[PS]Subsurface Analysis of Tripolitic Chert in Northwest Arkansas*

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Search and Discovery Article #51204 (2015)**
Posted December 14, 2015

*Adopted from poster presentation given at AAPG Mid-Continent Section meeting in Tulsa, Oklahoma, October 4-6, 2015

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Abstract

Over the past 70 years, the Mississippian strata of NW Arkansas have been studied in great detail by the faculty and students of the University of Arkansas. The current project is subsurface analysis of the distribution of tripolitic chert through well log analysis concentrated in the southern half of a 4,000 square mile mapping area. The University of Arkansas is located on the escarpment between the Boston Mountains and the Salem Plateau where a surface occurrence of Mississippian age rock allows for access to outcrops in close proximity to subsurface Mississippian in gas wells across NW Arkansas. These newly acquired well logs have been marked in Google Earth and integrated into an outcrop Google Earth Database. My work relates outcrops to shallow wells and their corresponding wireline data characterizing the Mississippian system and specifically focusing on occurrences of tripolitic chert. Further research will employ quantitative methods to facilitate the correlation of surface features with subsurface features. These methods will include well log correlation in association with shallow seismic, ground penetrating radar, and surface conductivity surveys.

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1 STUDY AREA

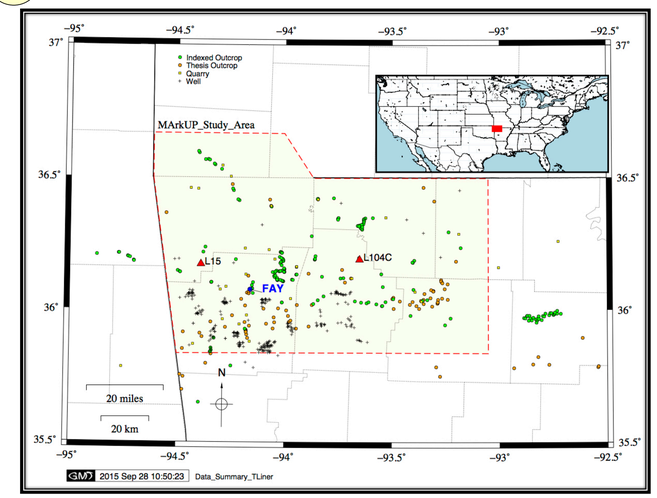
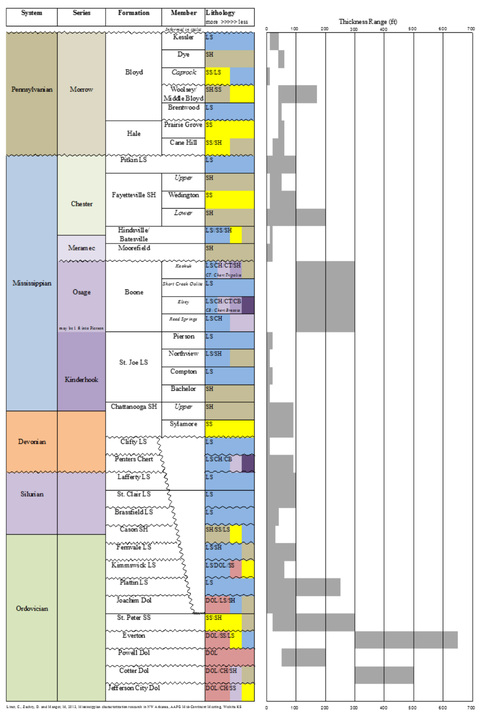


Figure 1: All data points collected by the MArkUP research group to date. Excludes EM31 conductivity, GPR, and near surface refraction survey locations.

2 NW ARKANSAS STRATIGRAPIC COLUMN



3 WELL LOG ANALYSIS

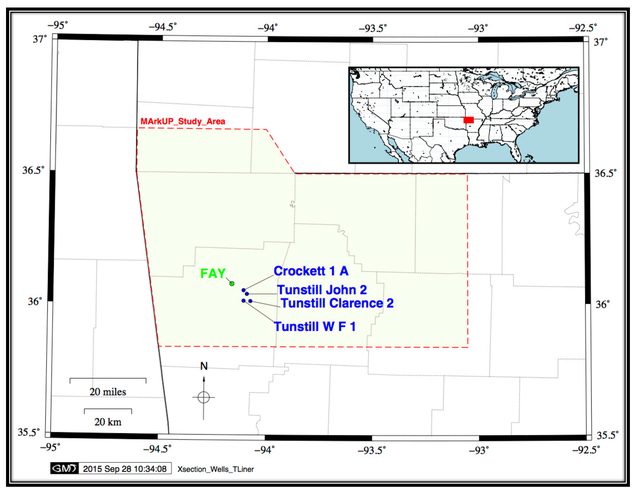


Figure 3: *The locations of four wells currently being studied in the research area.*
Crockett 1 A: *Permit No: 32539 API: 03143102880000 Sec-Town-Range: 24-16N-30W*
Tunstill John 2: *Permit No: 31259 API: 03143101590000 Sec-Town-Range: 30-16N-29W*
Tunstill W F 1: *Permit No: 31258 API: 03143101580000 Sec-Town-Range: 31-16N-29W*
Tunstill Clarence 2: *Permit No: 31507 API: 03143101720000 Sec-Town-Range: 32-16N-29W*

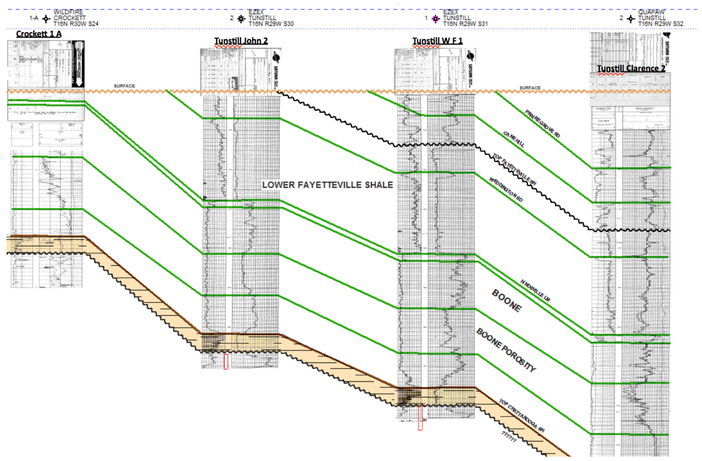


Figure 4: Cross section created using logs from 4 *wells located in the Baldwin gas field of Washington County AR. The cross section trace for these wells is labeled #2 in figure 5.*
Crockett 1 A: *Dry gas well located at 24-16N-30N that was completed 19860717. TD= 500ft Top Boone Porosity= 30ft Top Chattenooga= 340ft*
Tunstill John 2: *Gas well located at 30-16N-29W completed 19850417 with production from Sylamore Sand lasting from 19850515 to 20040722. TD= 705ft, Top Weddington= 40ft, Top Hindsville= 275ft, Top Boone= 290ft, Top Boone Porosity= 420ft, Top Chatenooga= 620ft*
Tunstill W F 1: *Gas well located at 32-16N-29W completed 19850508 with production from the Sylamore Sand lasting from 19850515 to present. TD= 860ft ,Top Weddington= 200ft, Top Hindsville= 420ft, Top Boone= 460ft, Top Chatenooga= 770ft*
Tunstill Clarence 2: *Is a dry gas well located at 31-16N-29W that was completed 19851021. TD= 1054f, Top Pgrove= 100ft, Top Canehill= 180ft, Top Fayetteville= 250ft, Top Weddington= 325ft, Top Hindsville= 520ft, Top Boone= 540ft, Top Chatenooga= 860ft*

4 FUTURE LOG ANALYSIS

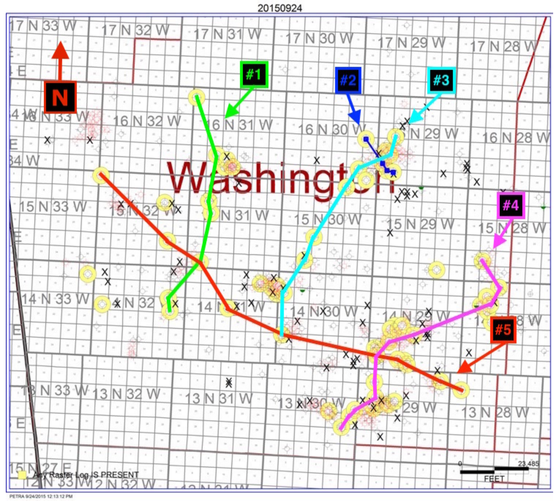


Figure 5: Petra basemap annotated with cross section traces proposed for future study. The blue trace labled #2 represents the cross section in figure 4. Trace #1= [7 wells] Trace #2= [4 wells] Trace #3= [8 wells] Trace #4= [10 wells] Trace #5= [9 wells]

5 OUTCROP ANALYSIS

Figure 6: *Increasing the resolution at which the mapping area is seen is one of the key goals of MArkUP. To achieve this goal the surface geology of the area must be studied and the results of these studies compared to other data such as well logs and seismic data. This process is the backbone of the MArkUP project since new data is crucial to increasing the resolution at which the Mississippian can be viewed. At present ~200 new Mississippian outcrops have been discovered and documented within the mapping area.*

8 ACKNOWLEDGEMENTS

King, M.E., King, J.T., and Boss, S.K., 2001, Bedrock Geology of Fayetteville Quadrangle, Washington County, Arkansas: Journal of the Arkansas Academy of Science, v.55, p.86-96.

Adams, G.I., and E.O., Ulrich. 1905, Description of the Fayetteville Quadrangle: United States Geological Survey, Geologic Atlas of the United States, Folio No. 119, 6pp.

Shelby, P.R., 1986, Depositional History of the St. Joe and Boone Formations in Northern Arkansas: Proceeding Arkansas Academy of Science, vol. xxxx.

Manger, W.L., 2014, Understanding the Mississippian System in the southern Midcontinent, Arkansas, Missouri and Oklahoma; a historical overview: Geological Society of America, Abstracts with Programs, 46(1):2.

6 TRIPOLITIC CHERT

KINDERHOOKIAN–OSAGEAN BOUNDARY → ***[Northview-Pierson Contact]***
1) Or within 1st foot of Pierson

TST → ***[Bachelor, Compton, Northview, and Pierson Formations]***
1) The St Joe is considered condensed within the study area.

MFI → ***[Reed Spring Formation][Lower Boone Formation]***
1) Consists of black to dark grey penecontemporaneous chert which is characterized by a lack of macrofossils, shrinkage fractures, and a low carbonate content.

HST/RST → ***[Elsey][Burlington-Keokuk][Upper Boone Formation]***
1) Consists of later diagenetic chert that is white to cream in color.
2) Replacement and silification are evident along the limestone bedding planes.
3) Usually Fossiliferous with a high carbonate content.
4) Chert is absent from youngest sections of the RST.

TRANSISTION ZONE →
There is an apparent transition zone consisting of white nodular chert between the black penecontemporaneous chert and the white later diagenetic chert. This transition zone is most likely the Elsey Formation from the Missouri Lithostratigraphy. It is believed that by the start of the chesterian series the later diagenetic chert was already in place.

NOT ENOUGH CARBONATE→
The Reeds Spring *[Lower Boone][MFI]* and the Elsey Formation *[Transition Zone][MFI][HST][Upper Boone]* do not have the carbonate content required to produce tripolitic chert.

In the Lower Mississippian the Upper Boone Formation *[Elsey][Burlington-Keokuk][HST/RST]* is the only unit with a carbonate content high enough to facilitate the formation of tripolitic chert.

UNCONFINED AQUIFER →
In order to better understand the formation of Tripolitic Chert it is best to think of it as a Paleozoic unconfined aquifer system.

Phreatic Zone = The low porosity and low permeability of the Reeds Spring *[Lower Boone]* functions as an aquaclude/aquatard and the Phreatic Zone rests on top of this.

PaleoWater Table = The paleo-water table is represented by the top of the Tripolitic zone. *[This is the contact between the Phreatic and Vandose zones]*

Vandose Zone = The Vandose Zone is represented by the NonTripolitic sections of the Elsey. *[Burlington-Keokuk] [Upper Boone] [The formation of multiple intervals of tripolitic chert above the paleowater table would be facilitated in this setting]*

7 WORK PLAN

Thesis studies:
- Read through the numerous thesis that pertain to the Mississippian.
- Document measured section locations, strat columns, and described outcrops.
- Locate and mark relevant data in Google Earth.

Outcrop Studies:
- Drive around searching for undocumented outcrops.
- Take photos and detailed notes
- Integrate acquired info into Google Earth

Well Log Studies:
- Pull relevant logs off of Arkansas Geological Survey website.
- Well log correlation.

Well Core Studies:
- Find relevant cores on Arkansas Geological Survey website.
- Evaluate the quality of the core.
- Well core correlation/record descriptive information