How can we tell whether rocks are porous and/or permeable?

And… how can we tell if there is a layer of rock that is "tight" and would be a good cap or "seal" for a reservoir?

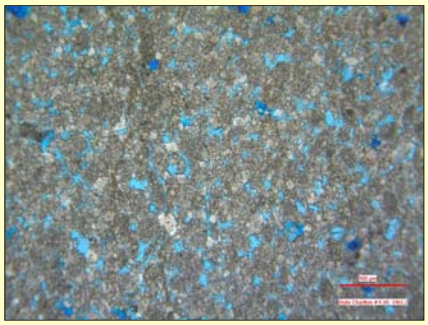
Answer: We can take samples of the rock at different depths beneath the surface and measure the ability of gas to flow through the rock with a permeameter (or even a bicycle pump, as shown in this display!)

We measure permeability in the field and in the laboratory with a permeameter. This model is a portable "minipermeameter". Gas is forced into a rock sample and then measurements of how fast the gas travels through the rock are sent to the computer.

You can make the same measurement yourself with a bicycle pump and a piece of rock core from deep underground. Which of the rock cores would make a good reservoir? A good seal?

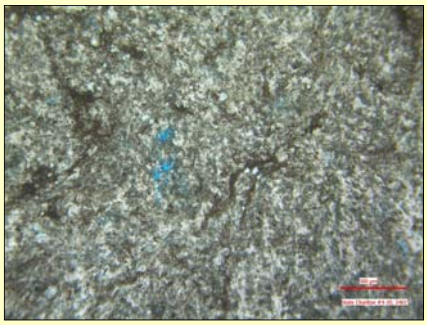
Rocks that have few connected pore spaces to allow fluid or gas to pass through are called "tight". It is the layers of "tight" rocks that keep oil, gas, water and brine trapped underground.

We can also look at the rocks directly to view what type of porosity they have. Rocks are cut into small chips and treated with a blue dye that will fill the pore spaces. Chips are glued onto a microscope slide, and then ground down into "thin-sections" that are so thin they can transmit light and be viewed with a microscope. In these three photos taken of thin sections of rocks from the State Charlton site, the amount of blue dye indicates porosity.



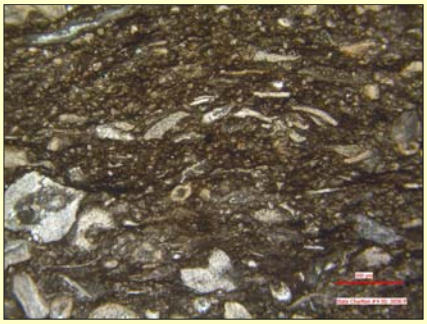
(1)

This photomicrograph is of rock that is highly porous and also very permeable. This is what a good reservoir for oil, natural gas or carbon dioxide would look like.



(2)

This is a photomicrograph of a rock that is porous but shows "microporosity." These pores are not well connected so the rock has low permeability and would not serve as a good reservoir.



(3)

This is a photomicrograph of a "tight" rock. No blue dye penetrated the rock. This rock would make a good "seal" for a reservoir.

Which rock has space to hold the carbon dioxide?

Which would trap the carbon dioxide in the reservoir?