DynaRed™ Fiber

Seepage Control Material and Hole Conditioner

Return Permeability Study of DynaRed™ Fiber

Data showing the effect of two drilling fluids on return permeability in Berea sandstone cores were generated by an independent laboratory. The return permeability test procedure and test results are provided in the report below.

Procedure

Two 1" diameter plugs were drilled from a block of standard Berea sandstone. The plugs were cleaned in a Soxhlet extractor using methanol to remove hydrocarbons, pore water and salt. After drying, ambient permeability to air and the porosity by Boyle's Law helium expansion were determined for each plug.

The core plugs were then saturated with a 35,000 ppm NaCl solution and each loaded into Hassler core holders and confined at an overburden pressure of 1,500 psig. The permeability to brine was then determined for each plug.

Each drilling fluid sample was then flowed through a core plug in the opposite direction to the brine flow. A drilling fluid pressure 50 psig greater than the pore pressure was maintained for a period of four hours. Brine was then flowed in the original direction and the final brine permeability was determined after 20, 50, and 80 pore volumes of displacement through the core plug.

The first mud sample consisted of 2,100 ml tap water, 6.0 g bentonite clay (mixed five minutes), 0.5 ml of 50% W/V NaOH solution (mixed 15 minutes), 4.5 g Drispac® Regular Polymer (mixed 20 minutes), and 120.0 g Rev dust to represent drill solids (mixed two hours).

The second mud sample was prepared by adding 5.0 ppb DynaRed™ fine grade fiber to the first sample and mixing an additional 20 minutes.

Results

The results are presented in the following table and in the attached graphs. Graphical data is presented in two versions: brine permeability (in Millidarcies) versus pore volumes produced (fig. 1) and normalized permeability versus cumulative pore volumes produced (fig. 2).

Table 1

Return Permeability Data (1,500 psig overburden)

	Without DynaRed™		With 5 ppb DynaRed™	
	Permeability	Normalized Data	Permeability	Normalized Data
Initial Permeability to Air, md	450.0		440.0	
Initial Permeability to Brine, md	210.0	1.000	198.4	1.000
Brine Permeability after Mud Invasion, md	74.5	0.355	136.2	0.686
Brine Permeability after 50 Pore Volumes, md	153.5	0.731	159.3	0.803
Brine Permeability after 80 Pore Volumes, md	172.2	0.820	173.5	0.874

Note: Formerly Dynamite Red, now called DynaRed™ Fiber

Figure 1

Return Permeability

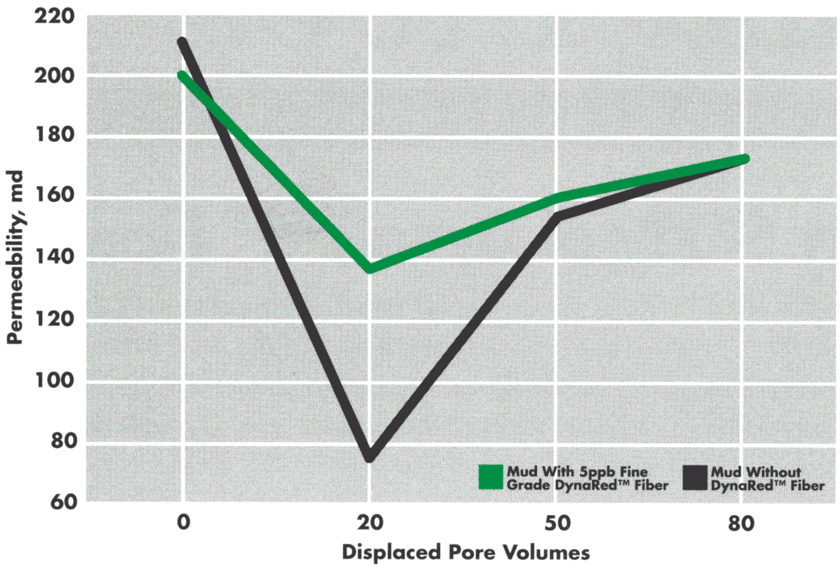
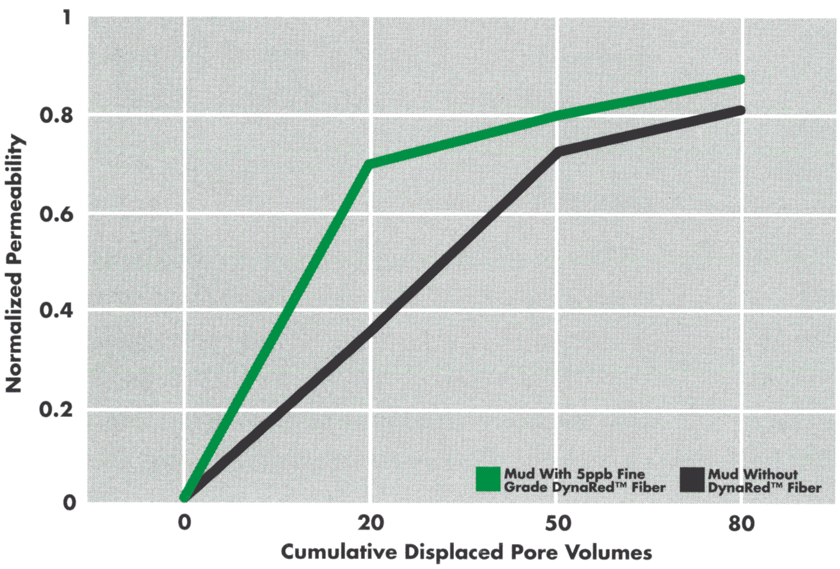


Figure 2

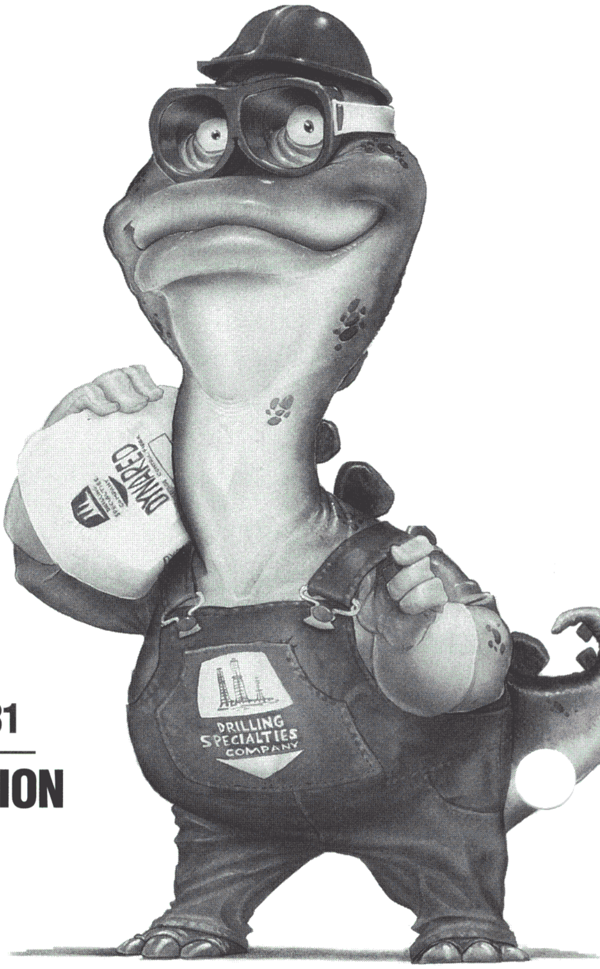
Cleanup Return Permeability



Conclusions

While both muds exhibit excellent return permeabilities, the mud containing DynaRed™ required less than half the number of pore volumes of brine to return to 70% permeability. Therefore it is expected that a mud with DynaRed™ would clean up more rapidly to achieve maximum production rates.

It is also noteworthy that after only 20 pore volumes the permeability of the DynaRed™ treated core was almost twice that of the nontreated core. This indicates that the core containing the fiber is significantly easier to remove, even where low differential pressure exists in the well.



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