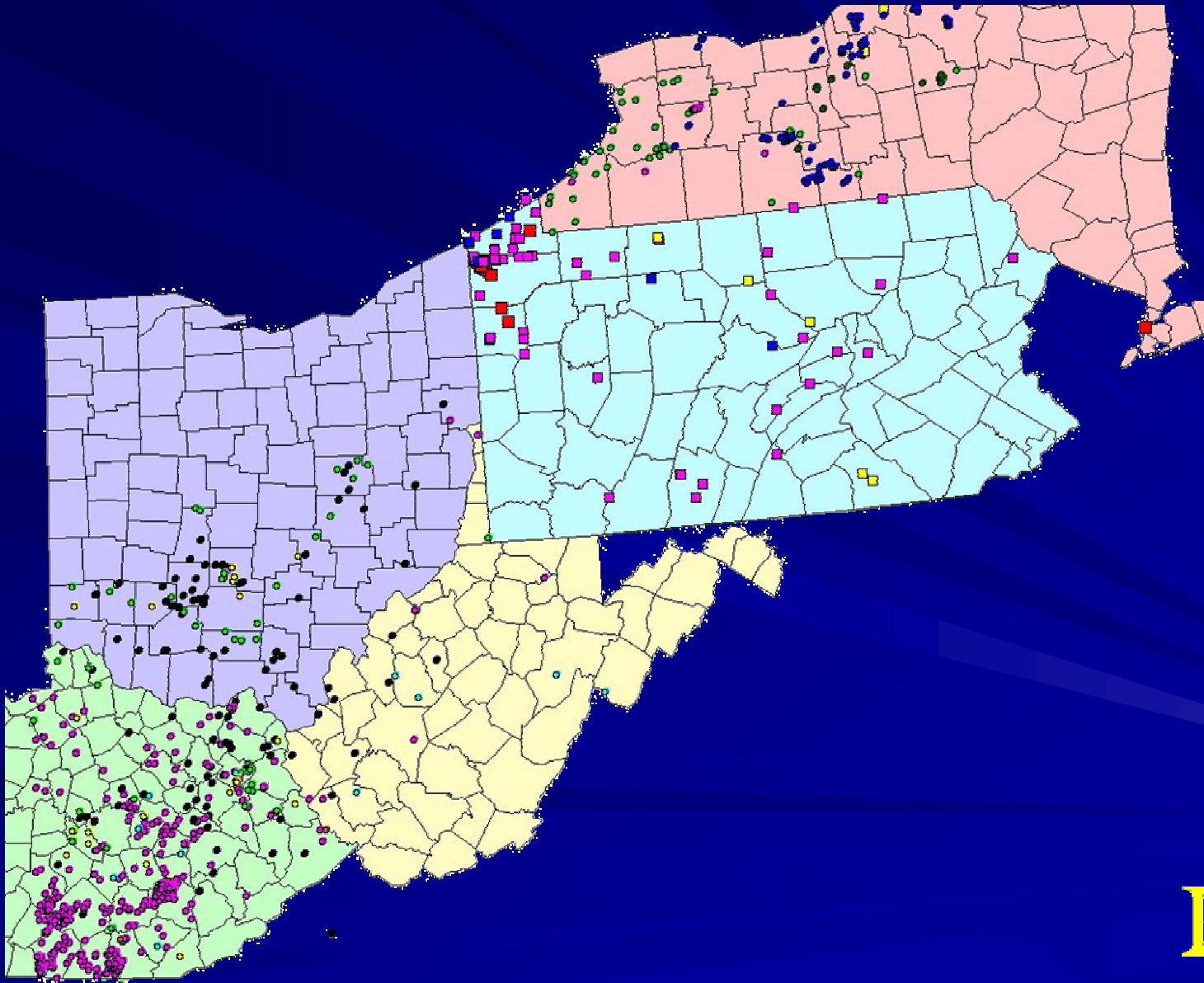
Interpretation of Current Data

- Ten regional seismic horizons interpreted for northeastern PA/southern NY region
- Time to depth converted horizons gridded over PA/NY project area:
 - Tully Ls (Devonian)
 - Trenton Ls (Ordovician)
 - Precambrian metamorphic basement

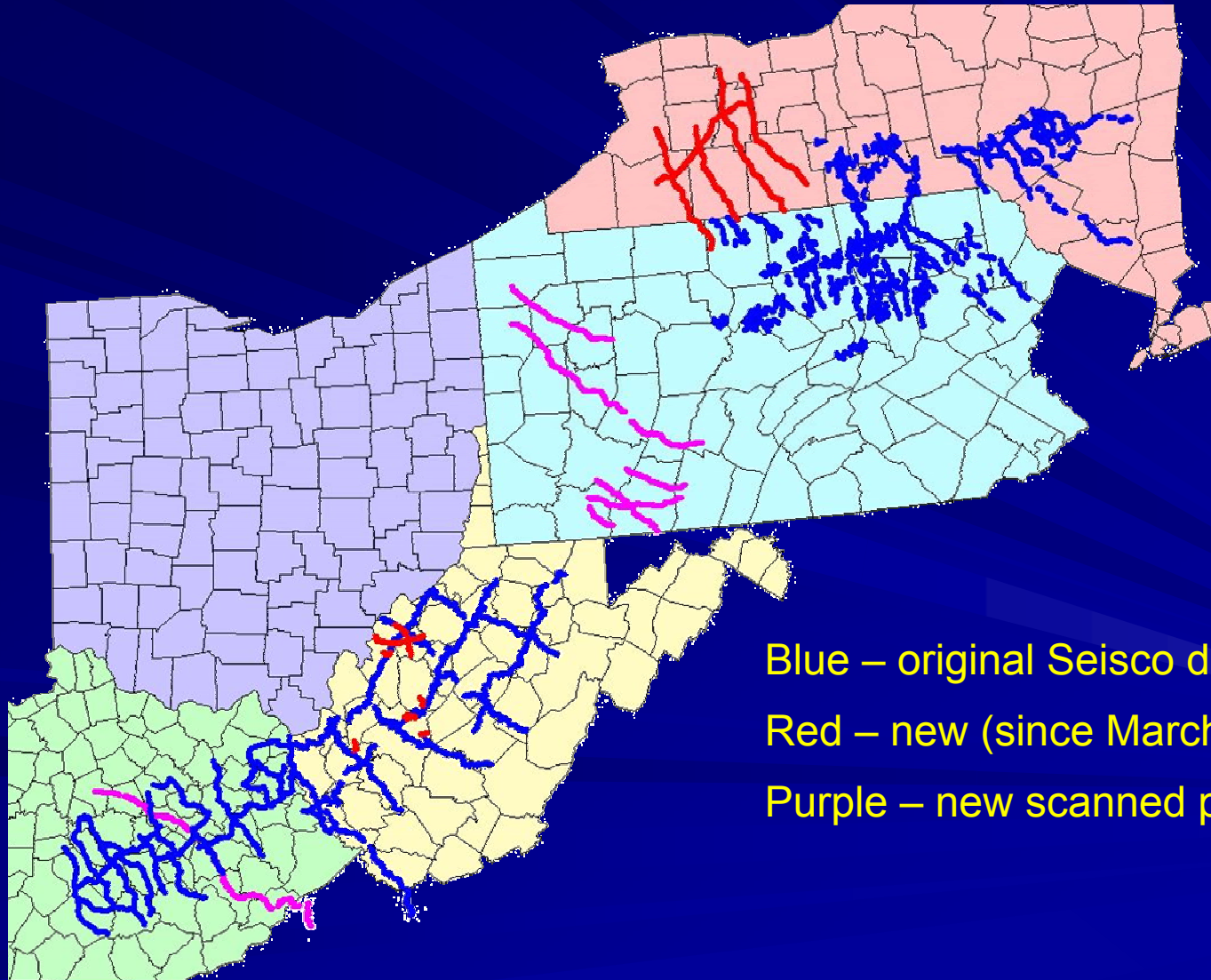
Data Interpretation, cont.

- Preliminary depth (feet) to Trenton Ls map for northeastern PA/southern NY
- 16 stratigraphic horizons interpreted KY/OH/WV seismic lines
- The interpretation of apparent basement offsets, along with other major faults is nearing completion (for the data presently collected by consortium).

Wells used for preliminary correlations



Current Seismic Data Loaded

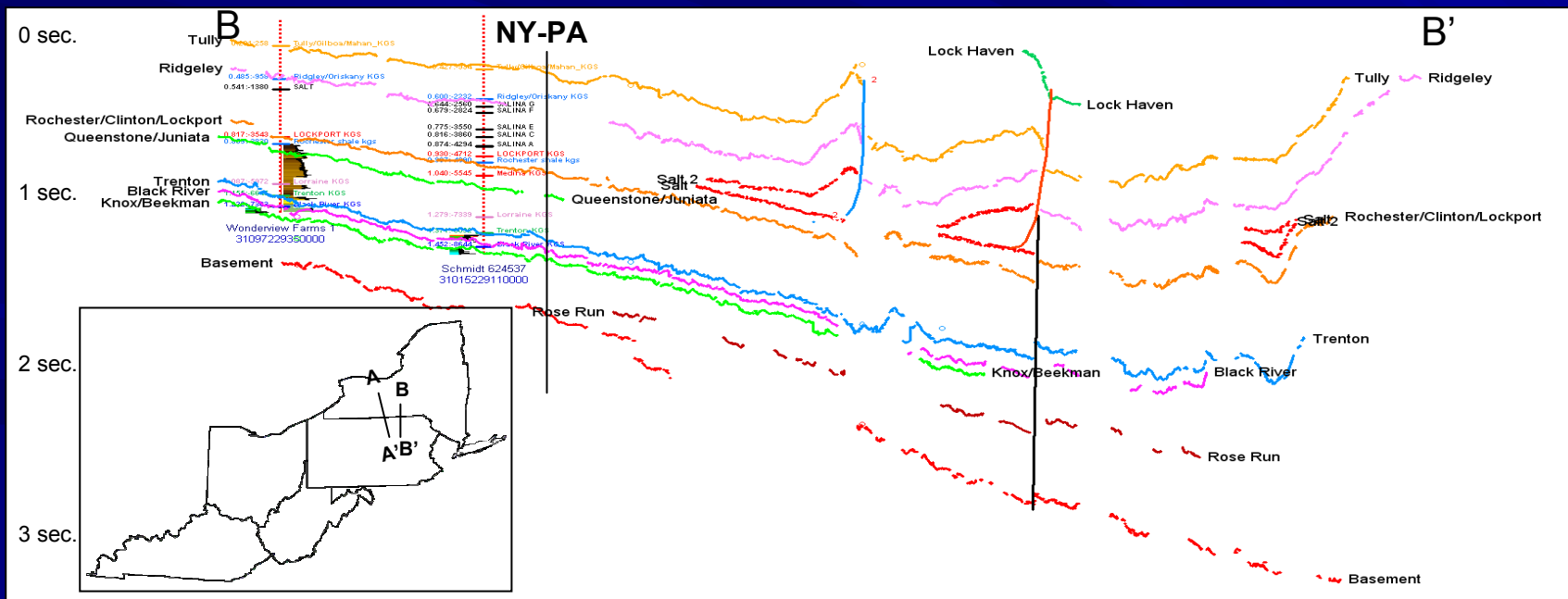
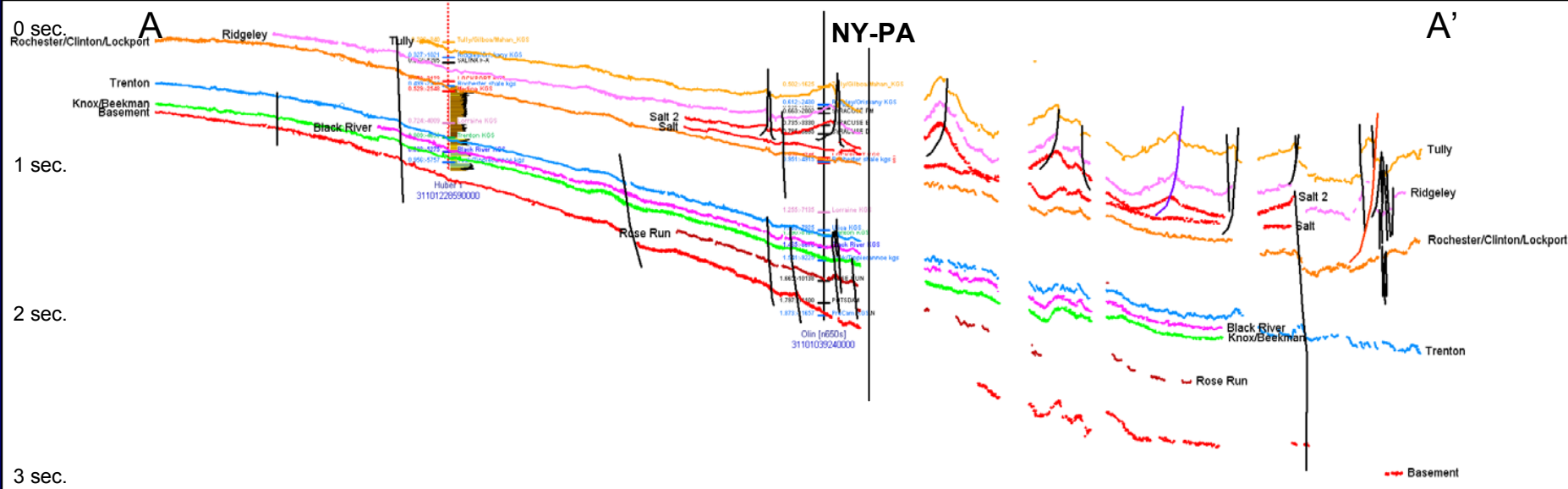


Blue – original Seiseco digital data

Red – new (since March) digital data

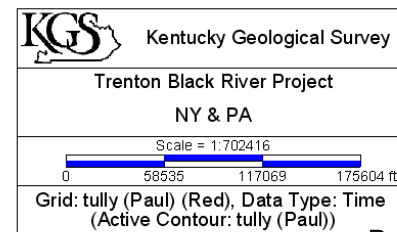
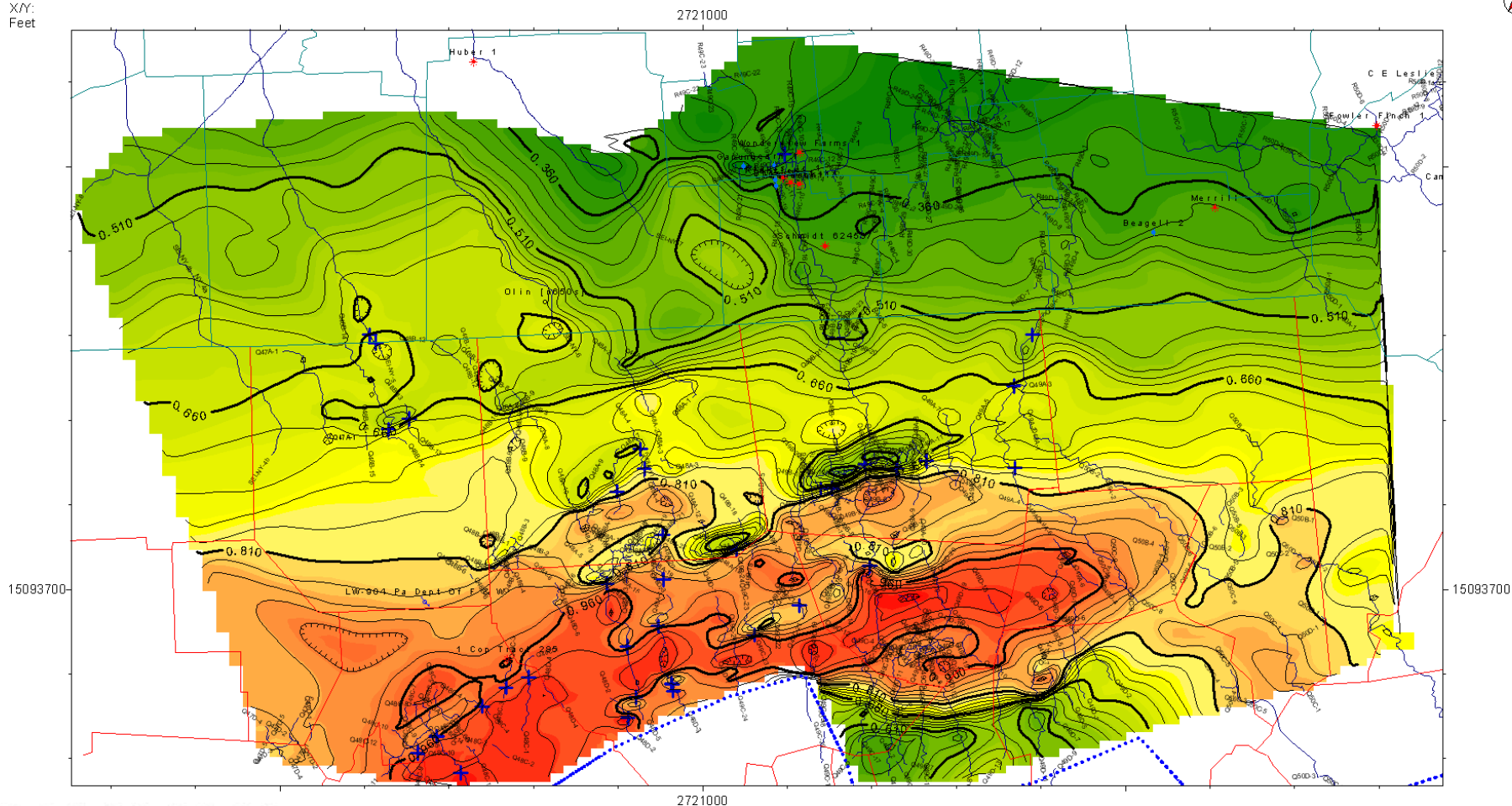
Purple – new scanned paper data

Seismic Interpretation



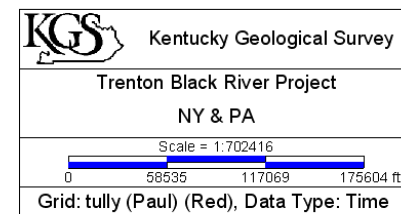
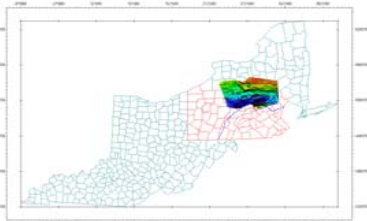
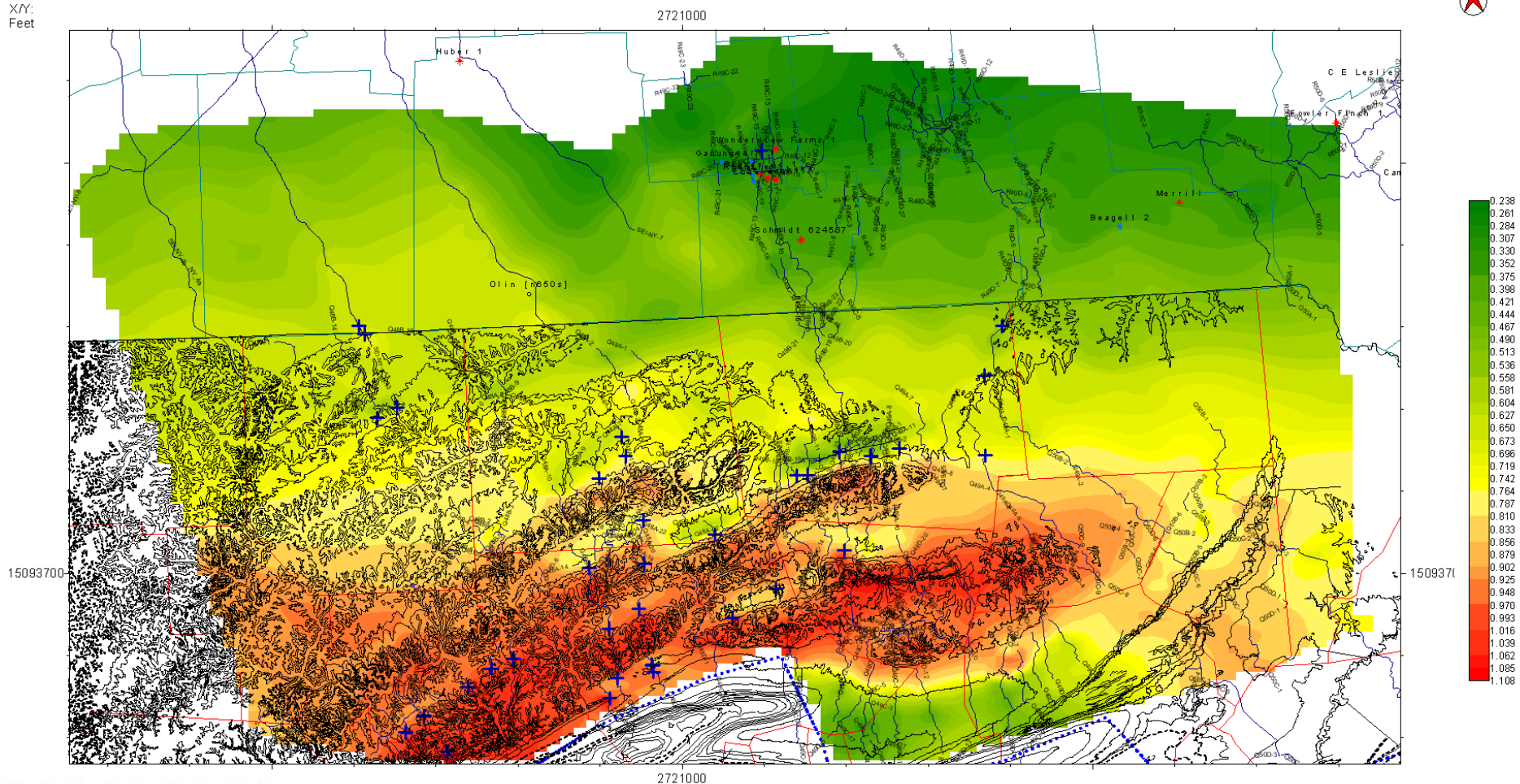
Preliminary Tully Two-Way Time Structure

X/Y:
Feet



Preliminary Tully Two-Way Time Structure

XY:
Feet



Preliminary Trenton Two-Way Time Structure

XY:
Feet

2721000

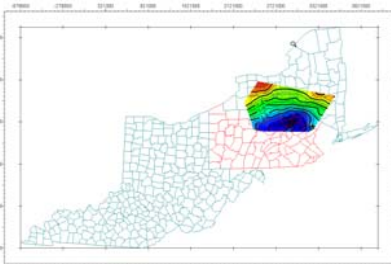
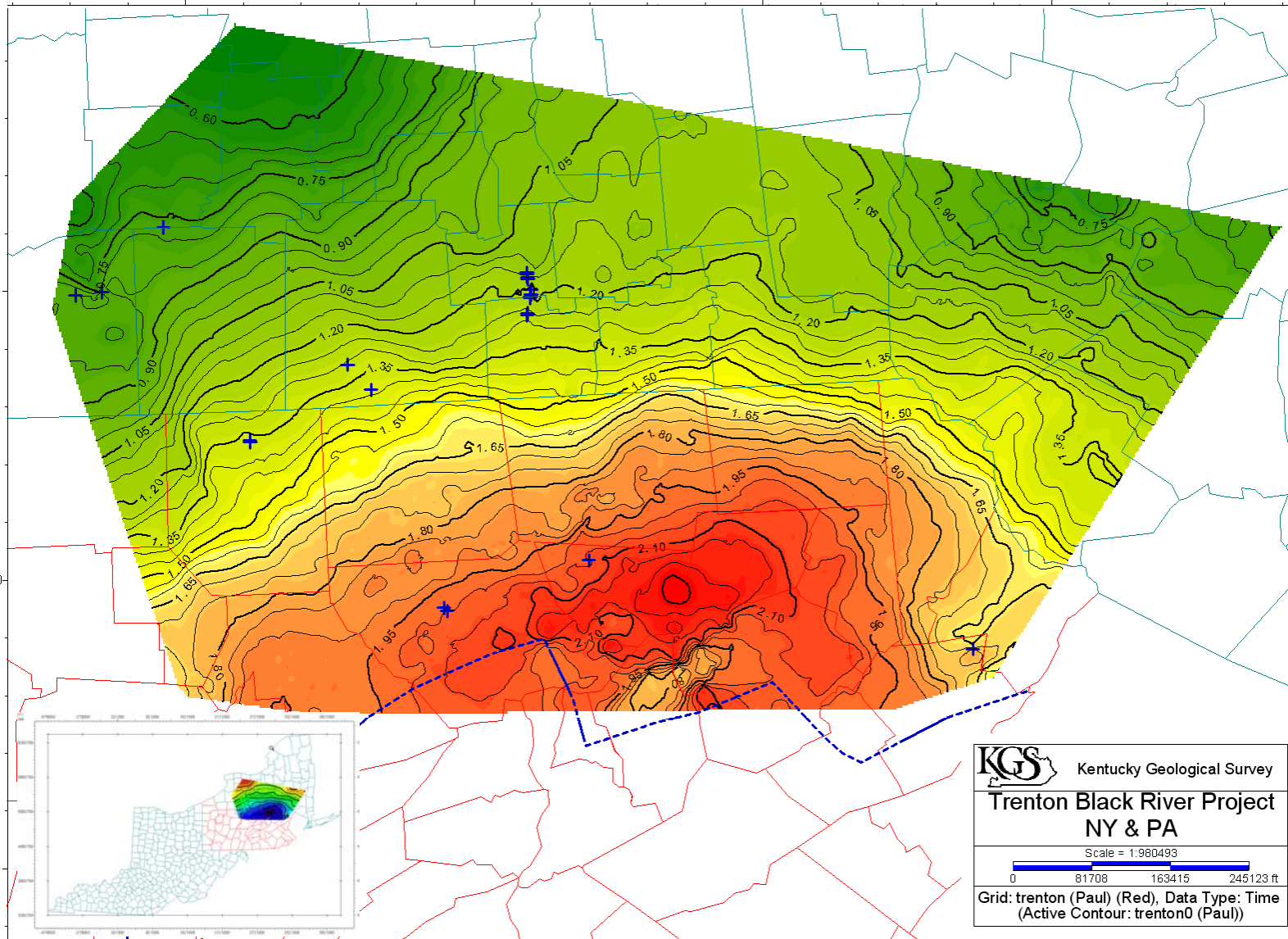
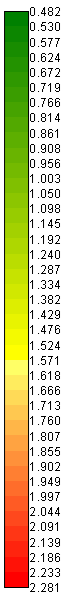
3321000

15093700

15093700

2721000

3321000



KGS Kentucky Geological Survey

**Trenton Black River Project
NY & PA**

Scale = 1:980493

0 81708 163415 245123 ft

Grid: trenton (Paul) (Red), Data Type: Time
(Active Contour: trenton0 (Paul))

Preliminary Trenton Depth Structure

XY:
Feet

2721000

3321000

15093700

15093700

2721000

3321000

2789.246
3090.190
3391.133
3692.077
3993.020
4293.964
4594.907
4895.851
5196.794
5497.738
5798.681
6099.625
6400.568
6701.512
7002.456
7303.399
7604.343
7905.286
8206.230
8507.173
8808.117
9109.060
9410.004
9710.947
10011.891
10312.835
10613.778
10914.722
11215.665
11516.609
11817.552
12118.496
12419.439
12720.383
13021.326
13322.270
13623.214
13924.157
14225.101



Kentucky Geological Survey

**Trenton Black River Project
NY & PA**

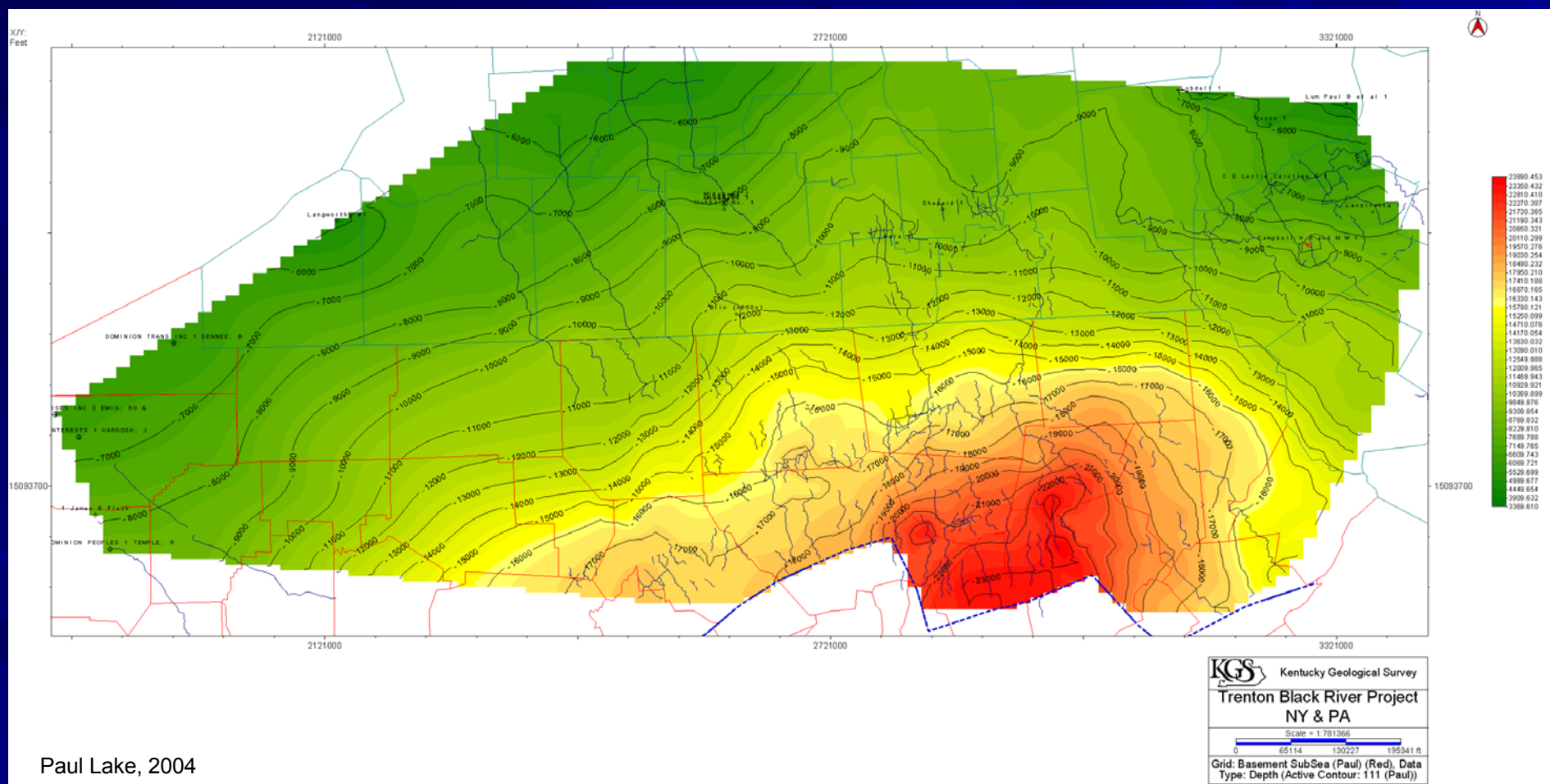
Scale = 1:933898

0 77825 155650 233475 ft

Grid: trenton subsea (Paul) (Red), Data
Type: Depth (Active Contour: trenton
subsea0 (Paul))

Paul Lake, 2004

Preliminary Basement Structure



Paul Lake, 2004

New Regional Velocity Model

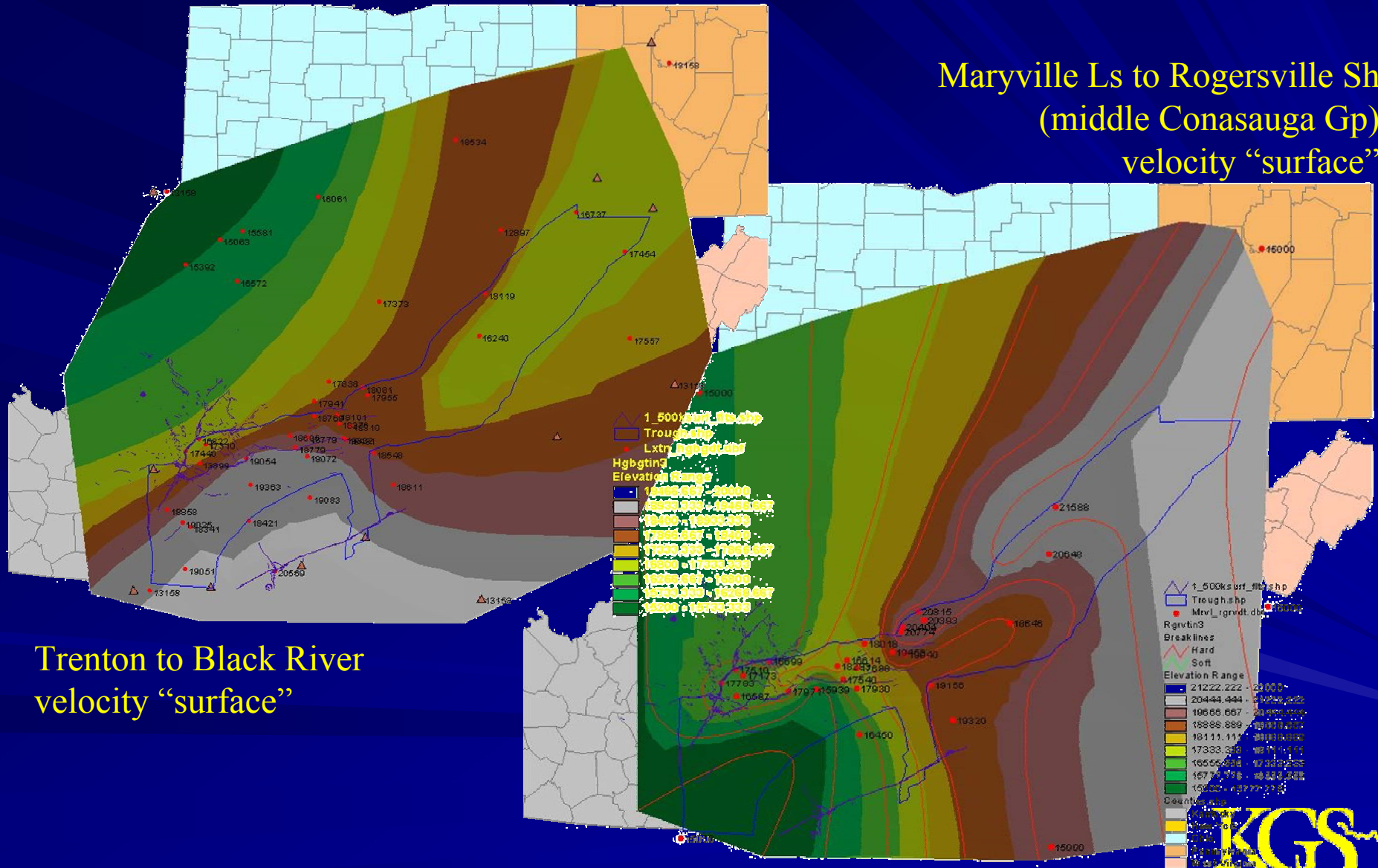
- Created to help determine the time-to-depth of seismic horizons, and to aid in stratigraphic correlation in areas of low resolution data
- Formation tops from 763 wells, and sonic logs from 54 LAS files were used from the deep wells in OH, WV, and KY
- Sonic log data averaged with petrophysical software (TerraStation™) within groups of strata resulted in precise internal velocities

Velocity Model, con't.

- Internal velocities of sixteen layers (groups of strata) corresponding to possible seismic horizons were “gridded” over KY/WV/OH project area, and edited for known fault trends
- In wells without sonic logs, internal velocities were calculated by the creating sonic log grids. These grids that were used to determine time to formation tops.
- A sixteen layer regional velocity model for the KY/OH/WV area, with an average error $< 5\%$, based on well data

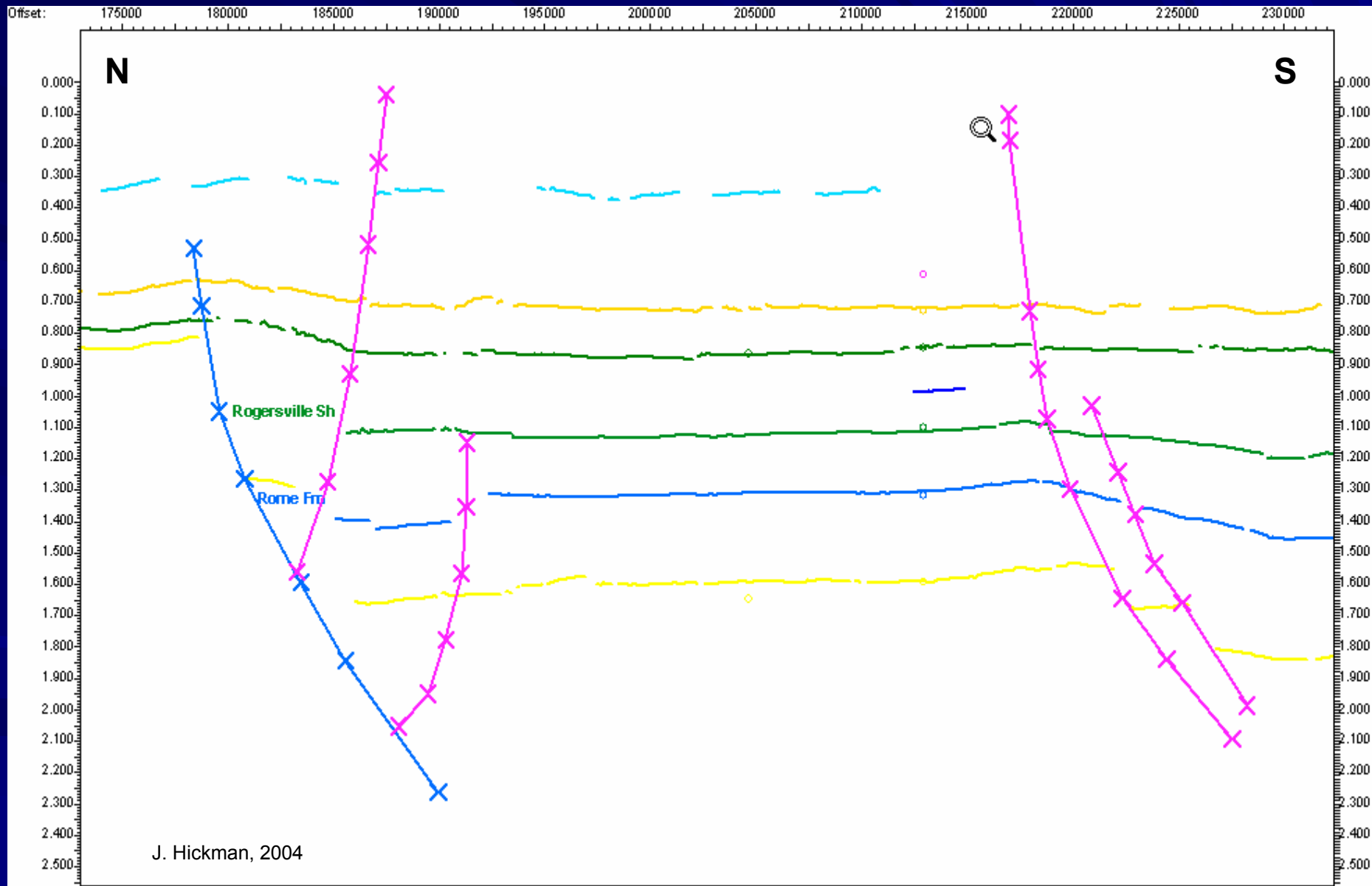
Kentucky/Ohio/West Virginia Velocity Model

Maryville Ls to Rogersville Sh
(middle Conasauga Gp)
velocity “surface”

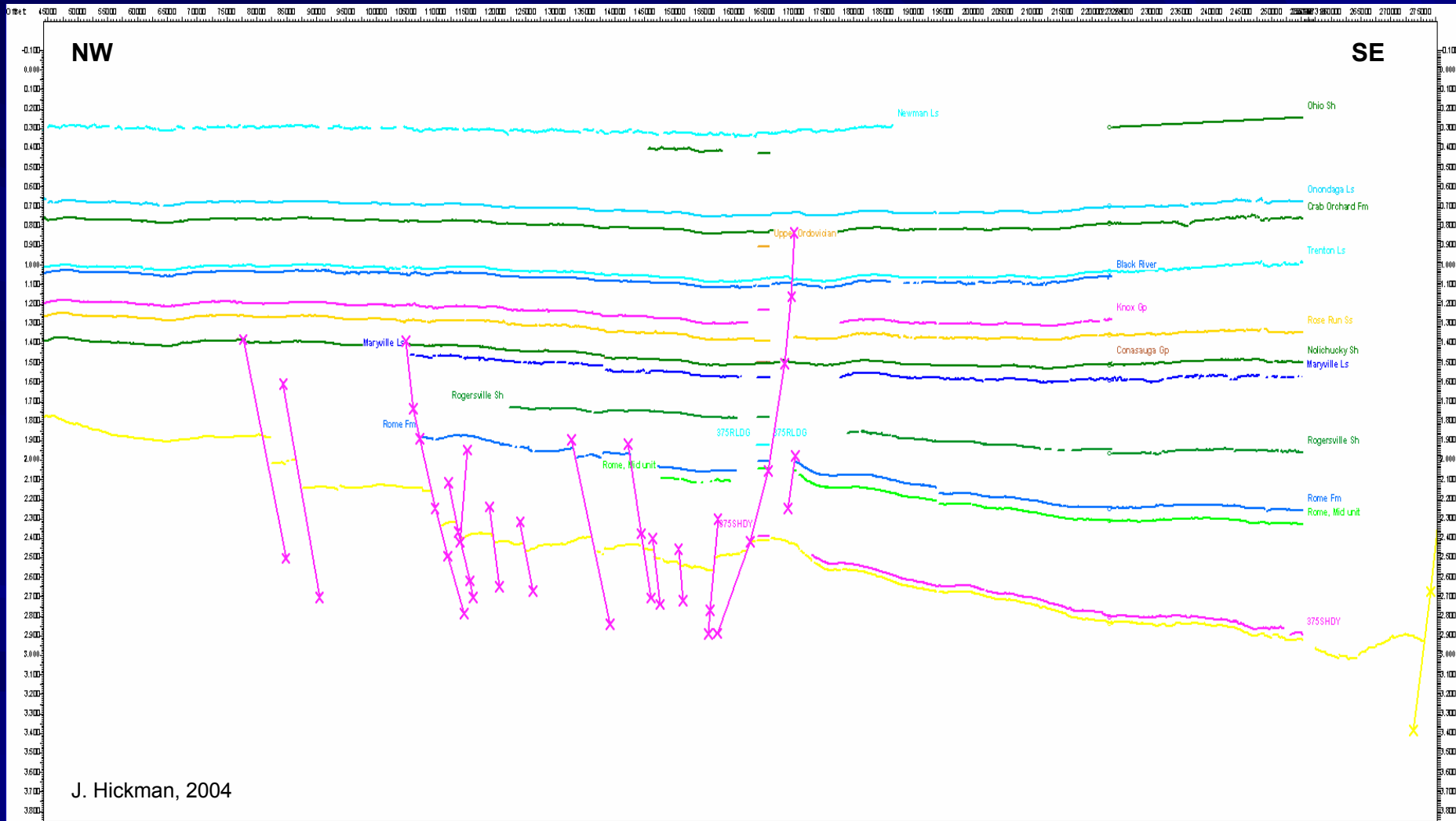


Trenton to Black River velocity “surface”

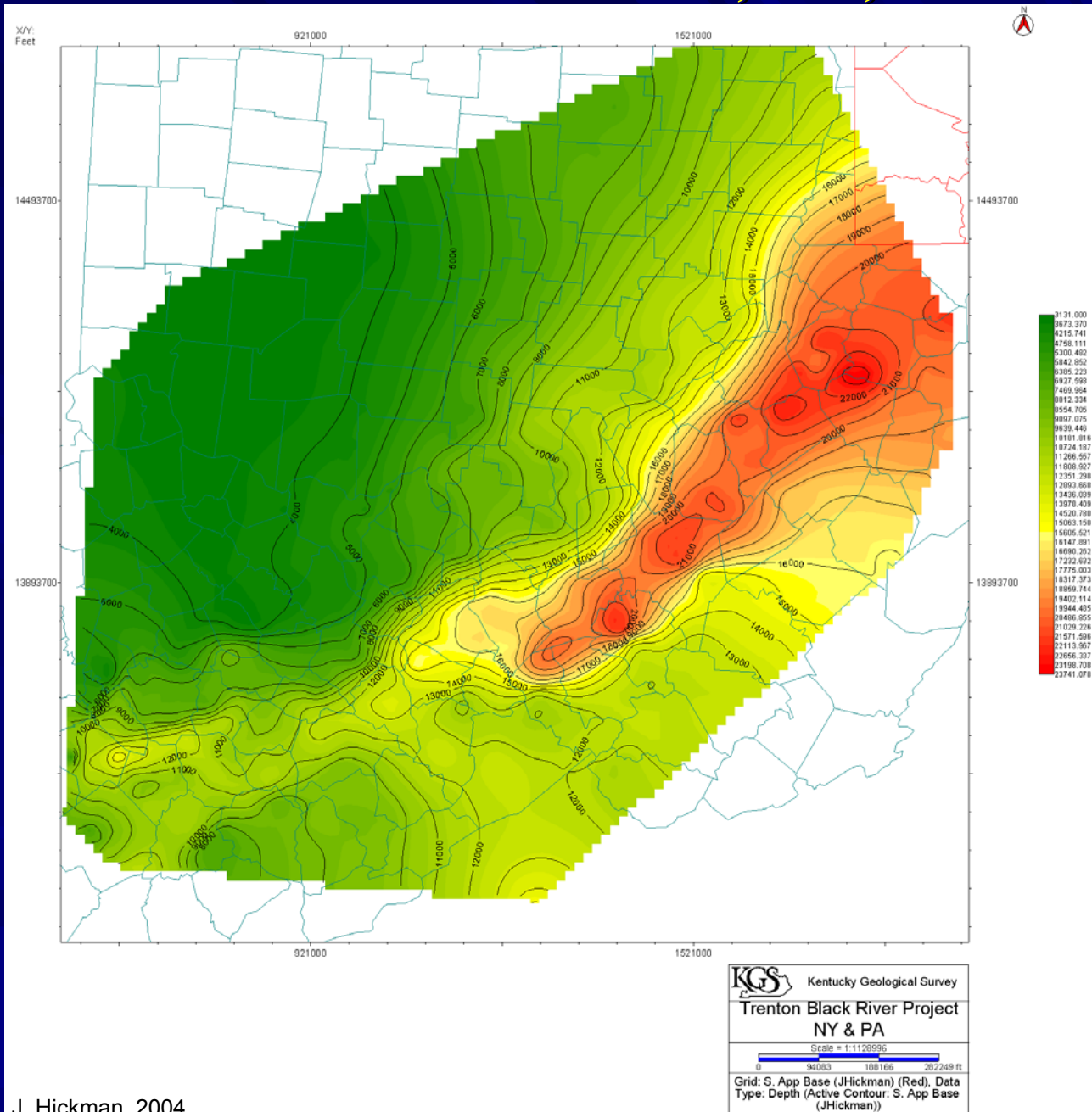
Eastern KY Rome Trough Section



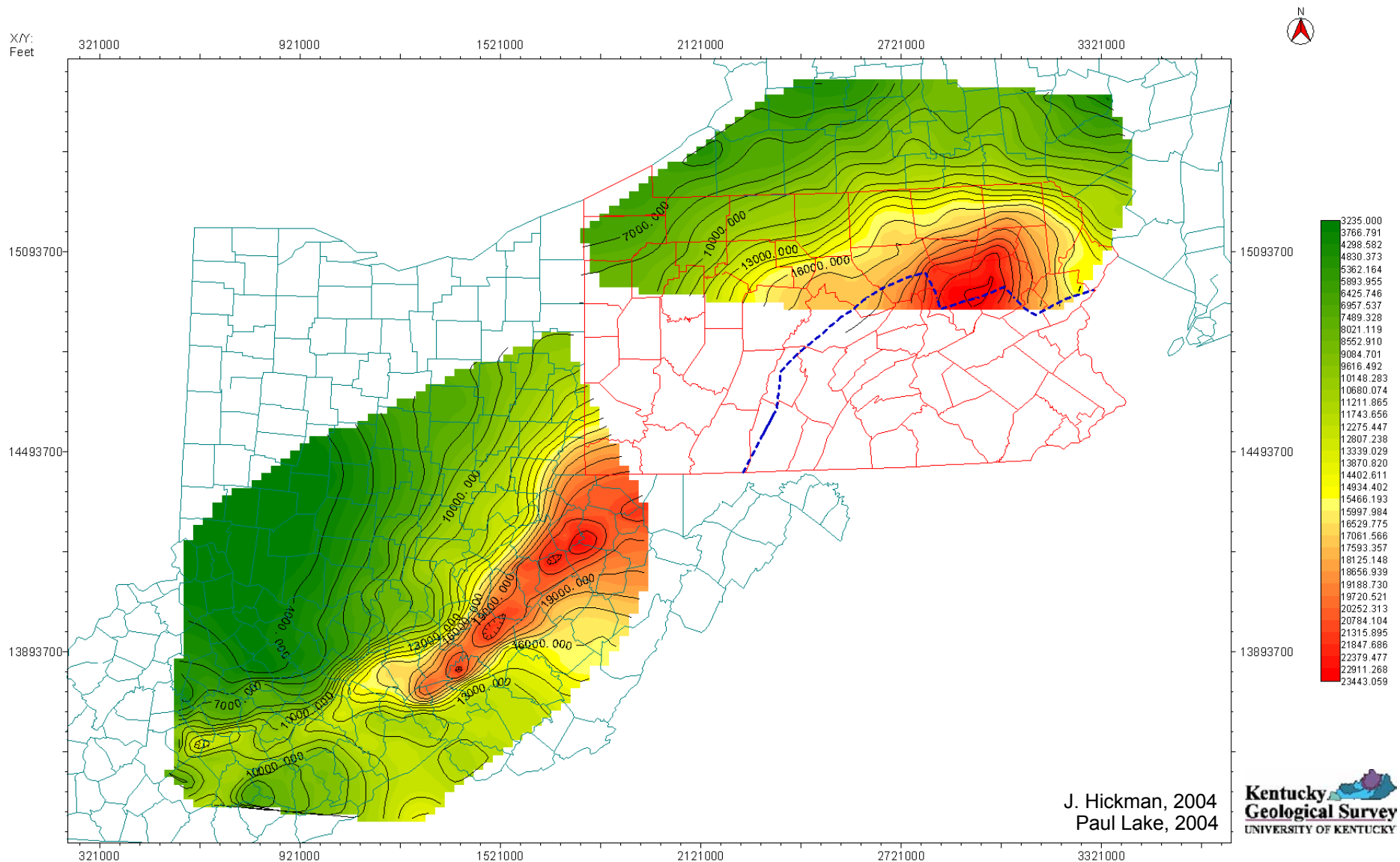
Northern Rome Trough Section, WV



Precambrian surface in OH, KY, and WV



Basement Structure



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Tectonic Dolomitization, Rough Creek Fault Zone Ohio and Grayson Counties, Ky.

