



Energy & Geoscience Institute

AT THE UNIVERSITY OF UTAH



ON DEMAND

Principal Investigator:

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Senior Petrologist

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Core through Pore EGI Research Services

Available to EGI Members



VALUE

- Core through Pore™ Integrated Petrological Workflow for cutting-edge interpretation of composition, texture, fabric, porosity, permeability, micro-tectonics, micro-facies/depositional evolution and diagenetic history.
- A progressive workflow for geological and material science samples
- Petrological atlases with panoramic thin section images

**Investment per Sponsor
& Duration**

TBD based on samples, services & evaluations.

Please contact us to discuss the possibility of a no-cost test project to prove value for future sample sets to be evaluated.

KEY DELIVERABLES

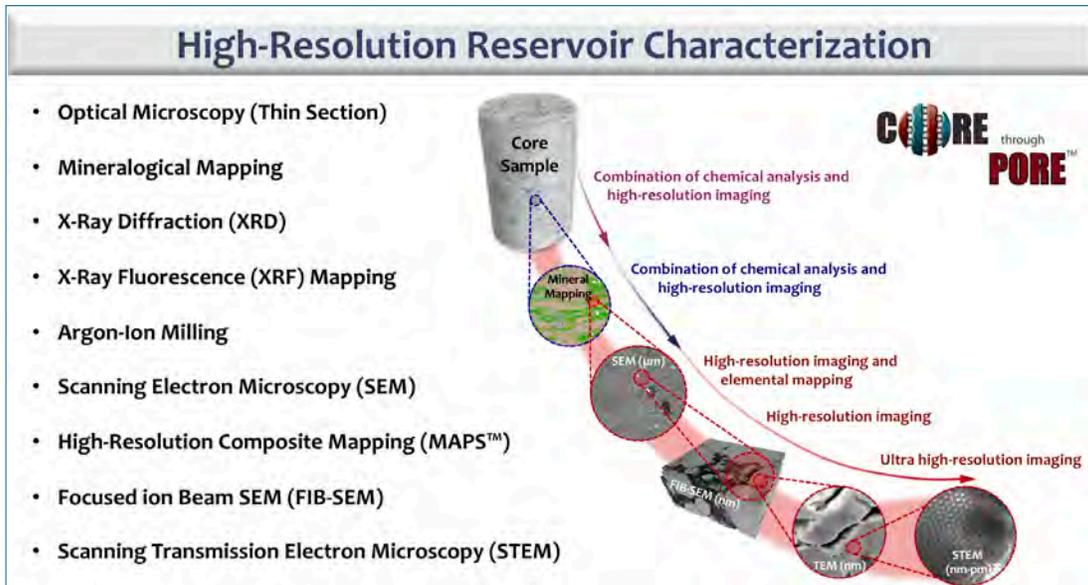
1. Comprehensive petrological analyses using the Core through Pore™ integrated analytical approach using optical microscopy, XRD, XRF, MINSKAN®, SEM, FIB-SEM and TEM/STEM.
2. Contextually connect nano to micrometers areas of interest to larger sample sets
3. Geochemical and petrological databases and charts (Excel).
4. Integrated assessment of analysis with available well log and magnetic data.
5. Delivered on ArcGIS platform with GIS catalog delivered in Excel format.
6. Documentation from interim and final project presentations.

EMAIL:

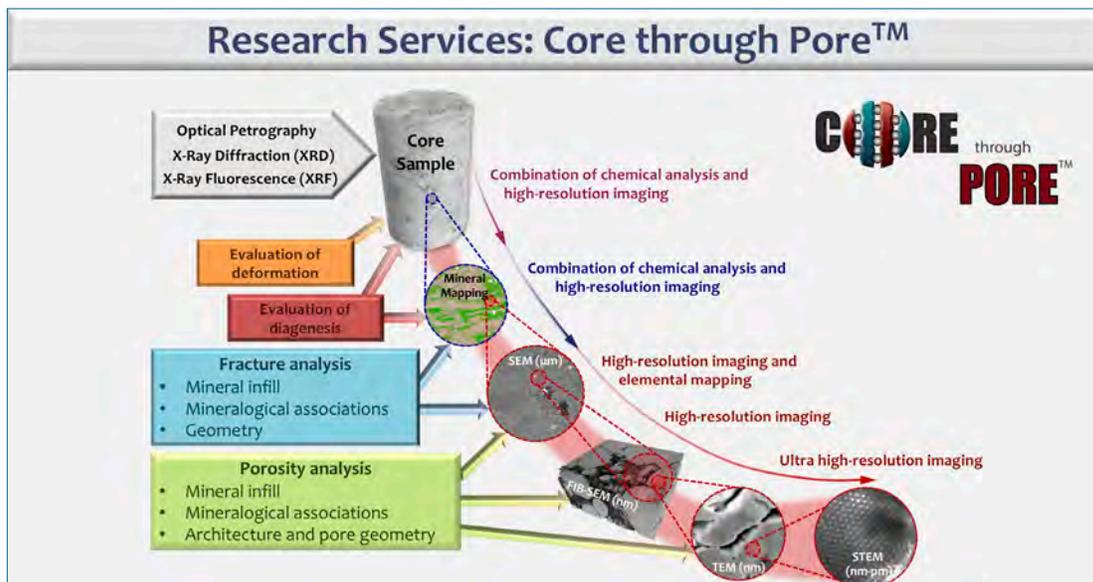
ContactEGI@egi.utah.edu

PHONE: (801) 585-3826

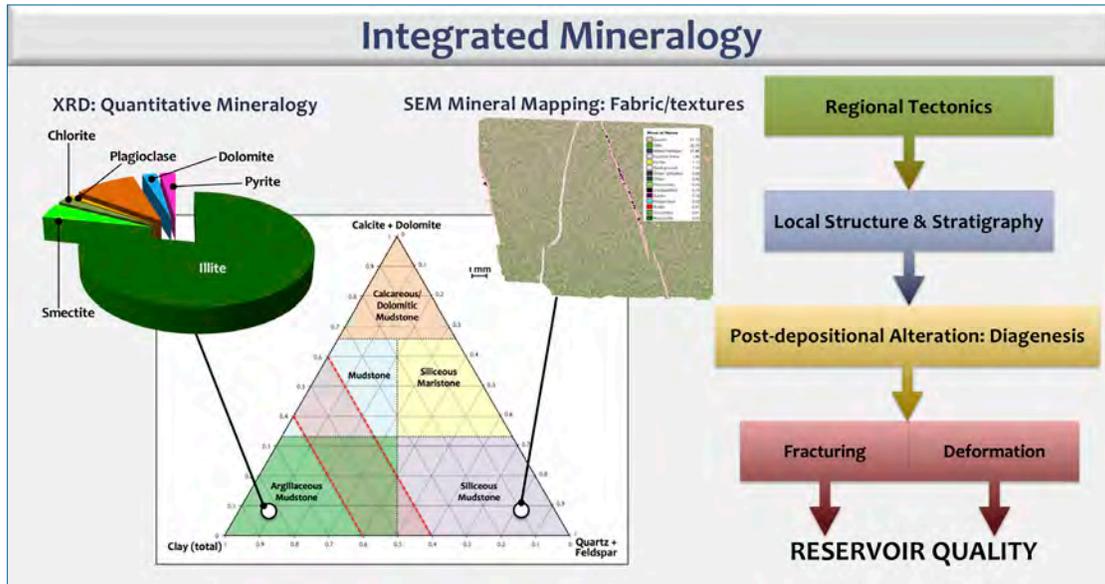
EGI’s Research Service Capabilities, encompassed under the term Core through Pore, include techniques related to petrology, geochemistry, geomechanics, and flow dynamics— the data from which has helped generate reports on sedimentology, petrology, thermochronology, geochronology, and inorganic geochemistry across Europe, Asia, Oceania, Africa, North America and South America. Recent publications utilizing research services have included mineralogical/petrological, geological and, geochemical studies across a diverse range of geological settings related to both academic and industry work, ranging from basin tectonics and sedimentology to small-volume magmatism and geothermal energy.



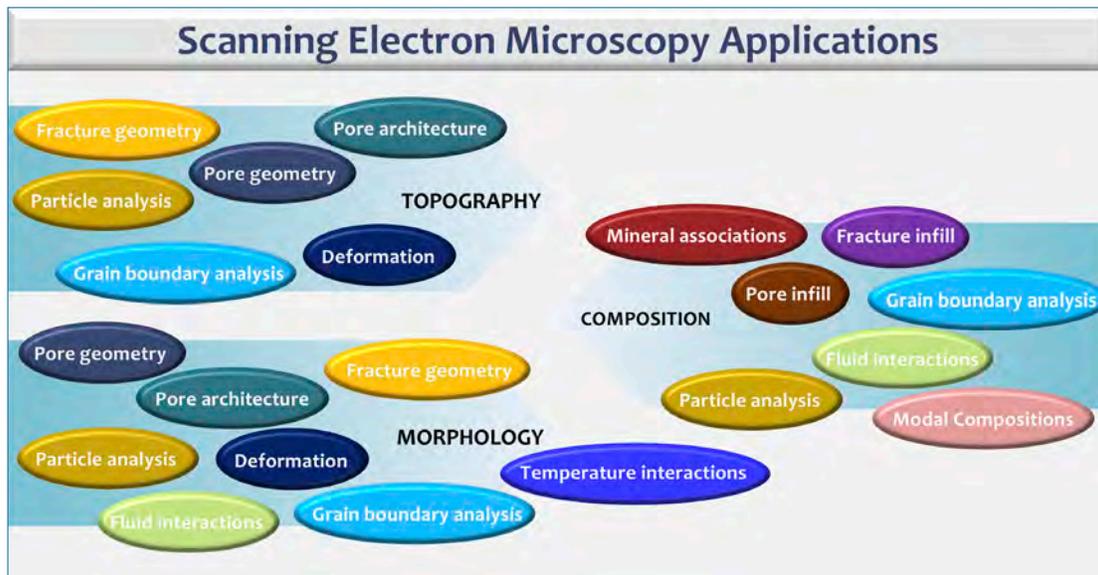
Techniques within research services fit within a progressive workflow for geological and material science samples which involves the use of optical microscopy and X-ray diffraction (XRD)/X-ray fluorescence (XRF) through to the use of scanning electron microscopes for mineralogical mapping and the progressively higher-resolution techniques of focused ion beam scanning electron microscopy (FIB-SEM), and transmission electron microscopy (TEM).



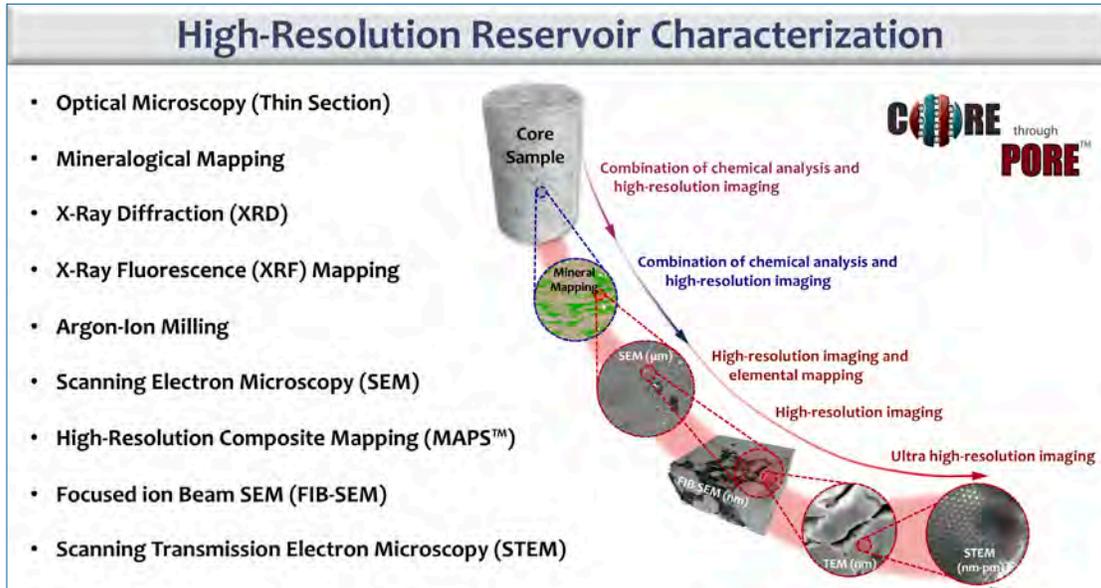
Starting with optical microscopy, recent projects have included those in the Astrakhan region of Russia, and geoarchaeological work on artifacts. Our optical microscopy work includes petrological atlases with panoramic thin section images allowing comparisons of the mineralogy, micro-structural deformation, and diagenetic evolution of complex sample sets to be evaluated and presented.



X-ray diffraction and x-ray fluorescence are critical in establishing the mineralogical and geochemical composition of samples, especially important in samples which are clay-rich like shales and other tight, unconventional reservoir rocks. Our XRD and XRF knowledge is especially useful when paired with techniques like optical microscopy and mineral mapping allowing both the composition, textures, fabrics, and micro-depositional fabrics to be evaluated.



Scanning electron microscopy is commonly used as a follow-up to optical microscopy and geochemical analysis, answering questions which higher-resolution techniques are more suited to. Our SEM work has included large studies from Europe, Asia, Oceania, Africa, North America and South America consisting of mineralogical, porosity and permeability, fluid-flow, and deformational evaluation of samples. Additional SEM work relates to Department of Energy grant work under the Energy Frontiers Research Center, looking at architected materials as an analogue to shales.



One of the most critical aspects of our research services and the Core through Pore workflow is the ability to contextually connect nano to micrometers areas of interest to larger sample sets, for example cores and well logs. Our MAPS software is one the ways in which we achieve this. MAPS software allows large (mm-scale) areas of samples to be scanned using high-resolution SEM imaging which can then be correlated to additional datasets.

PROJECT TIMELINE, REPORT & INVESTMENT

Each project is designed to meet the agreed upon scope of work and timeline.

EGI TECHNICAL CONTACTS & CONTRACT INFORMATION

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Bryony Richards, PhD

SENIOR PETROLOGIST



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Research Interests

- Mineralogy and geochemistry
- Radiochemistry (thermo-chronology, stable isotopes)
- Micro to nano-scale mineralogy
- Integrated mineralogy (petrography, microprobe, XRD, QEMSCAN®, SEM, SEM-FIB)
- Characterization of shales using SEM-FIB
- Integration of mineralogy and computing technology
- Microtectonics (petrofabrics)



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Senior Petrologist Bryony Richards joined EGI in 2012 as a Research Scientist. After earning a B.Sc. Hons at the University of Durham and a Ph.D. in Geology from Royal Holloway College, UK, she subsequently completed postdoctoral research at the University of Johannesburg, South Africa in conjunction with a number of mining companies related to the assessment and development of kimberlites in southern Africa. Professional industry experience includes the evaluation and development of mineral prospects in Africa, with an emphasis on the geochemistry of sedimentary basins, basin/facies analysis, and sediment-hosted mineral deposits. Her work included the interpretation and development of geochemical surveys (soil, rock, and drilling) from reconnaissance and small-scale to full, extensive geochemical programs. She has a recognized background in integrated techniques utilizing mineralogy/petrology, inorganic geochemistry, radiochemistry, and the evaluation and interpretation of complex, multiple technique databases. Her ongoing research includes the evaluation of hydrocarbon potential in various unconventional reservoirs across the world.

At EGI, Bryony's focus is on the development of integrated analytical approaches for the advancement of conventional and unconventional reservoir understanding, exploration, and development as well as understanding to what degree petrofabrics (microtectonics) within shales can reveal greater basin conditions.

Dr. Richards' publications include mineralogical/petrological, geochemical, and radiochemical studies across a diverse range of geological settings related to both academia and industry work, ranging from tectonics and small-volume magmatism, to kimberlites and sediment-hosted copper deposits. Select publications include EGI reports from South America; China, United Kingdom, United States, India and Central Eurasia, focusing on the advancement of shale reservoir characterization using integrated petrological techniques.

Research Experience

- Interpretation of complex databases
- Integrated mineralogical workflow characterization of unconventional reservoir rocks, using macro to nano-scale integrated methods.
- Integrated low-resolution petrological analyses.
- High-resolution (micro- to nano-scale) microscopy for advanced petrological analyses and interpretation including; Ar-ion milling, microprobe, SEM, FIB-SEM and TEM/STEM analyses.
- Integrated imaging techniques including; large composite imaging of SEM analyses, 3D modeling using FIB-SEM and computed tomography.
- Radiochemical techniques including; $^{40}\text{Ar}/^{39}\text{Ar}$ thermochronology, U-Pb geochronology and stable isotopes ($\delta^{18}\text{O}$).