Abstract

The Midwest Geological Sequestration Consortium (MGSC), lead by the Illinois State Geological Survey, Archer Daniels Midland (ADM). Schlumberger Carbon Services, and the U.S. Department of Energy’s National Energy Technology Laboratory (DOE), is implementing a large-scale study to confirm that carbon dioxide (CO₂) can be stored or sequestered permanently in the Cambrian Mount Simon Formation. Studies of other deep rock formations including the Cambrian Knox Group are ongoing to evaluate their geology and storage potential.

In 2009 and 2010, Schlumberger Carbon Services drilled two wells (injection and monitoring) down to the Precambrian basement at a depth of approximately 7,000 feet. During drilling through the Potosi Dolomite in the Knox Group, circulation was lost and bit drops occurred on both wells suggesting a zone of cavernous porosity. In one of the wells, approximately 30 feet of core was cut down to this lost circulation zone.

Regional studies of the Potosi Dolomite suggest this lost circulation zone may translate across the Illinois Basin implying paleo-karstification because of a regional unconformity. However, petrographic analyses show that porosity enhancement of the Potosi Dolomite is related to multiple events of dolomitization along fractures and specified facies. Although, later diagenetic events such as quartz precipitation occludes porosity and has been shown to translate across the Illinois Basin. Currently, petrographic and geochemical analyses are being completed to determine the paragenesis and controls on cavernous porosity development in the Potosi Dolomite throughout the Illinois Basin. The Potosi Dolomite may be a reliable and excellent reservoir for CO₂ sequestration and/or wastewater disposal throughout the Illinois Basin.
Reference

Controls on Porosity Development and the Potential for CO$_2$ Sequestration or Waste Water Disposal in the Cambrian Potosi Dolomite (Knox Group): Illinois Basin

Eastern Section AAPG, Sept. 25, 2012

Jared T. Freiburg
and
Hannes E. Leetaru
Introduction

• Two holes at the Illinois Basin Decatur Project (IBDP), a Carbon Capture Sequestration (CCS) Project, have penetrated the Precambrian basement.

• Significant lost circulation and bit drops were encountered during drilling through the Upper Cambrian Potosi Dolomite.

• First core cut and preserved in the Potosi Dolomite from the Illinois Basin
Questions

• How extensive is cavernous porosity in the Potosi Dolomite?

• What are the geologic controls on porosity development in the Potosi; stratigraphic, structural?

• Is the Knox Unconformity a major control on cavernous porosity development in the Potosi?
Stratigraphy with Potential Seals and Sinks in the Illinois Basin

- Knox Unconformity
  - Glenwood St. Peter Ss.
  - Shakopee New Richmond Oneota
  - Eminence
  - Potosi

Potential Seal
Potential Sink
Coal Bed
Potential Sink and Seal
Cabot #2 Disposal Well, Douglas Co.
API# 120412122000

73 Million Gallons of Waste Injected Annually From 1976-1990

Lost Circulation

Lost Circulation
CCS-1 Well, Macon Co.
API# 121152341500
Verification-1 Well, Macon Co.
API# 121152346000

- Lost Circulation Took 236 Bbls
- Lost Circulation Took 372 Bbls
- Lost Circulation

Cored
4513-4544
Fullbore Formation MicroImager Log (FMI)

Lost Circulation Zone Solution Cavities
Digitate Stromatolites; Solution Enhanced Fenestral Porosity

Howe, 1966
Digitate Stromatolite Colonies, Missouri

Oneota

Potosi
Dolomitized Peloidal Microbialites

- Microbial Carbonate Building Blocks
Collapse Breccia

- Sucrosic Dolomite Matrix
CT-Scan Collapse Breccia
CT-Scan Collapse Breccia
CT-Scan Collapse Breccia
CT-Scan Collapse Breccia
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CT-Scan Collapse Breccia

PQ5000
Ex: 15577
Se: 7800/1
Im: 54/124
Ax: S754.6
512 x 512
Mag: 1.0x
120.0 kV
150.0 mA
2.0 mm/0.0:1
Tilt: 0.0
-8.5 s
W:1634 L:1855

Terratek
810690
4549.4
Acc:
2010 Dec 20

DFOV: 13.3 x 14.0cm
CT-Scan Collapse Breccia
CT-Scan Collapse Breccia

PQ5000
Ex: 15577
Se: 7800/1
Im: 56/124
Ax: S758.6

512 x 512
Mag: 1.0x

120.0 kV
150.0 mA
2.0 mm/0.0:1
Tilt: 0.0
-8.5 s
W:1634 L:1855

Terratek
810690
4549.4

Acc: 2010 Dec 20

DFOV: 13.3 x 14.0cm
CT-Scan Collapse Breccia
CT-Scan Collapse Breccia

PQ5000
Ex: 15577
Se: 7800/1
Im: 58/124
Ax: S762.6
512 x 512
Mag: 1.0x
120.0 kV
150.0 mA
2.0 mm/0.0:1
Tilt: 0.0
-8.5 s
W: 1634 L: 1855
DFOV: 13.3 x 14.0cm

Terratek
810690
4549.4
Acc:
2010 Dec 20

L
Fractures and Vugs w/ Late Dolomite Cements
Dolomite-lined Vugs

Plane-Light

Cathodoluminescence
Quartz-Lined Solution Enhanced Vugs

Cathodoluminescence
### Potosi Paragenetic Sequence

#### Relative Timing

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**Late Stage Hydrothermal Diagenesis or Unconformity?**
Widespread Diagenetic Chalcedony and Quartz in the Potosi Arcadia, WI

Unconformity...

Old Mines, MO

Decatur, IL
Conclusions

- Cavernous porosity appears to be a common porosity within the Potosi Dolomite in the Illinois Basin suggesting a relationship to karst processes during an unconformity.

- Algal beds are diagenetically altered via partial or complete dissolution of digitate stromatolites offering vuggy or fenestral porosity.

- Fractures and collapse breccias are common with typical late-stage dolomite cements and sometimes sucrosic dolomite matrixes.

- Chalcedony and mega-quartz line vugs and cavities and are a common diagenetic event in the Potosi across the Illinois Basin and onto the Ozark Uplift and Wisconsin Arch further suggesting a relationship to unconformity.
Thank You!

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