Pore Structure Determination from Geophysics

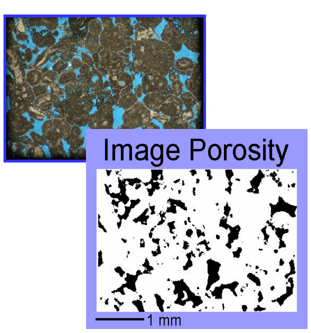
PSI: Pore Structure Inversion

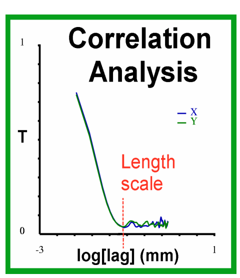
An integrated set of effective media models are combined with a maximum entropy inversion technique which allows for the prediction of **pore structure** based on geophysical constraints. The constraining data for **PSI** can be obtained from any combination of available observations, including a wide variety of core measurements, log measurements, and petrographic observations. Central to the methodology is a set of integrated effective media models which all operate on a generic pore structure.

PSI Applications

- Rock Type Identification.
- Integrated Petrophysical Models for Populating Simulators.
- Improved Log Analysis.
- Core Screening to Optimize Special Core Analysis.
- Permeability from NMR in Carbonates.
- Capillary Pressure from NMR.

Laboratory measurements on cores are used to constrain the inversions. The pressure dependence on permeability, formation factor, velocities, NMR, and capillary pressure data can also be used.

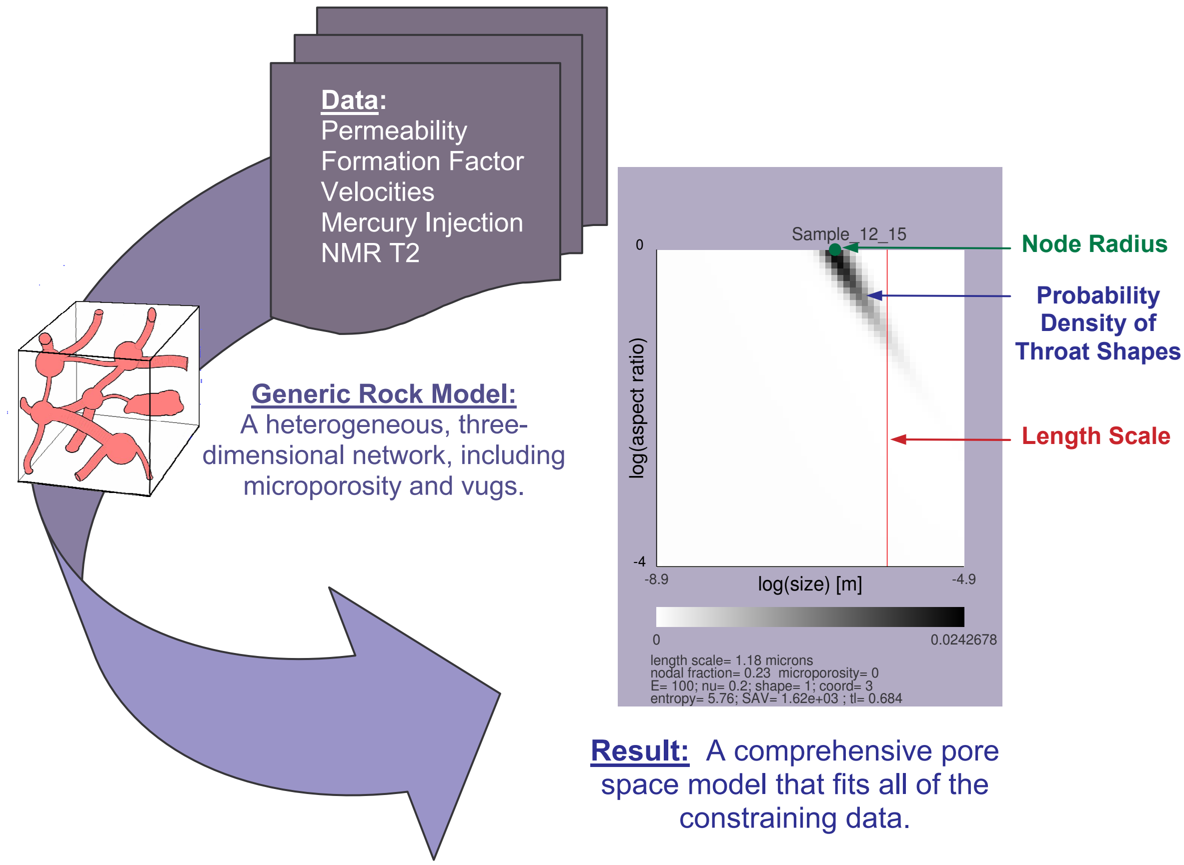




Direct observations from thin sections or SEM, can be used to help constrain the dominant length scale of the pore network and evaluate pore types such as nodes, vugs, and other non-network porosity attributes.

  contact: *boitnott@ner.com*

Pore space is conceptualized as an equi-dimensional array of nodal pores interconnected by a heterogeneous network of throats having different sizes and aspect ratios. Three geometric parameters define the network: (1) The characteristic length, or the mean length between nodes, (2) The nodal fraction, which is the fraction of porosity tied up in the nodes, and (3) The mean coordination number of the network. In addition, several types of non-network porosity can also be handled by **PSI**.



The output of the inversion process is a pore throat shape spectrum, providing a statistical description of the sample pore structure. In addition to the volume fraction and size of nodal pores and vugs, it also includes the distribution, sizes and shapes of the pore throats.

The key advantage of the **PSI** approach is that it produces a quantitative, robust and internally-consistent 3-D description of the pore space for each sample. This is because the method combines the requirements of all sources of observation into a single pore space model. The resulting pore space description is therefore consistent with all known constraints and directly linked to the measured geophysical properties at the core scale. In contrast with other methods of pore space characterization such as mercury injection and NMR T2 analysis, our approach uses a more realistic generic pore structure and is uniquely constrained by a comprehensive set of physical properties.

contact: *boitnott@ner.com*