

Carbon Storage Core Characterization Efforts at NETL

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Research & Innovation Center

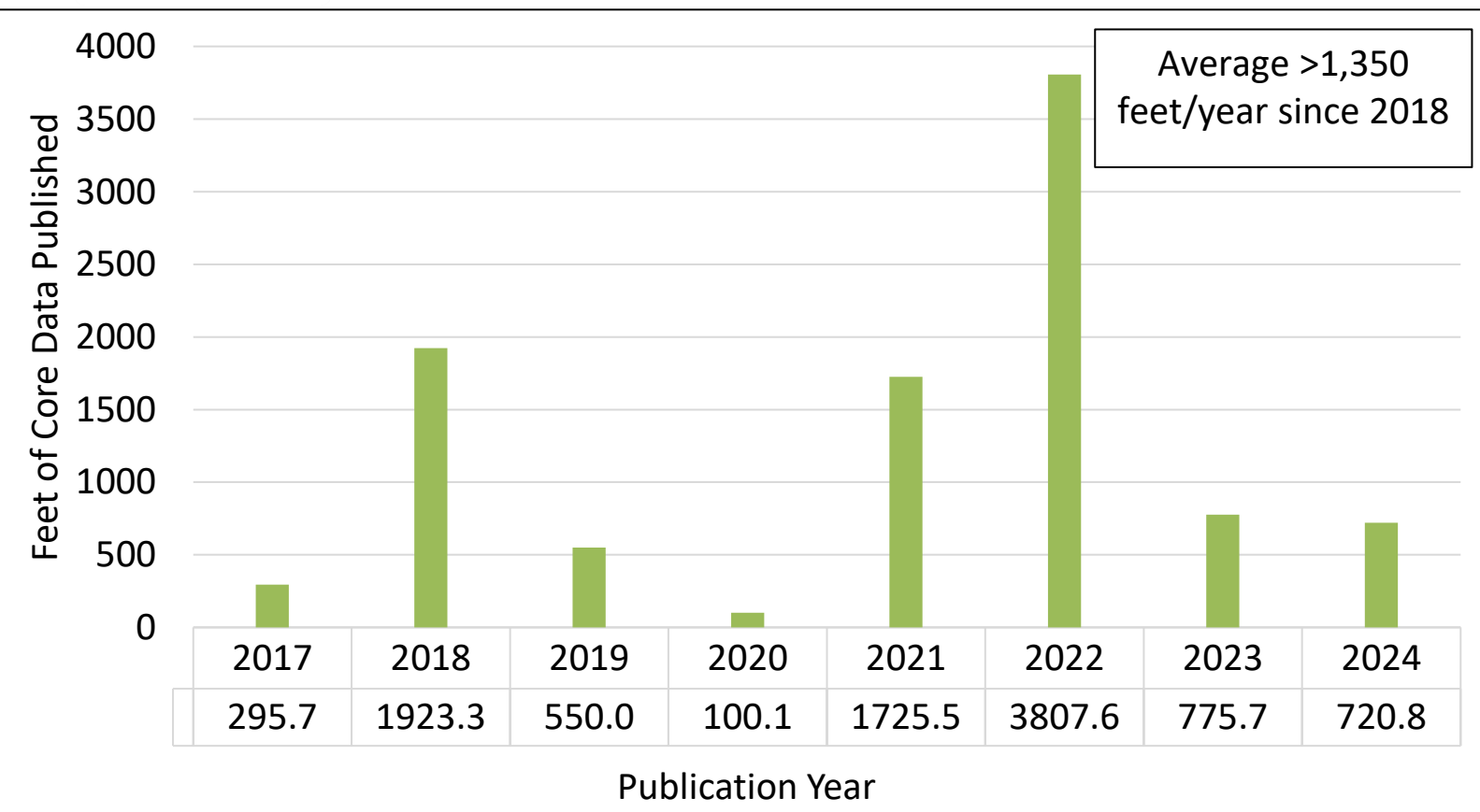
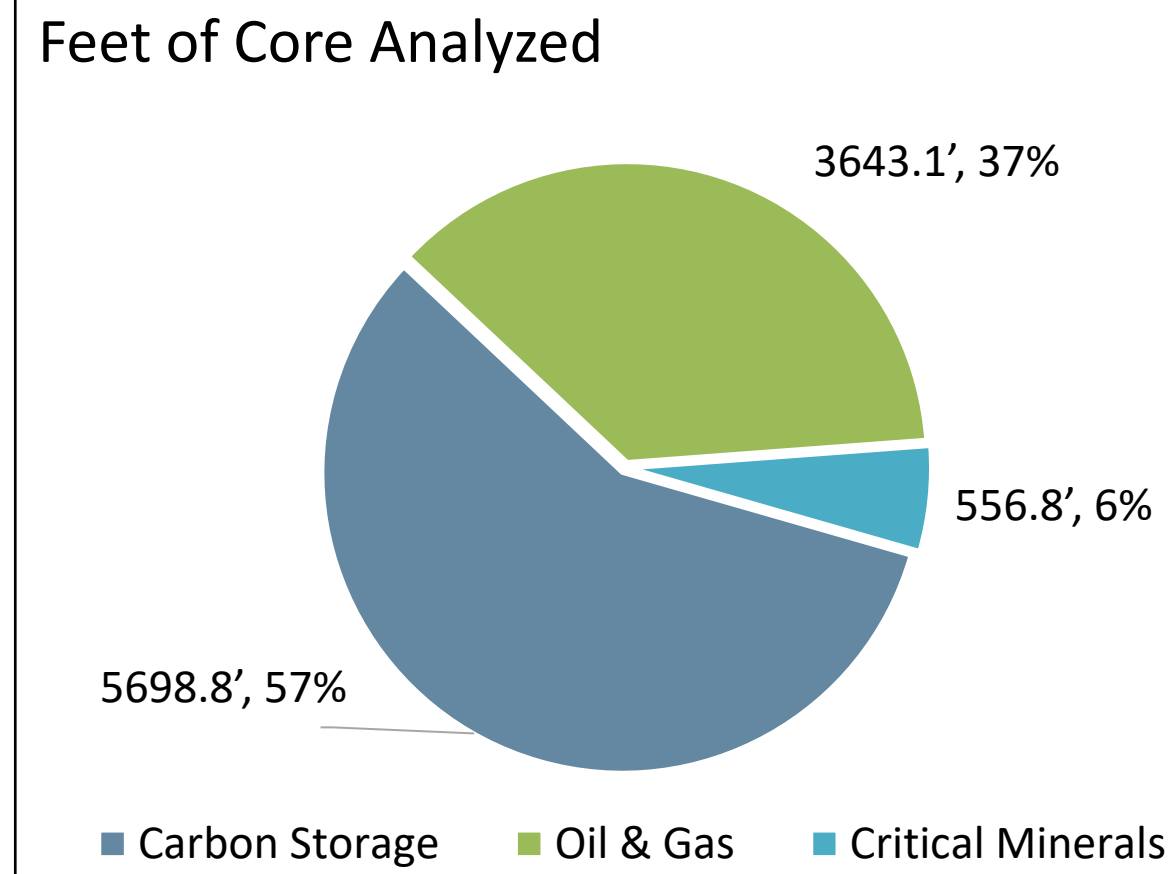
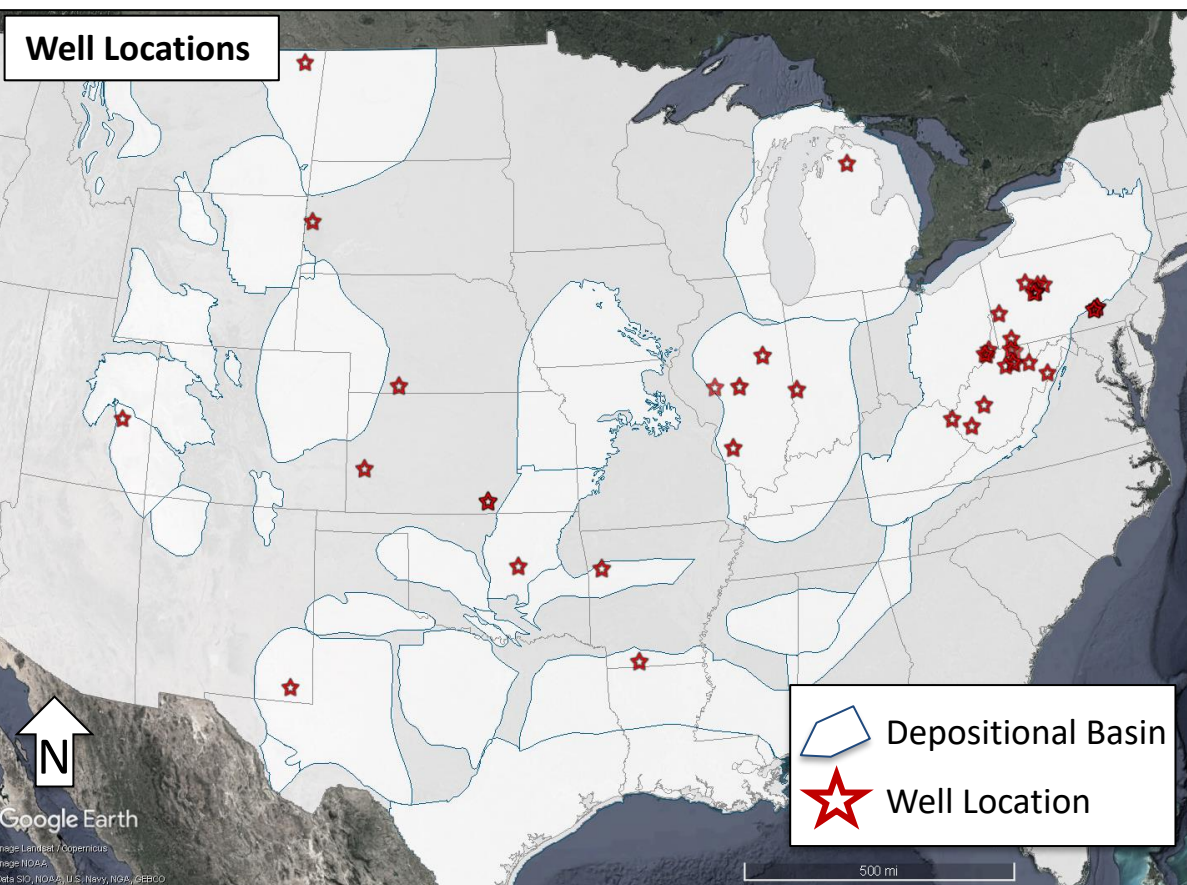


Abstract

The multi-scale computed tomography (CT) and core flow facility in the Geocharacterization Laboratory at NETL, Morgantown yields porosity, permeability, and fracture properties of rock core samples obtained from the subsurface while maintaining the integrity of the sample. Additionally, geophysical bulk rock properties are analyzed with the laboratory's GeoTEK Multi-Sensor Core Logger in a comparable fashion to downhole methods. NETL researchers collaborate with stakeholders within the carbon storage, oil and gas, and critical minerals sectors. Since 2017, over 1.88 miles of core have been analyzed within the laboratory and all data is publicly available through the Technical Report Series (TRS) on the Energy Data eXchange (EDX). Additionally, the website, RokBase, was curated to extrapolate and visualize the high-resolution data from field operations. The characterization of the Lively Grove #1 (LG#1) well provides a case study into the full capabilities of the Geocharacterization Laboratory. During the comprehensive study of LG#1 ~1-2 mm in diameter, vertical to bedding, cylindrical structures were identified throughout the St. Peter Formation. These structures are pervasive throughout the St. Peter Formation at depth and are characterized as the trace fossil, *Skolithos*.

Collaboration and Core Characterization

Ninety wells have been characterized to date across the 37 published reports of these cores and samples. Through collaboration with over 15 different state organizations, national laboratories, and FECM-funded project leads energy relevant cores across the United States have been digitally preserved and made publicly available on EDX and RokBase. Multiple students, interns, and researchers have assisted with these efforts over the past 8 years.



Non-destructive Multi-scale CT Imaging and Multi-Sensor Core Logger

PORE

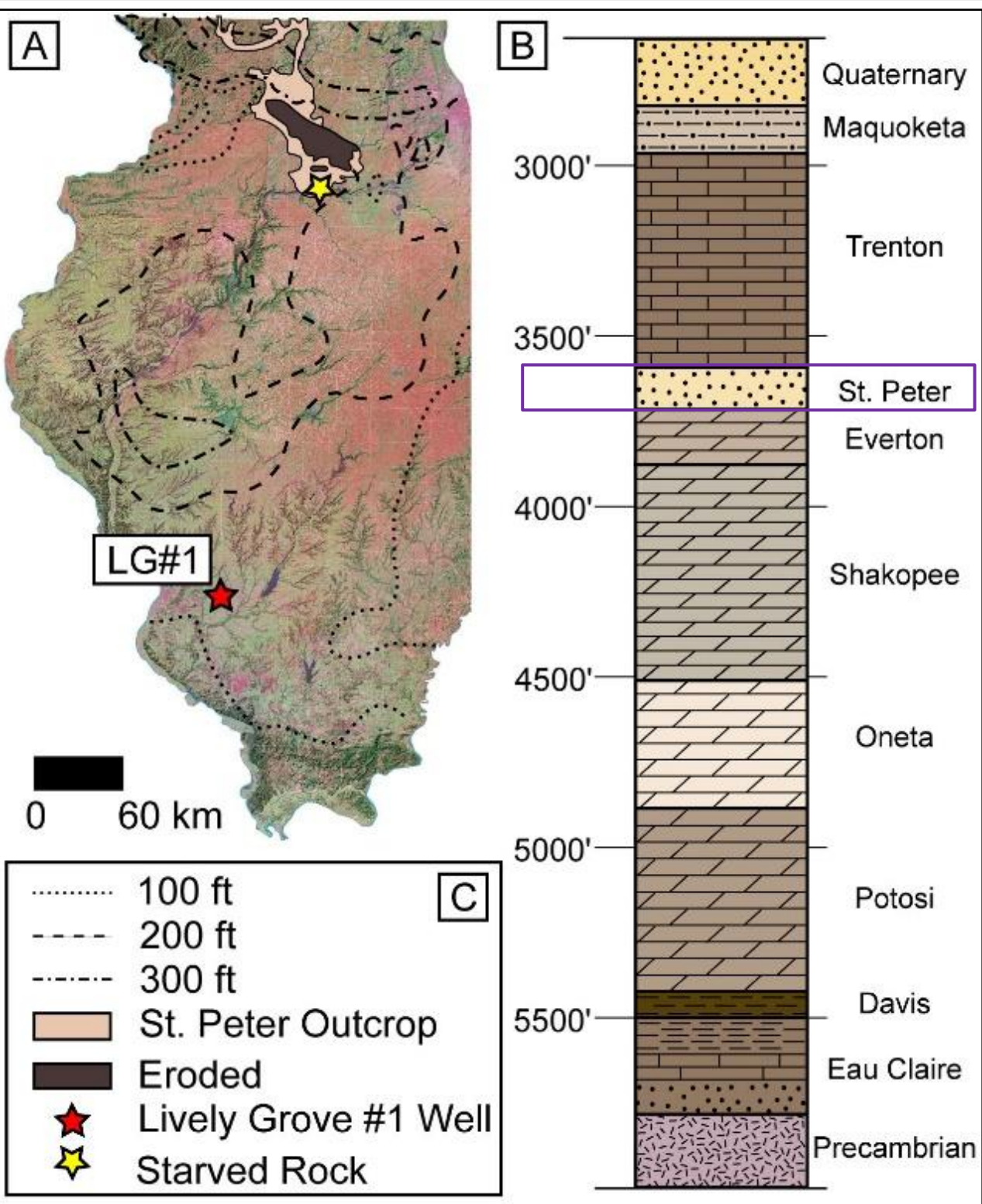
- A) Micro CT: 10^{-6} to 10^{-5} m (ZEISS Xradia Micro-CT Scanner)
- B) DynaTOM CT: 10^{-5} to 10^{-4} m (TESCAN DynaTOM Micro-CT Scanner)
- C) Industrial CT: 10^{-6} to 10^{-3} m (North Star Industrial CT Scanner)
- D) Medical CT: 10^{-4} to 10^{-2} m (Toshiba Aquilion Medical CT Scanner)
- E) Multi-Sensor Core Logger (Whole Core)

COR E

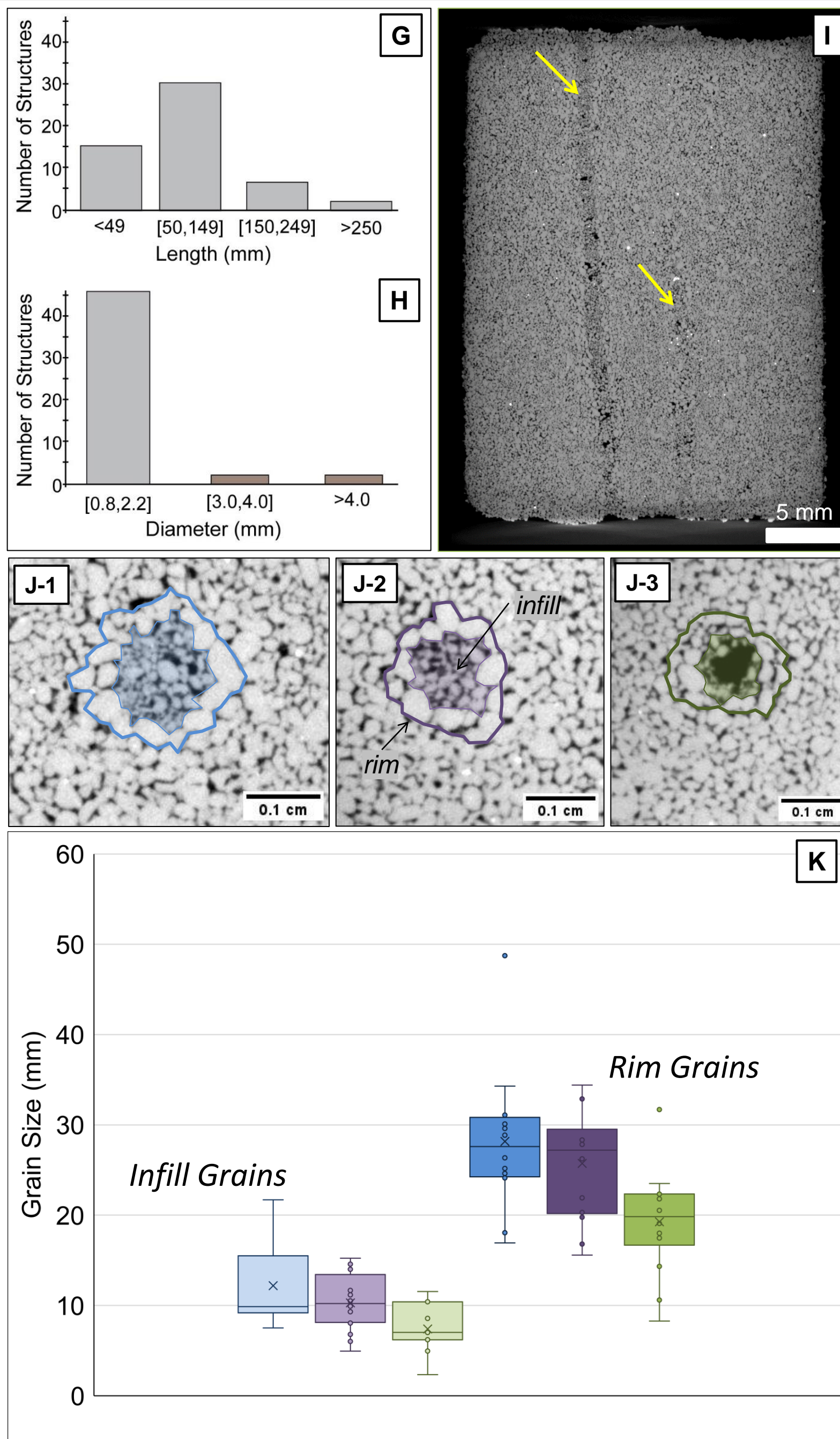
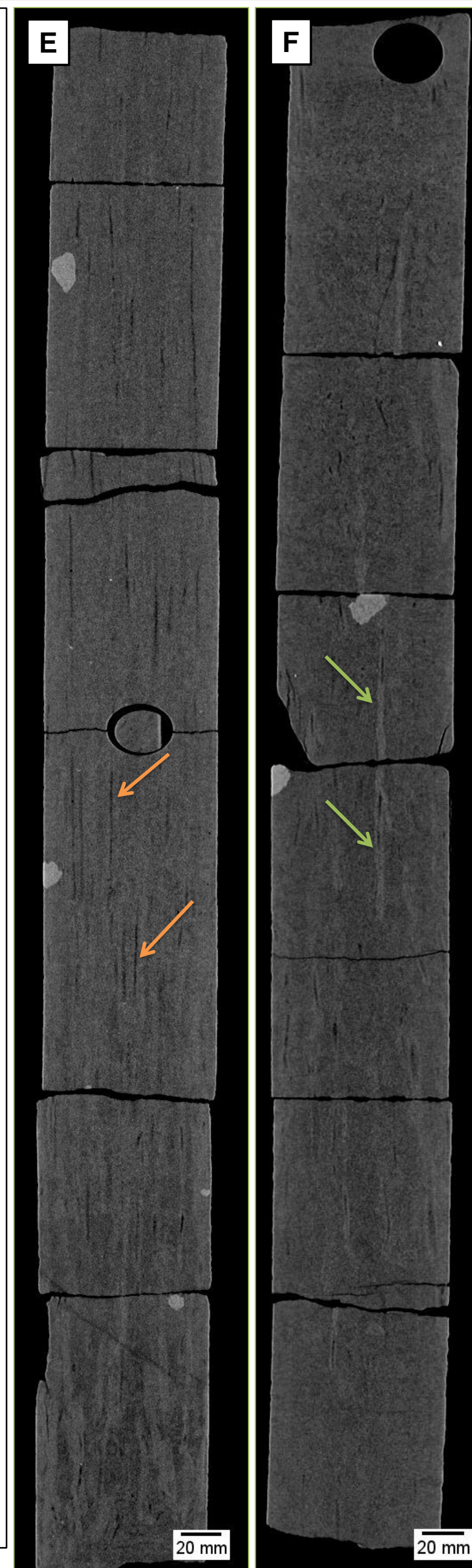
- Handheld XRF
- Gamma Density
- P-Wave Velocity Sensor
- Magnetic Susceptibility Point Sensor

Case Study: Lively Grove Well #1 (LG#1), Illinois, USA

The LG#1 characterization well was drilled in southern Illinois intersecting the middle Member of the St. Peter Sandstone locally where the unit is ~100 ft thick. Identifiable in most but not all hand samples and notably pervasive in CT imagery are ~1-2 mm diameter, vertical to bedding, cylindrical structures within most of the St. Peter Sandstone obtained from cores from the Lively Grove #1 well.



C) LG#1 Core 1, depth of 3,590-3,597.11 ft from Crandall et al., 2023.



E) Medical CT scan of LG#1 core from 3,651-3,654 ft, orange arrows indicating 1-2 mm semi-hollow vertical structures and **F)** 3,660-3,663 ft, green arrows indicating high attenuating, high density regions alongside semi-hollow vertical structures.

This comprehensive study undertaken by the researchers within the multi-scale CT imaging facility at NETL, Morgantown illuminated the pervasive bioturbation in the St. Peter section of the LG#1 core.

References

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