The Collingwood/Utica Shale in Michigan

William B. Harrison, III
Michigan Geological Repository for Research and Education
Western Michigan University

Acknowledgements

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- Farsheed Rock, WMU Geosciences Master's Student for maps and cross sections prepared in Petra well data management software
- MDNRE – Geological Survey for making well data and logs available
- JEM Petroleum, Dart Oil and Gas and Hunt Energy for donating core and samples to MGRRE

National Press is all over New Gas Discovery in Michigan

StreetInsider.com
if you're not inside...you're outside

"Encana Corp. (ECA) announces acquisition of Nat Gas Shale Play in Michigan"
May 7, 2010

PennEnergy

"Collingwood-Utica Gas Play – Michigan"
May 7th, 2010

INVESTOPEDIA®

"Say Hello To The Collingwood Shale "
May 18, 2010

OIL&GAS FINANCIAL JOURNAL

"Encana, several other producers developing Collingwood shale"
Jul 1, 2010

Oil and Gas Investor.com

"New Michigan Shale Play Features Collingwood And Utica"
May 11, 2010

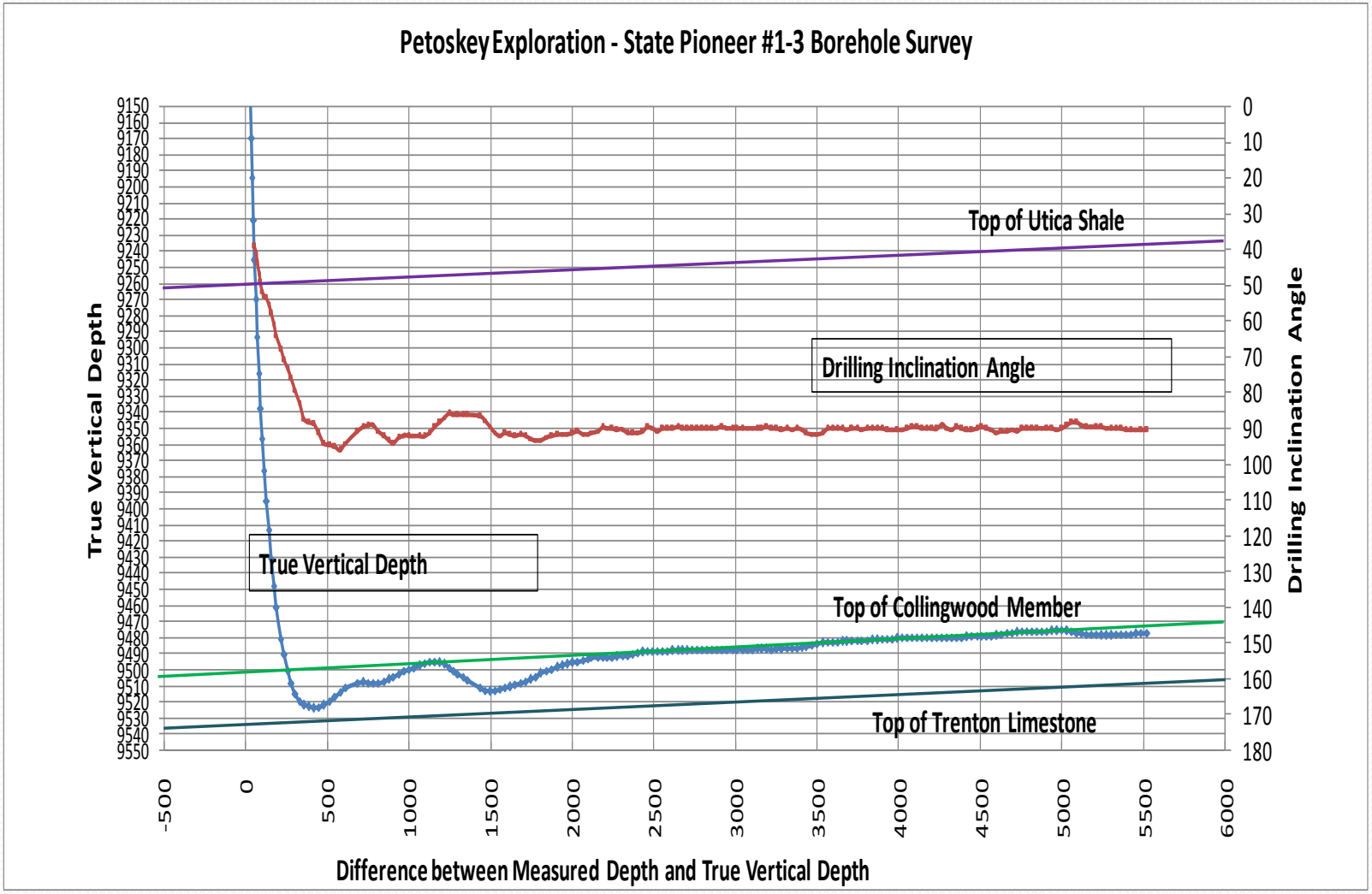
Bloomberg Businessweek

"250,000 Acres of land in Collingwood Shale in Michigan"
September 14, 2010

What has caused all this attention?

- Drilling and completion of the Petoskey Exploration, LLC. – St. Pioneer #1-3 well in sec. 3 – 24N – 7W of Missaukee Co., Michigan.
- The well reached a measured depth of 15,001 ft and a true vertical depth of 9477 ft. on Jan. 11, 2010. Including about 5500 ft. horizontally in the Upper Trenton/Collingwood Formation
- The well was stimulated from 9,800 ft. – 14,968 ft. With 168,000 bbls of slickwater, 1.3 million lbs. 100 mesh sand and 2.58 million lbs of 40/70 sand over 15 stages.

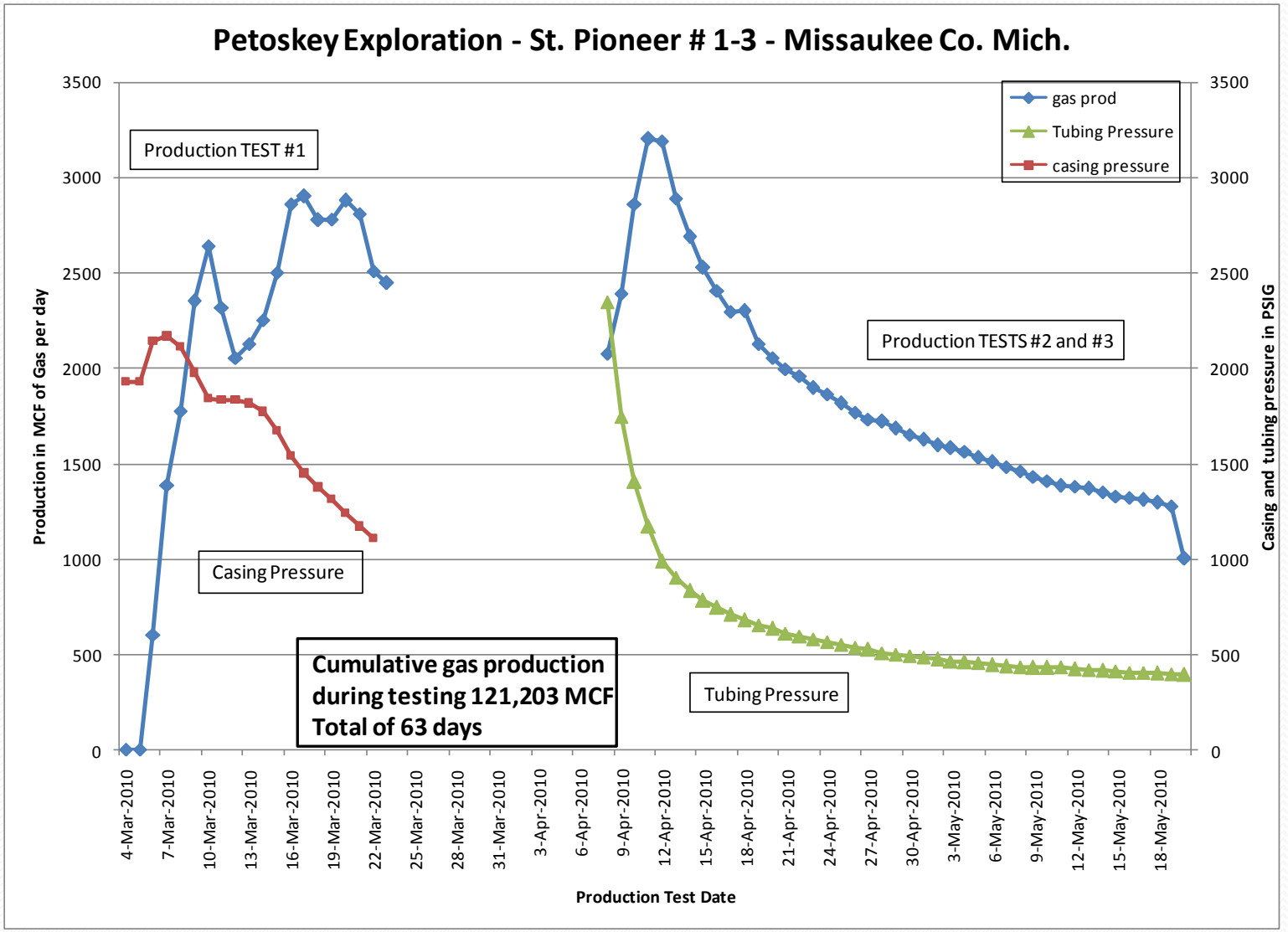
Approximate Borehole path



Production Testing

- Production test #1 – March 4 to March 24, 2010 with a maximum gas rate of 2,899 MCF/day
- Production test #2 – April 8 to May 8, 2010 with a maximum gas rate of 3,188 MCF/day
- Production test 3 – May 8 to May 20, 2010 with a maximum gas rate of 1,430 MCF/day
- A few bbls of oil per day were produced along with hundreds of bbls of load water per day.

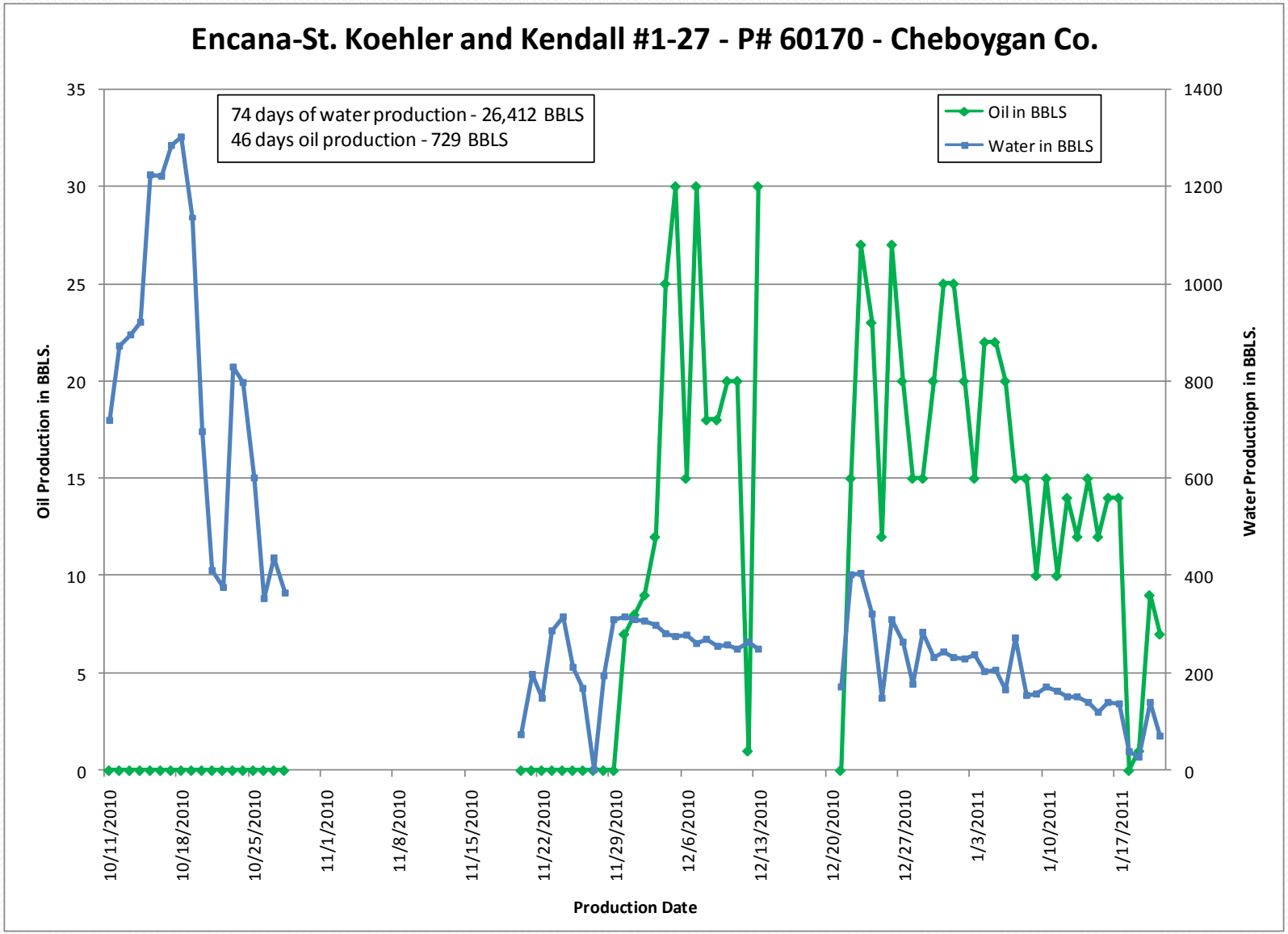
Production Testing Data



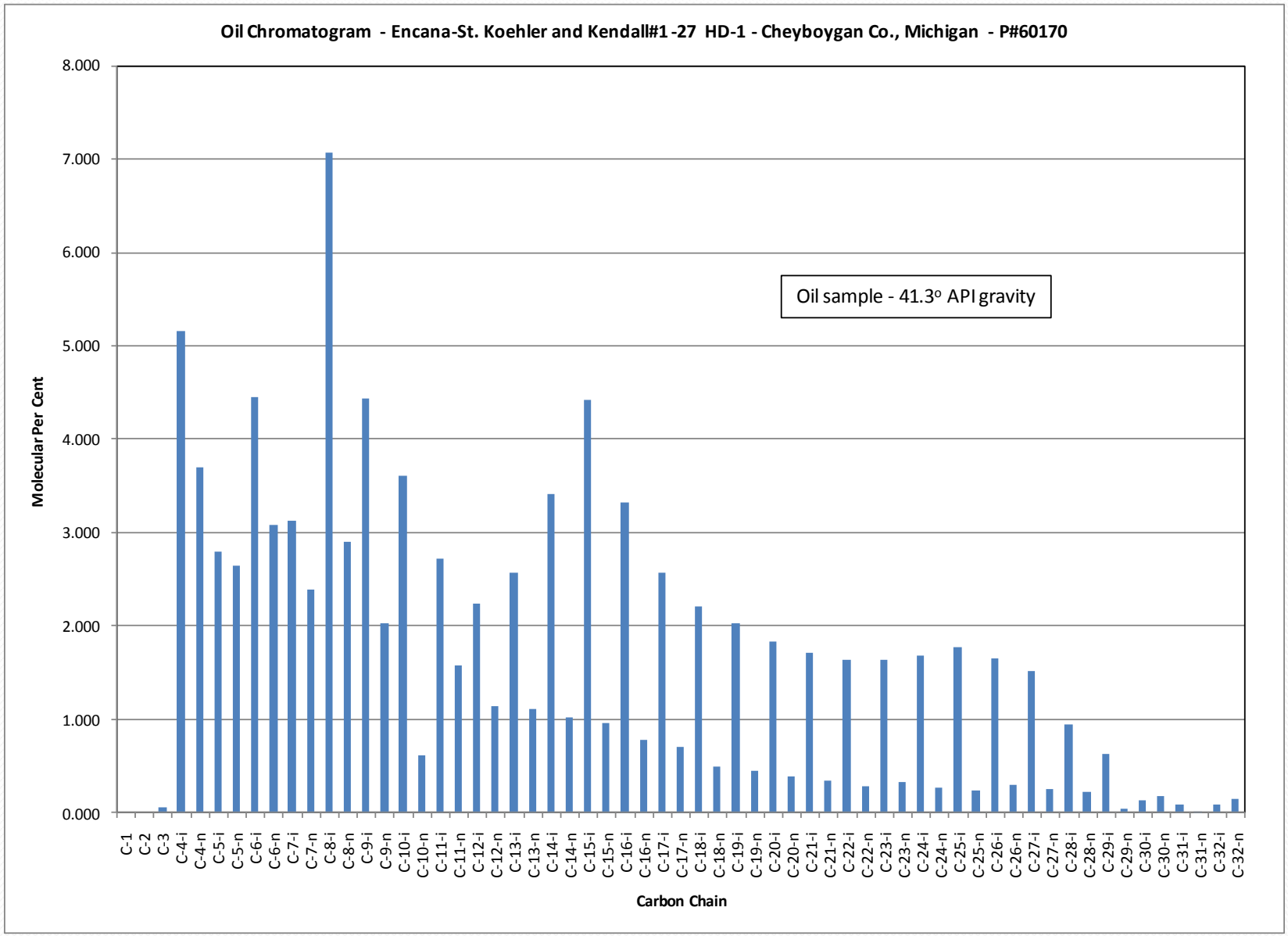
Additional Drilling and Completion

- Encana- St. Koehler &Kendall#1-27HD1 – Cheboygan Co. – 34N-2W
- Reached TD on Sept 28, 2010. Measured depth of 7595 ft. and TVD of 4243 ft. About 3100 ft of horizontal leg
- Completed Oct. 4 to Oct 10, 2010 from MD 4425 ft to 7572 ft. with 77, 538 bbls of slickwater and 2.84 million lbs 20/40 sand, 241,812 lbs 30/50 sand and 423,277 40/70 sand pumped over 11 stages
- Test Results – 74 days of water production – 26,412 bbls and 46 days of oil production – 729 bbls (up to 30 b/d)

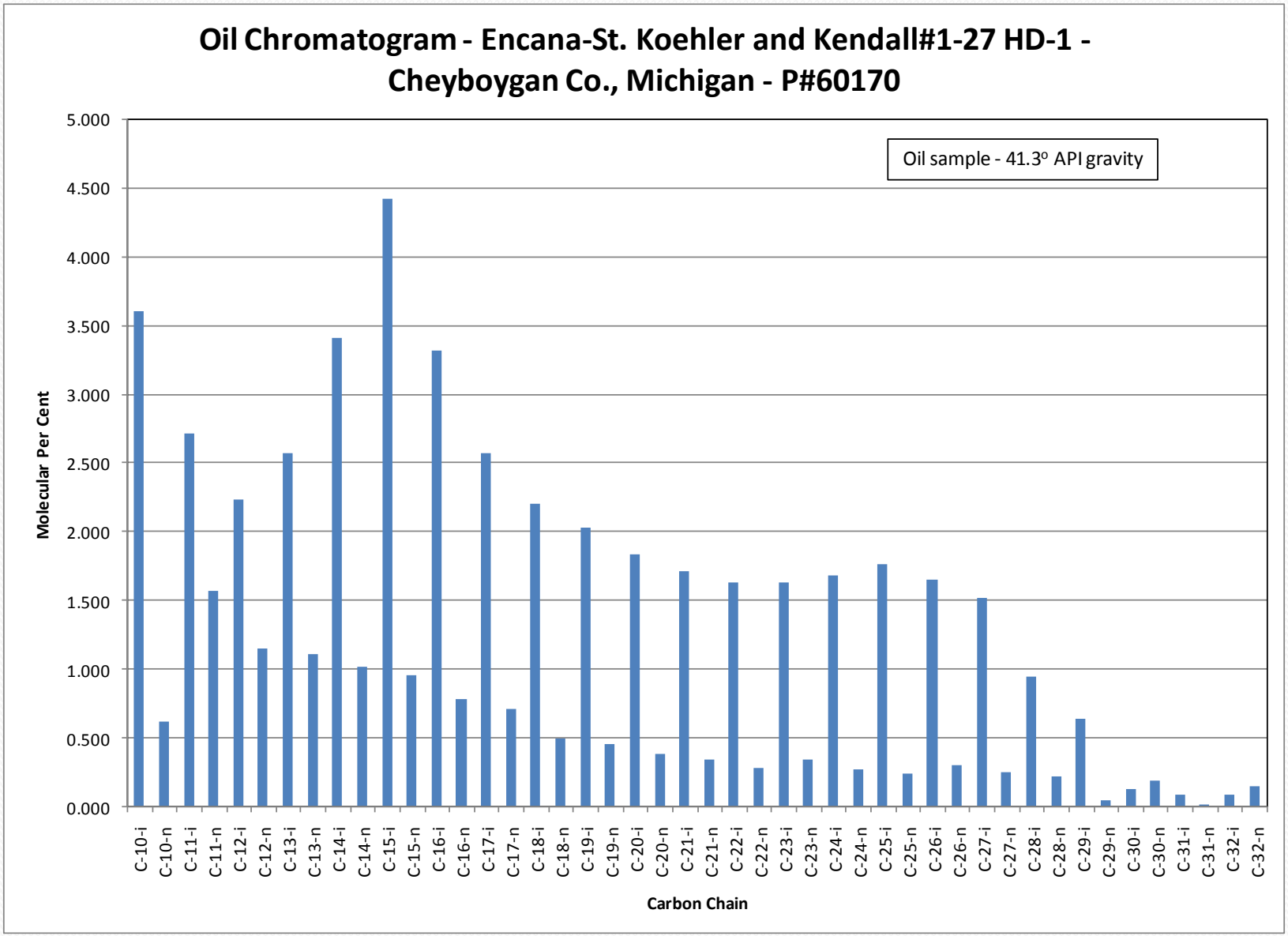
Encana-St. Koehler & Kendall #1-27 HD-1



Collingwood Oil from St Koehler & Kendall #1-27



Encana-St. Koehler & Kendall #1-27 HD-1



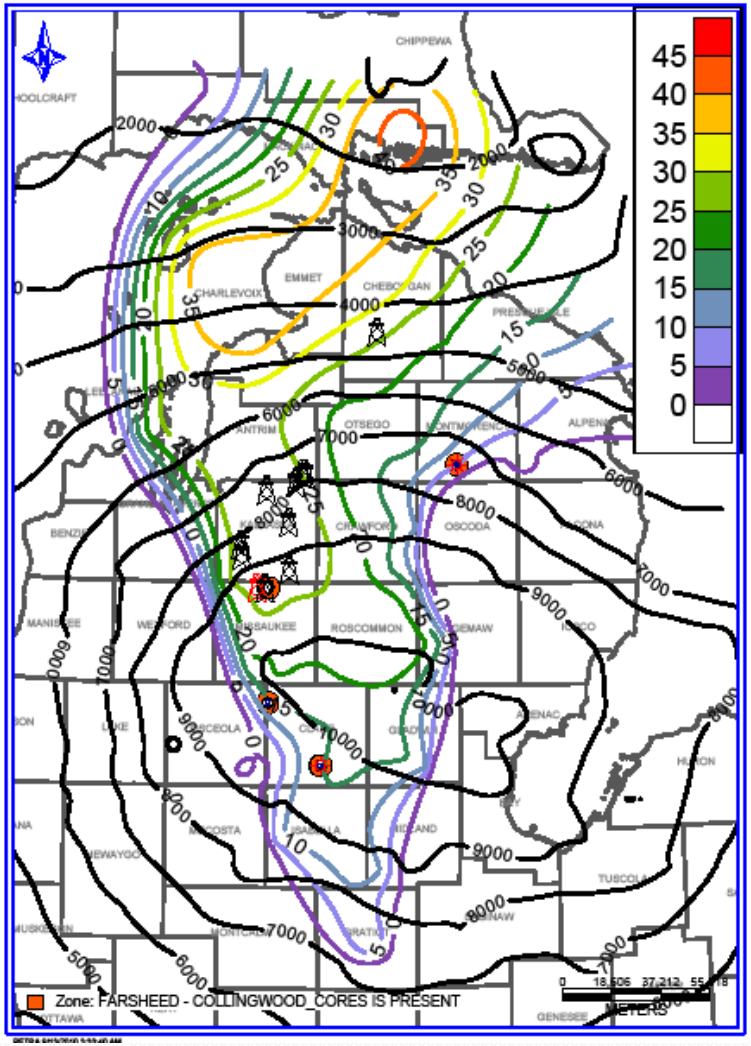
Other Collingwood Wells of Interest

- Antrim Co. - Mancelona Twp. 29N-5W
  - Chevron-St. Mancelona #1-28 – P#60137 – TD- 1/24/2011
  - Chevron-St. Mancelona #1-28 HD-1 – P#60271
  - Chevron-St. Mancelona #1-31 – P#60169
  - Chevron -8 other permit applications
- Cheboygan Co. – Tuscarora Twp. 35N-3W
  - Encana- St. Tuscarora #1-34 – P#60328
- Cheboygan Co. – Wilmot Twp. 33N-3W
  - Encana- St. Wilmot #1-21 – P#60305 – TD-6/12/2011
- Kalkaska Co. – Boardman Twp. 26N-8W
  - Chevron-Lucas #1-13 – P#60138 – TD-11/19/2010
  - Chevron-Lucas #1-13 HD-1 – P#60198 – TD-11/30/2010

Other Collingwood Wells of Interest

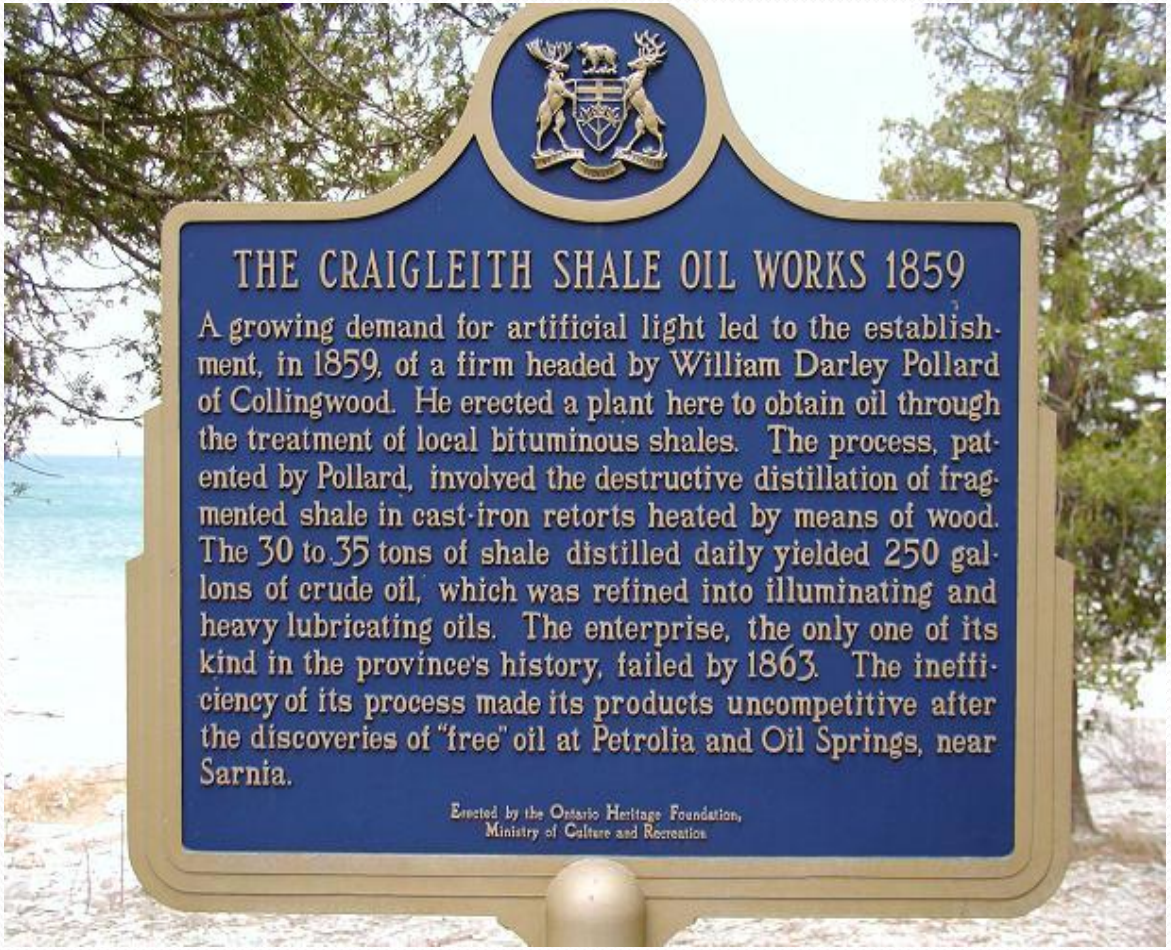
- Kalkaska Co. – Excelsior Twp. 27N-6W
  - Encana-St. Excelsior #1-24 – P#60183
  - Encana-St. Excelsior #1-13 HD-1 – P#60360 –TD-7/21/2011
- Kalkaska Co. – Garfield Twp. 27N-6W
  - O.I.L. Niagaran-St. Garfield #D4-13 – P#60176
- Kalkaska Co. – Oliver Twp. 26N-6W
  - Encana-St. Oliver #1-1 – P#60357 - Drilling
- Kalkaska Co. – Orange Twp. 26N-7W
  - Chevron-Ryckman #1-29 HD1 – P#60162
  - Chevron-Rowe #1-31 – P#60142
- Kalkaska Co. – Rapid River Twp. 28N-7W
  - Chevron-Gerber &Staley #1-12 – P#60186
- Missaukee Co.
  - Atlas-St. Pioneer #1-1 – P#60136
  - Atlas-St. Norwich #1-6 HD1 – P#60161

Collingwood Wells of Interest



Early History of the Collingwood Shale?

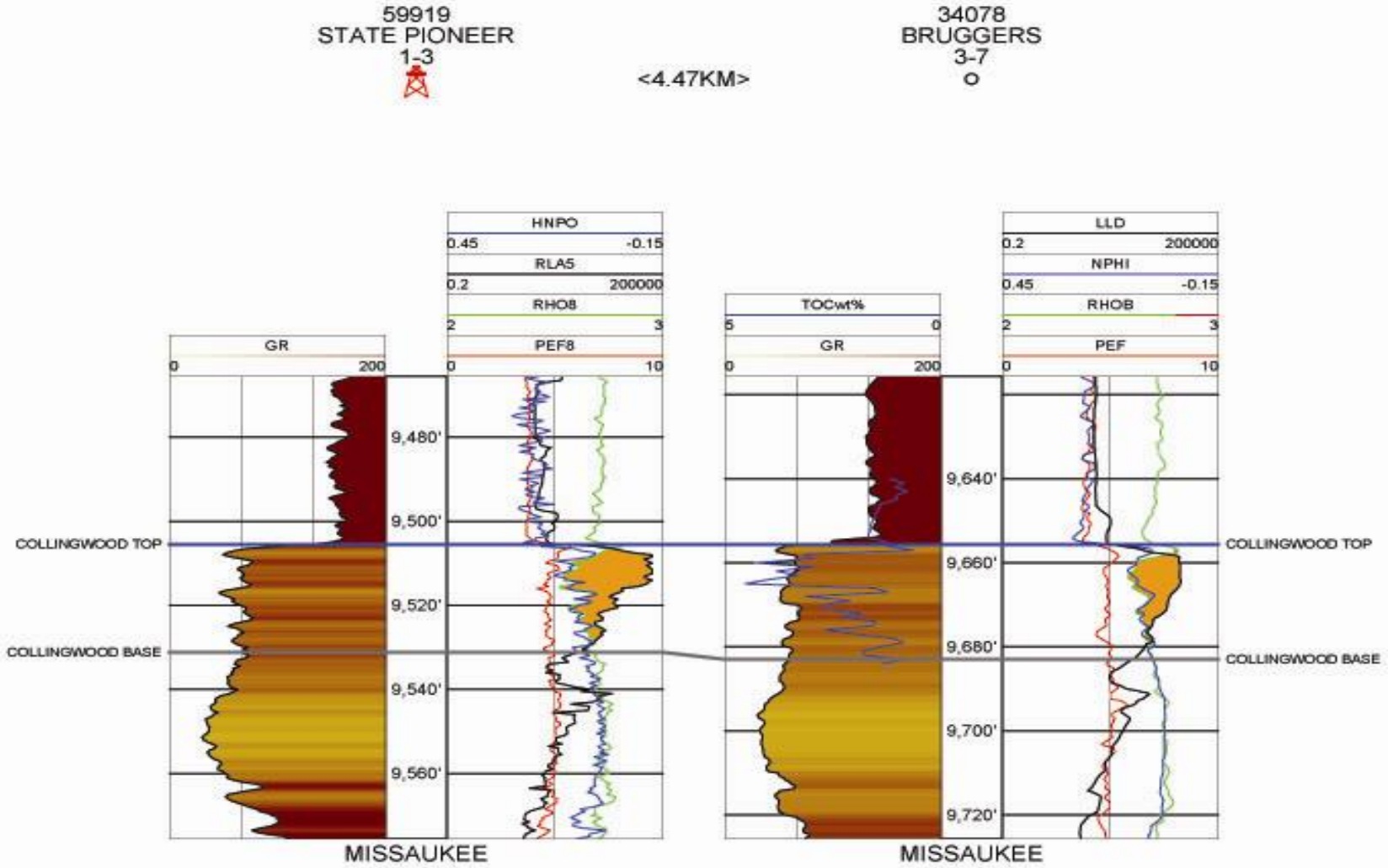
- Collingwood is named for the town of Collingwood, Ontario, Canada where these rocks outcrop and was surfaced mined and retorted as an oil shale from 1859 to 1863 near Craigleith, Ontario on Georgian Bay.



Collingwood Geology in the Michigan Basin

- Collingwood is the uppermost interval of the Trenton/Black River package of strata in the north-central part of the Michigan Basin
- Wireline log characteristics include:
  - Slightly increased Gamma Ray around 60 API units
  - Trenton GR about 30 API, Utica Shale GR about 140 API
  - Bulk Density lower than Trenton or Utica
  - Resistivity significantly higher than Trenton or Utica
- Rock type is very fine-grained organic-rich limestone grading downward into shelly limestone of Trenton

Log Properties Collingwood and Utica Shale



Rock Types in the Utica Shale and Collingwood

- Utica Shale is a true shale made primarily of compacted clay with minor silt and carbonate.
- Light to dark gray or occasionally black in color
- Organic content ranges from 0.5 % to 1.3 % by weight

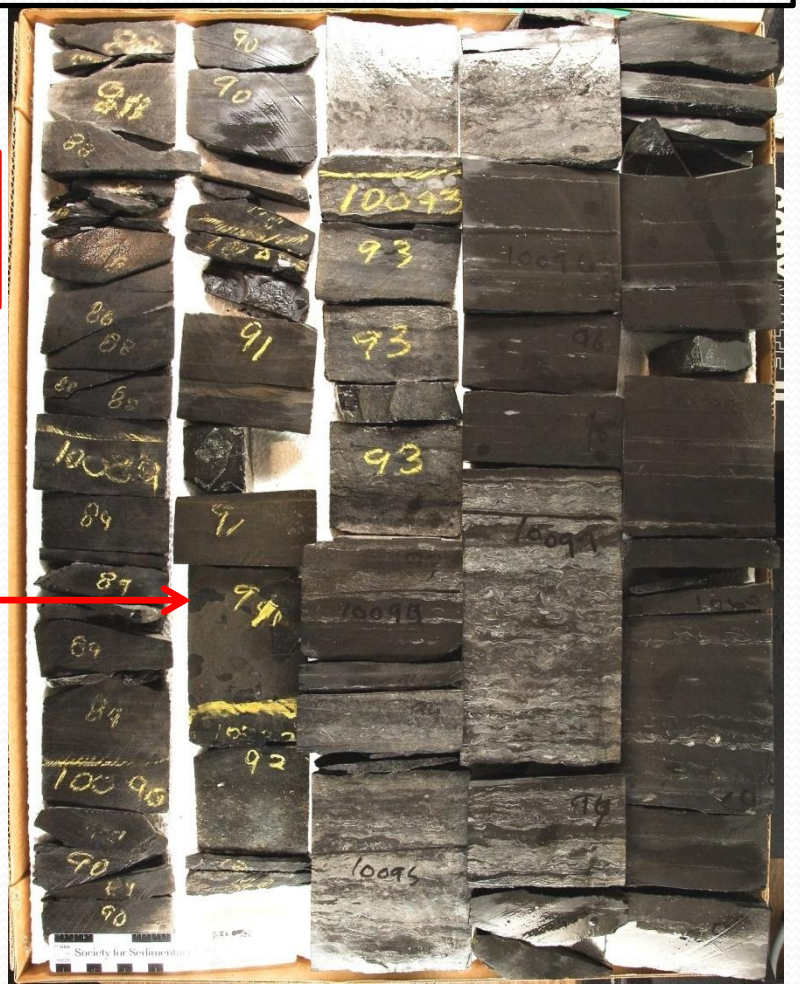
- Collingwood is a black, fine-grained limestone that is interbedded with shelly limestone of the upper Trenton
- Organic content ranges from 2.5 % to 6.0 % by weight

Collingwood and Utica Shale in Core from Central Michigan Basin

Utica Shale

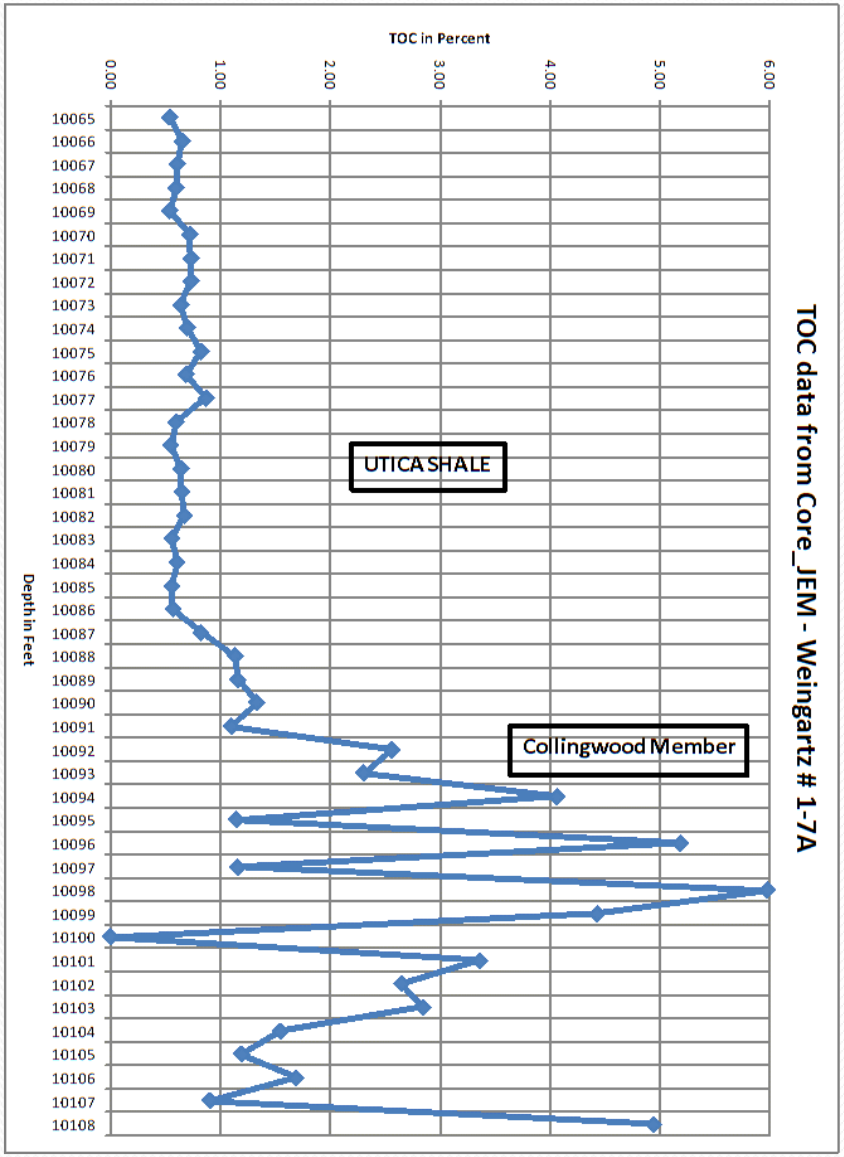
JEM-Weingartz #1-7A Core Clare Co., MI

Utica /Trenton/Collingwood Contact



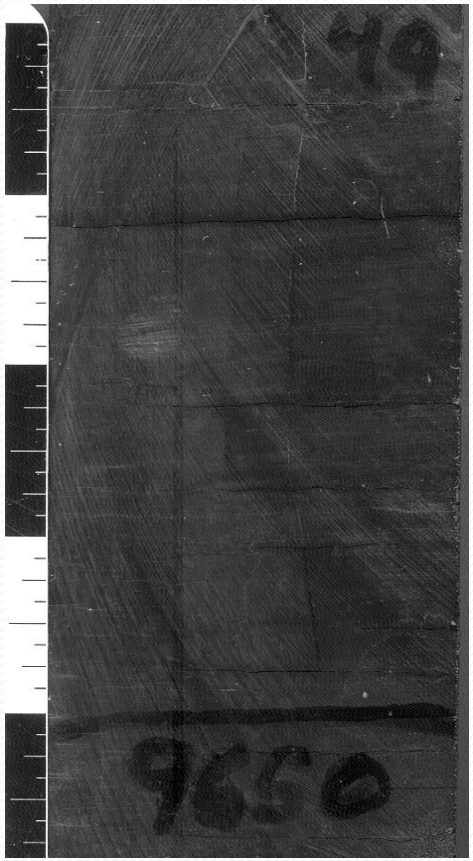
Hardground contact

TOC Content from Core in Clare Co.

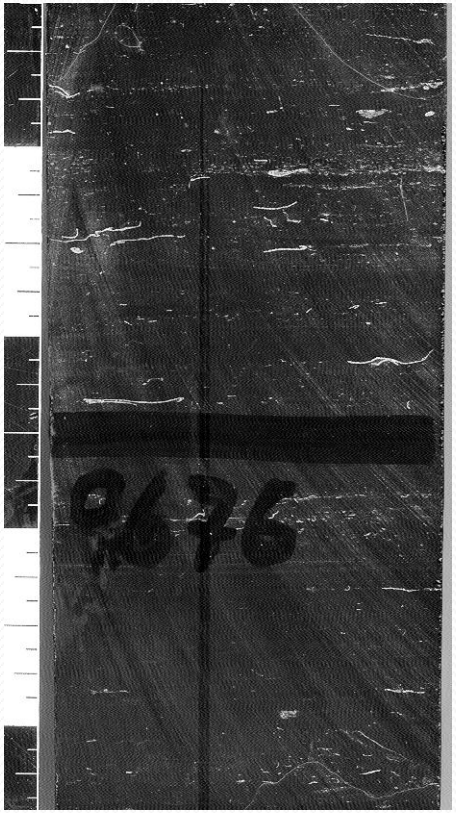


Core Samples from the Utica and Collingwood

JEM- Bruggers #3-7 Core
Missaukee Co., MI



Utica Shale



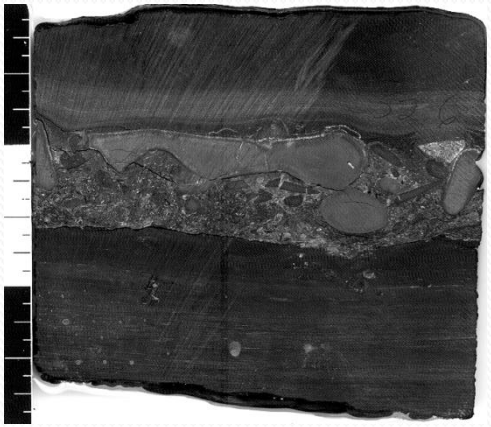
Collingwood

Shell-rich Collingwood

Collingwood (Trenton)-Utica Contact in Basin Center

Jem-Bruggers # 3-7
Missaukee Co.

Jem-Weingartz # 1-7A
Clare Co.



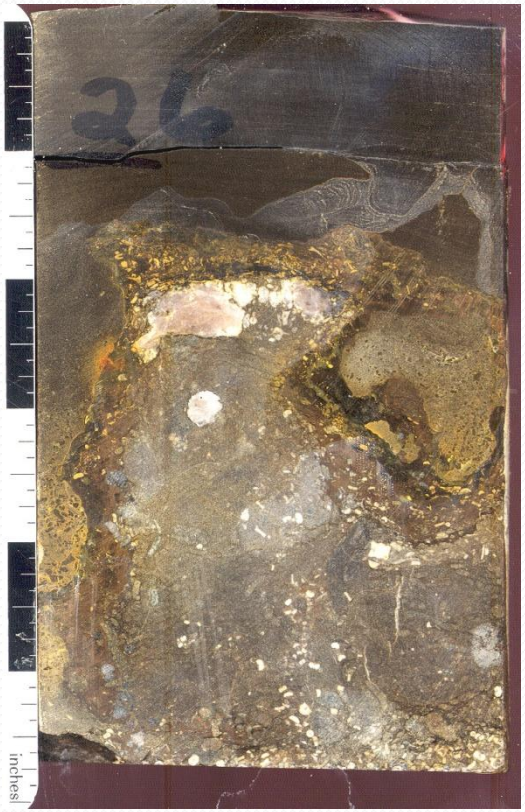
Shell St. Albert # 1-23
Missaukee Co.

Collingwood (Trenton)-Utica Contact on Basin Margin

Pyrite and phosphate-crusted hardground with 1-2 inches of relief locally

Trenton below is dolomitic (cap dolomite)
Utica above is gray, clay and silty shale

No Collingwood lithofacies is present in southern part of the basin

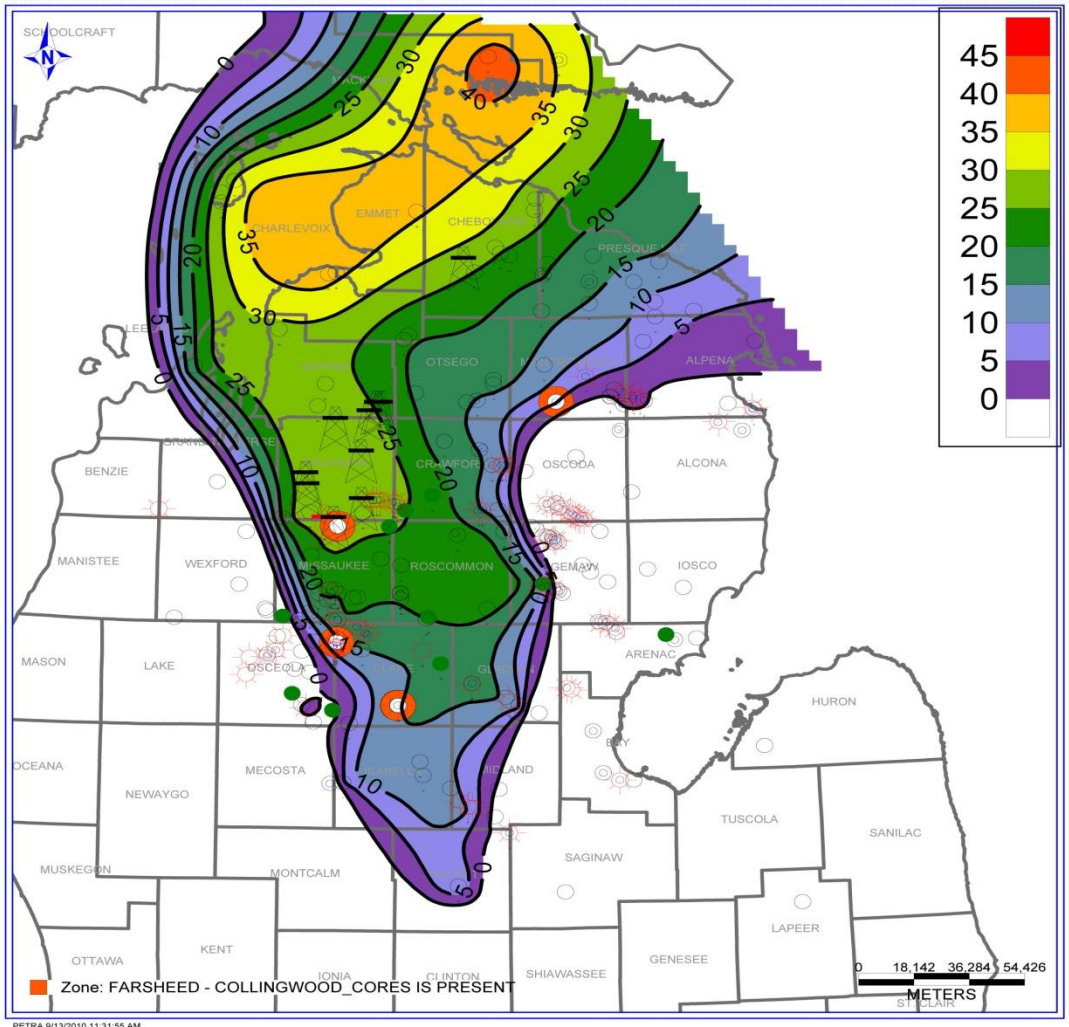


Marathon – Rzepke #1-27
Branch Co.

Extent and Thickness of Collingwood in Michigan Basin

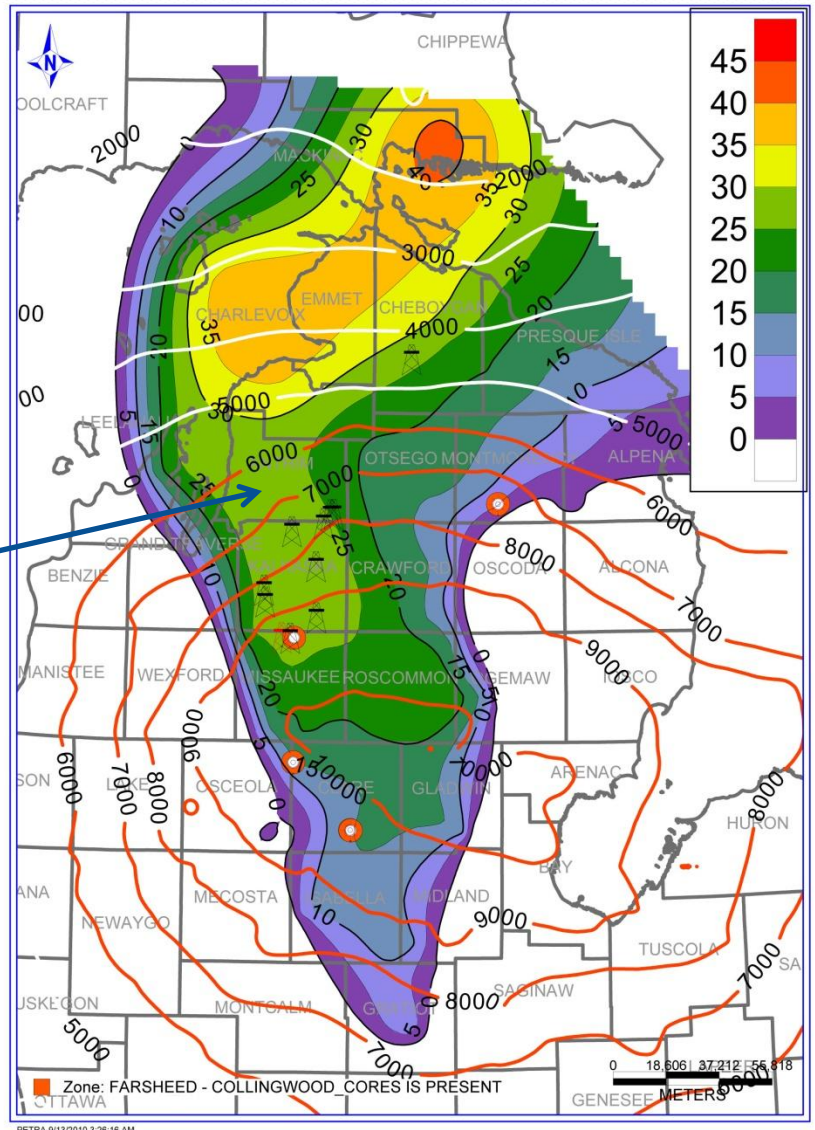
- Present only in North-Central portion of Basin
- Thickest near Straits of Mackinac
- Absent in Western, Eastern and Southern parts of Basin
- Maximum thickness of around 40 feet
- Approximately 25 feet thick in St. Pioneer #1-3 discovery well and the St. Koehler & Kendall #1-27 well

Extent and Thickness of Collingwood In Michigan Basin



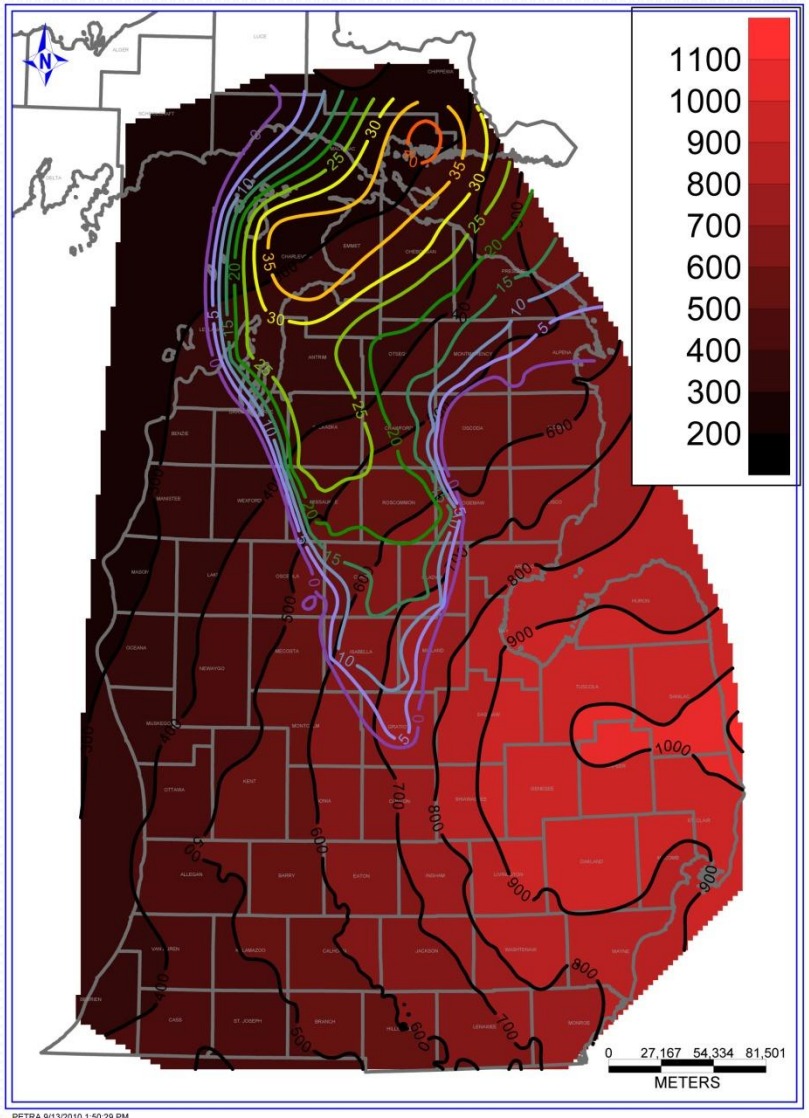
Depth to the Collingwood

Estimated Oil/Gas Window Boundary

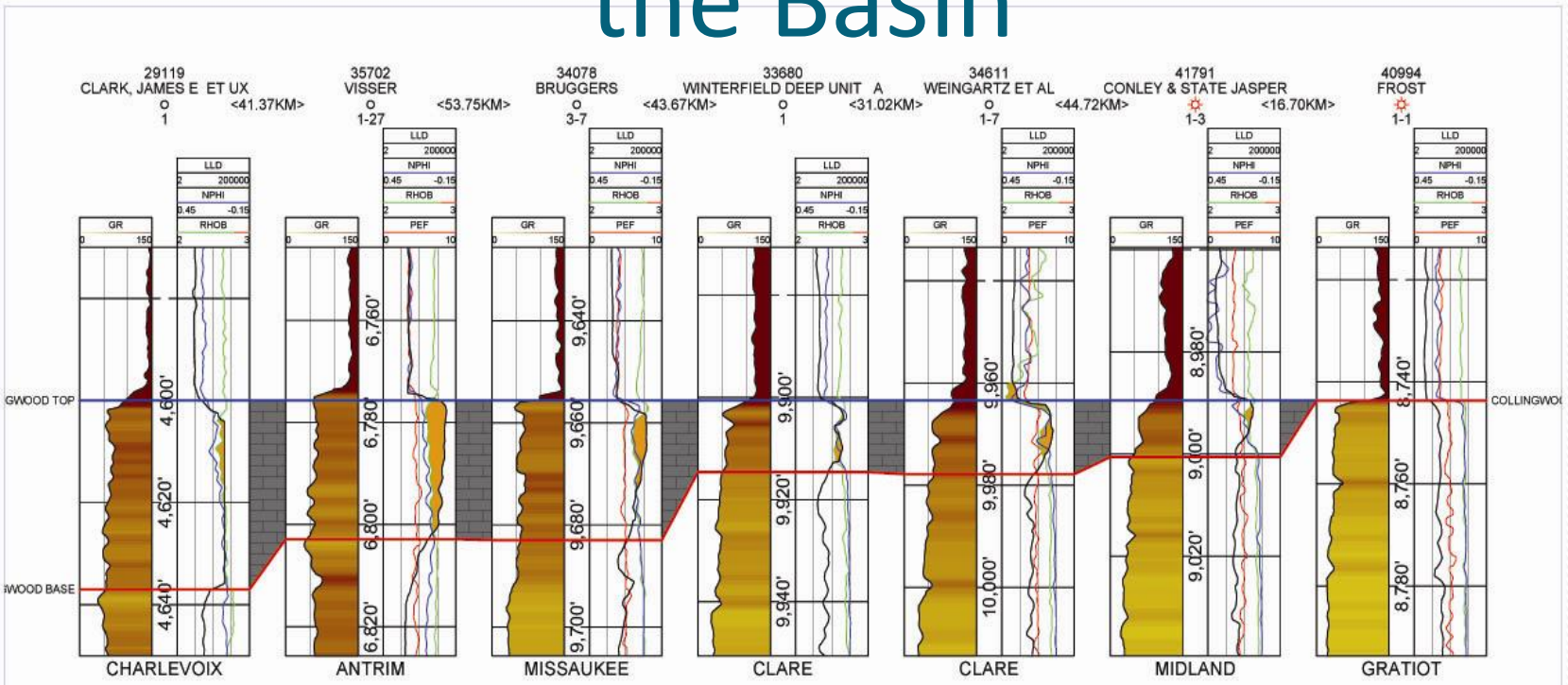


Trenton/Collingwood Isopach Relationships

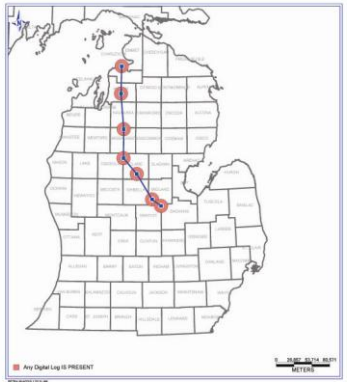
- Trenton/ Black River thick in SE Michigan
- Collingwood thick in North Central Michigan



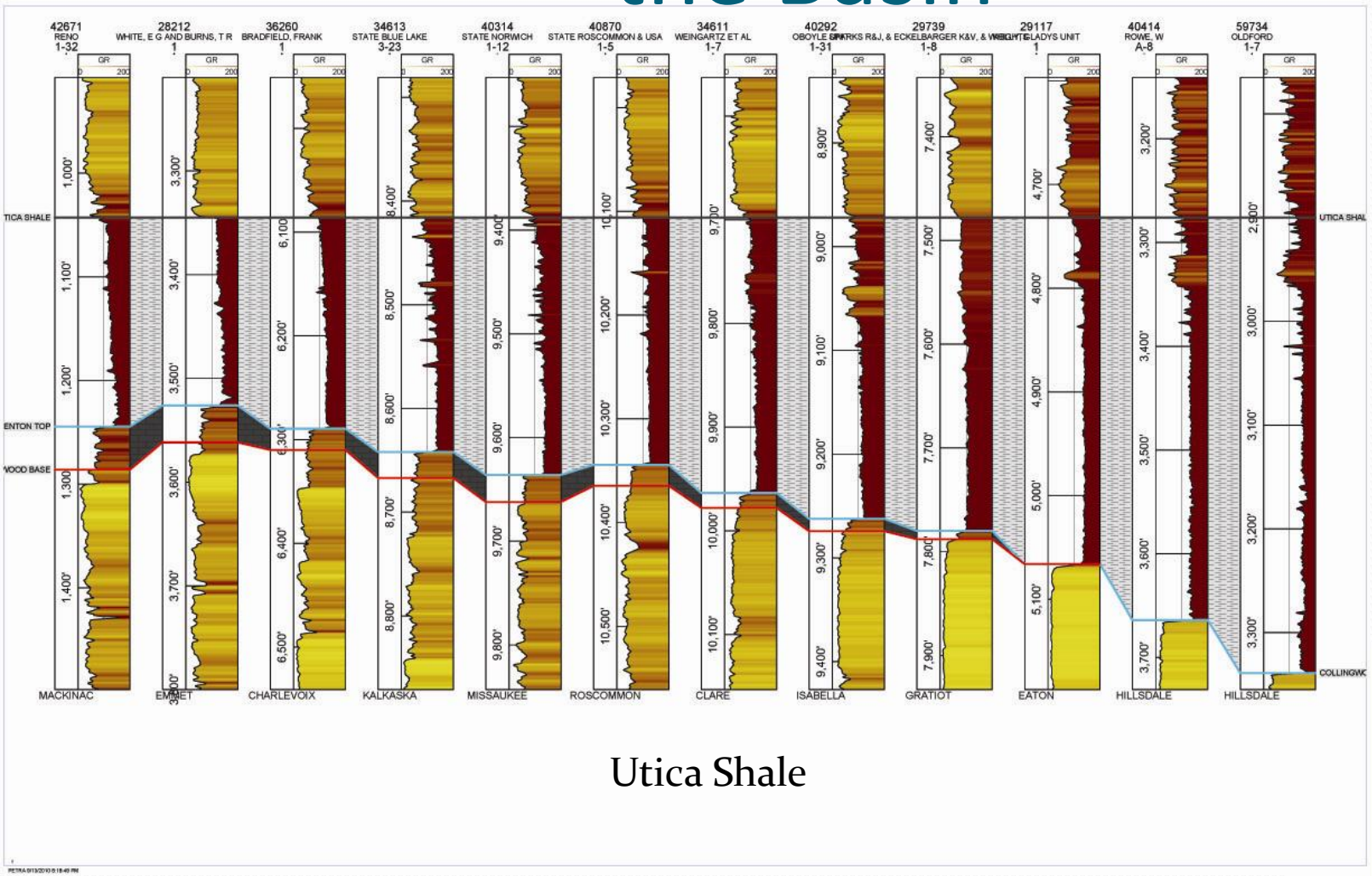
Wireline Log Cross-Sections across the Basin



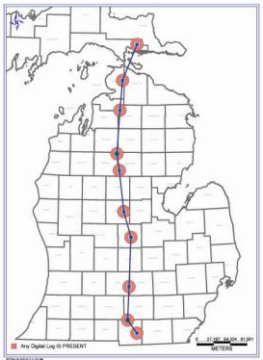
Collingwood Member of Upper Trenton
Log footage intervals – 20 ft.



Wireline Log Cross-Sections across the Basin



Utica Shale



Summary and Observations

- Collingwood and Utica Shale have become an important zone of interest in the Michigan Basin, and attracting NEW players to Michigan.
- The Collingwood is an organic-rich fine grained limestone, whereas, the Utica Shale is a true shale.
- The Collingwood is restricted to the North-Central part of the Michigan Basin, but the Utica Shale is present through out the Basin.
- Greatest Collingwood thickness is around 40 feet, but thins to West, East and South.
- Utica Shale thickens from 200 ft in the north to 400 feet in the south of the Basin.

Summary and Observations

- Organic content of the Collingwood is 2 to 4 times that of the Utica Shale.
- Collingwood potential development area well-defined by existing wireline log data
- Exploration depth for Collingwood from 7000 to 10,000 feet in gas window, oil window in shallower areas apparently confirmed by St Koehler and Kendall # 1-27 well in Cheboygan Co. on into outcrop area in Canada.
- Utica Shale potential currently unknown due to lack of data, but may be quite variable throughout the Basin.