Contributions by Energy and Minerals Section, Water Section, and Geologic Hazards Section

Brandon Nuttall, Speaker

East Ky SPE, 18-Jan-2018
Permits Issued, 1948 to 2017

- 1948: 34
- 1983: 6,795
- 2017: 161

Change
KRS 353

Percent change
Distribution of New Permits

- **Oil**
- **Gas**
- **Class II**
- **Horizontal**

Western Coal Field
Eastern Coal Field
Kentucky Oil and Natural Gas Production
Producing Counties

2016 Production
- No production
- Oil
- Gas
- Combined oil and gas

Kentucky Geological Survey
Good News?

17-Jan
$3.19
KGS Carbon Storage Program: Carter County Research Well

- Operations
  - Drilled to Precambrian basement, TD 4,835 ft
  - Cut 454 ft of cores
- Step-rate tests
  - Rose Run Sand
  - Copper Ridge B zone
  - Maryville-Basal Sands
- Frac gradients all ~0.60 psi/ft
- Final reports in prep
KGS Carbon Storage Program: Johnson County Research Well

- CO₂ enhanced gas recovery – not demonstrated
- CO₂ adsorption in organic shale
- Phase changes at shallow depths
- Final report in prep

Memory read-out gauge at 1,724 ft
Berea Consortium Project Update

- Public release: 1-May-2017
- Five presentations at 2017 AAPG Eastern Section
- Outside publications
  - Frontiers in Energy
  - Five additional in press
- KGS publication pending
• Source rocks similar to the Sunbury and Ohio shales
• Lateral and updip migration on the order of 5 to 50 miles
• Intergranular and secondary porosity important contributors to total porosity

Vitrinite Reflectance (VR₀)

Berea Consortium Findings

 Courtesy of C. Eble and P. Hackley
Production from Devonian Berea Horizontal Wells

Is there an optimal lateral length for Berea wells?
SEM Laboratory with Dept. of Earth & Env. Sciences

Berea SS, Ashland Hattie Neal 1, Lawrence Co.
MRCSP: Storage and Enhanced Gas Recovery for Organic Shale

- Marcellus maps
  - Structure, top & base
  - Contour: mean TOC (P50)
  - Isopach maps
    - Net thickness organic-rich TOC >= 4%
    - Net thickness organic-rich shale > 180 API
- Results
  - > 36 million acres
  - ≈ 1.8 billion acre-feet

Net GR >180 API
Red: 200’ plus
MRCSP: Storage and Enhanced Gas Recovery for Utica Shale

- **Approach**
  - Compile TOC & logs
  - Modeling
  - Storage assessment

- **Results**
  - Utica – assessment of TOC content models

![Residuals (Observed – Estimated)](image)
USGS-Funded Geochemical Data Preservation Project

• Data Types
  • Rock-Eval pyrolysis
  • Total organic carbon (TOC)
  • Natural gas composition and isotopes
  • GC graphs for oils (scans)
  • XRD data for shales

• Approach
  • Compile, categorize, and document reports
  • Data entry into searchable, standardized database
Origin, Transport and Accumulations of Geogenic Carcinogens

Geology and Health
• Radon
• Metals contamination

Dr. Bill Haneberg, Bethany Overfield, & Warren Anderson

AGU New Orleans-December, 2017
Geospatial Approaches to Epidemiology Short Course

Dr. Bill Haneberg, KGS
Dr. Jay Christian, Public Health
Meteorite Database and Story Map – completed 2017

KGS Meteorite Collection Database

Worldwide collection

kgs.uky.edu/storymap/meteorites/
Database of Meteorite Information

KGS Meteorite Collection Database
by Warren H. Anderson, Ethon S. Davis, Richard A. Smith

Burnwell

Download Photo

This stone fell through roof and porch in eastern Kentucky. It has a higher iron nickel content than most H group chondrites.


Meteorite Type: H-4 Ovillobrona chondrite (Meteorite Classification Chart)

Mass: 1.4 kg
Weight: 3.3 lb
Minerals Activity

• Public service
• Lebanon Quarry – black shale fires
• Website updates
  • Rocks and Minerals
  • Frac Sand
  • Update Minerals Database
Fracture ("frac") Sands in Kentucky

St. Peter (WI, Tier I)
- Rounded
- Sorted
- Few contaminants

Sharon (OH, Tier II)
- More angular
- Less well sorted
- More contaminants

Hardinsburg (KY)
- Angular
- Poorly sorted
- More contaminants

No study
Minerals and Geochemistry Map Service

Minerals cores included

kgs.uky.edu/kgsmap/KGSMineral/
Digital Earth Analysis Lab

- 2 dedicated workstations
- 80” ultra-HD touchscreen display
- High-speed internet connection
- 10 Tb server connected to workstations
- Point cloud, terrain modeling, remote sensing, digital photogrammetry, virtual mapping, and other advanced software
- LiDAR applications post-doc position
- UK-wide research connections
LiDAR for improved surficial geological mapping

Hammond (2017, KGS CR-7)
LiDAR for change detection and geohazard assessment

2012 LiDAR, Ohio River Valley

2007-2012 LiDAR Difference

New Landslide

Haneberg (2017, AGU)
LiDAR based machine learning for sinkhole delineation

Zhu & Pierskalla (2016, J. Hydrol.)
3D digital outcrop analog modeling and virtual mapping
Kentucky 3D Geology Project

• **Approach**
  • Create DB of subsurface geology horizons
  • Build web interface
  • Calculate depths on-the-fly, so data is always current

• **Results**
  • Project in initial design stages
Eastern Kentucky Microseismic Monitoring Project

**Approach**
- Deploy network in Rome Trough
- Monitor local-area earthquakes
- Model network sensitivity

**Results**
- 4 earthquakes in Rome Trough
- None near deep O&G wells or SWD wells.

*Increased rate of induced seismicity*
Observations Jun-15 to Jun-17:
• 27 (EKMMP) – 4 in Rome Trough
• 9 (USGS) – 0 in RT

Modeled sensitivity in RT:
• Nighttime = mag. 0.5 – 1.0
• Daytime = mag. 0.8 – 1.3
Well Sample and Core Library

- New station for core photography
- Optimizing image acquisition and throughput
Well Sample and Core Library

- Images will be available on web

Savage Zinc Hutson S-4
Devonian Ohio Shale
Correlation Chart

- Compiled by S. Greb
- 25” x 36” poster
- kgs.uky.edu/kgsweb/olops/pub/kgs/MCS211_12.pdf
Class II Salt Water Disposal and Injection Wells

- Primacy KyDOG
  - EPA granted KY Division O&G Class II UIC wells
  - Effective 21 March 2017
  - Records received from EPA Region 4 (110 boxes)
- KGS
  - Maintains web site
  - 158 SWD (71 active)
  - 2,948 ERI (800 active)

goo.gl/xQZ2QD
Oil and Gas Regulatory Review Workgroup

• KRS 211.893 – Established workgroup (2016)

• Effective June 29, CHFS:
  • KRS 211.862 – Definitions of NORM and TENORM
  • KRS 211.863 – Regulation of TENORM

• 805 KAR 1:060 Plugging
  • Conditions for downhole disposal of tubular goods, pipe scale, sludge

• 902 KAR 100:180 TENORM
  • Conditions for disposal of drill cuttings
  • Conditions for disposal of waste water

• All effective Dec. 7, 2017
• www.EUOGS.org
• May 7-8, 2016
• Clarion North Hotel, Lexington, Ky
• Abstracts due Jan. 26, 2018

• Program
  • Upstream – horizontal drilling, fracking
  • Midstream – compression, pipelines
  • Downstream – regulated utilities, petrochemicals