

Field Test and Evaluation of Engineered Biomineralization Technology for Sealing Existing Wells

Award Number: DE- FE0009599

Project Summary:

The goal of the project was to develop a biomineralization-based technology for sealing preferential flow pathways in the vicinity of injection wells. An advanced method for sealing wells (e.g., engineered biomineralization) was evaluated in the field using the existing 4900-foot-deep Gorgas well located in Alabama. This project successfully integrated mesoscale laboratory experiments at the Center for Biofilm Engineering (CBE) together with simulation modeling conducted at the University of Stuttgart to develop the protocol for conducting the biomineralization sealing test in the field well. The test was accomplished using conventional oilfield technology including an 11.4-liter (3.0 gallon) wireline dump bailer for injecting the biomineralization materials downhole. Metrics indicating successful microbially induced calcite precipitation (MICP) sealing included reduced injectivity during seal formation, reduction in pressure falloff, and demonstration of MICP by-products including calcium carbonate (CaCO_3) in treated regions of side wall cores.

Project Outcomes:

The MICP sealing protocol test resulted in complete biomineralization sealing of a horizontal fracture located 340.7 m (1118 feet) below ground surface (bgs). The fractured region was considered completely sealed when it was no longer possible to inject fluids into the formation without exceeding the initial formation fracture pressure. Field plugging results compared favorably with model predictions (25 Ca, six inoculation injections) made using an MICP simulation model developed at the University of Stuttgart. Model predictions were made prior to the field test based on planned injection strategy.

If properly controlled MICP can successfully seal fractures, high permeability zones, and compromised wellbore cement in the vicinity of wellbores and in nearby caprock, thereby improving the storage security of geologically stored carbon dioxide.

Prime Performer:
Montana State University

Principal Investigator:
Alfred B. Cunningham

Project Duration:
10/01/2012 – 09/30/2015

Performer Location:
Bozeman, Montana

Field Sites:
Jasper, Alabama

Program:
Carbon Transport & Storage

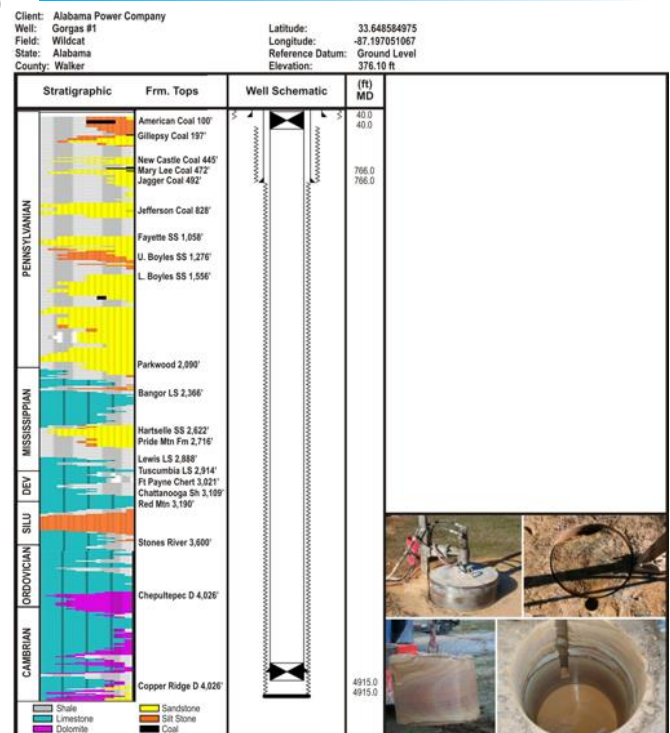


Figure 1: The biomineralization sealing test targeting the Fayette Sandstone was performed on the Gorgas #1 well during April 2014. Pulsed neutron geophysical logging was conducted, and rock core samples were obtained over the entire well depth. The image shows 76.2 cm (30 inch) diameter cores being drilled from the Boyles sandstone.

Presentations, Papers, and Publications

Final Report: [Field Test and Evaluation of Engineered Biomineralization Technology for Sealing Existing Wells](#) (December 2015) – Cunningham, Alfred.