Schlumberger

Continuous Measurement of Permeability for CO_2 Storage Modeling

Case study: Permeability measurements with CMR tool

Challenge

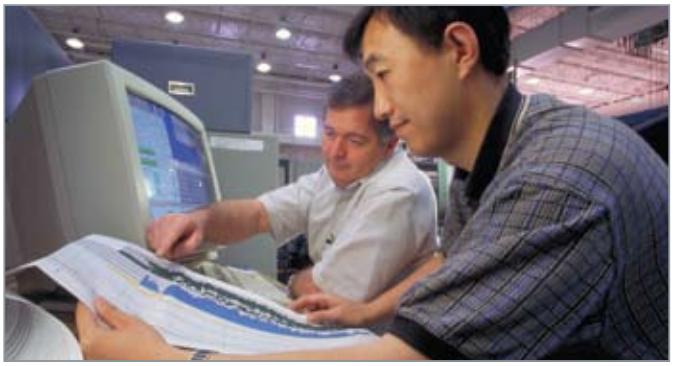
To obtain good estimates of permeability for accurate CO_2 injection and migration modeling.

Solution

Using CMR* combinable magnetic resonance technology, Schlumberger was able to measure the distribution of the pore sizes in the rock formations.

Results

Determined continuous reservoir permeability.



Enhanced analysis of all log data led to confidence in most reservoir properties.

Modeling the capacity and injectivity of carbon dioxide (CO_2) in reservoirs depends on accurate knowledge of key petrophysical parameters. Among these are porosity and permeability. Continuous measurement of these parameters initiates chain of success by creating:

- better models, which enable
- more accurate prediction of CO_2 plume growth, which allows
- focused characterization and monitoring on the correct area, which in turn
- optimizes the cost and surface impact of sequestration projects.

Continuous measurement on reservoir permeability is not easy, and most methods used fall short. However, a client with a project on the Gulf Coast of the United States turned to Schlumberger for help. The company realized the importance of continuous measurement, but was not familiar with the latest advances in logging.

Finding accuracy in the midst of change

There are several methods of performing continuous measurements of reservoir permeability, none of which are perfect for all conditions. It is important to measure permeability and distinguish formation layers, while ensuring varying grain size or changing lithology does not change your results.

Gathering data on all sand packages

At this particular project, there was limited well log data from the reservoir. The only permeability measurements were from older core. Our client searched all databases for existing log and core data, but this was not enough.

To build an accurate reservoir model of the plume, and to calculate potential injectivity, we needed permeability measurements across all the sand packages in the reservoir. This brought with it tremendous potential for variations in lithology, grain size, and grain sorting—all of which would affect formation permeability calculations.

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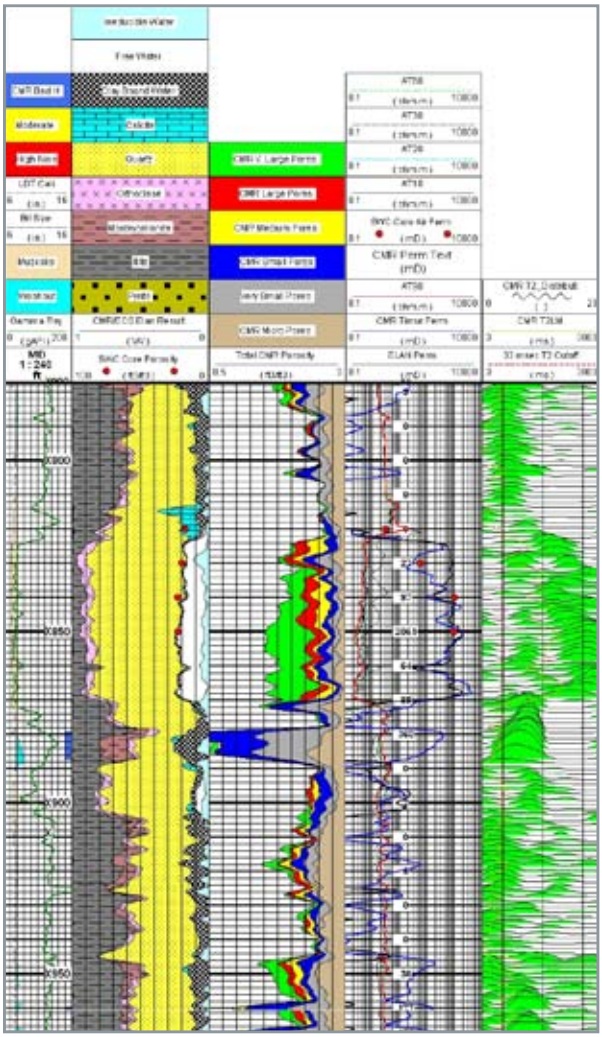
Creating a solution with advanced tools and methods

Schlumberger implemented continuous measurement by utilizing CMR* combinable magnetic resonance logging together with Platform Express* wireline logging and ECS* elemental capture spectroscopy measurements.

Information from the CMR and ECS logs was processed and compared to sidewall core measurements. This enabled us to develop permeability and porosity relationships. And as a further enhancement to accuracy, the CMR permeability data was available in the logging unit at the wellsite in real time.

Superior technology for measuring clastic environments

The Gulf Coast project clearly demonstrated that CMR logging is a superior method of determining continuous reservoir permeability in a clastic environment. The method applies to any clastic formation around the world.



The CMR permeability calculation (blue curve in Track 4) was confirmed at several points by sidewall core results (red dots).

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