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Saturn 3D Radial Probe Successfully Samples Fluid by Preventing Unconsolidated Reservoir Plugging

Probe supports the formation to prevent loosening of mud particles that rendered extraction by a conventional probe impossible, North Dakota

CHALLENGE

Eliminate formation plugging of a permeable unconsolidated reservoir that was occurring after 30 min of pumping during conventional water sampling operations.

SOLUTION

Deploy the Saturn* 3D radial probe to support the formation with its drain assembly while acquiring fluid at a reduced velocity through the large flow area to prevent mobilizing the fine particles.

RESULTS

Successfully sampled low-contamination water at all six stations with unimpeded flow.

Water sampling fails when the formation plugs

In a two-well logging campaign, the Energy & Environmental Research Center (EERC) at the University of North Dakota required water samples from a relatively permeable zone in an unconsolidated reservoir. A formation tester equipped with a conventional single probe was used in the first well; however, formation plugging that occurred after pumping for about 30 min rendered sampling impossible at all nine stations. Thorough analysis of the flowing response from the well deduced that fine mud particles were mobilized by the pumping to invade the formation and eventually plug the pore throats. The resulting significant decrease in permeability dropped the flowing pressure and the conventional probe was unable to function.

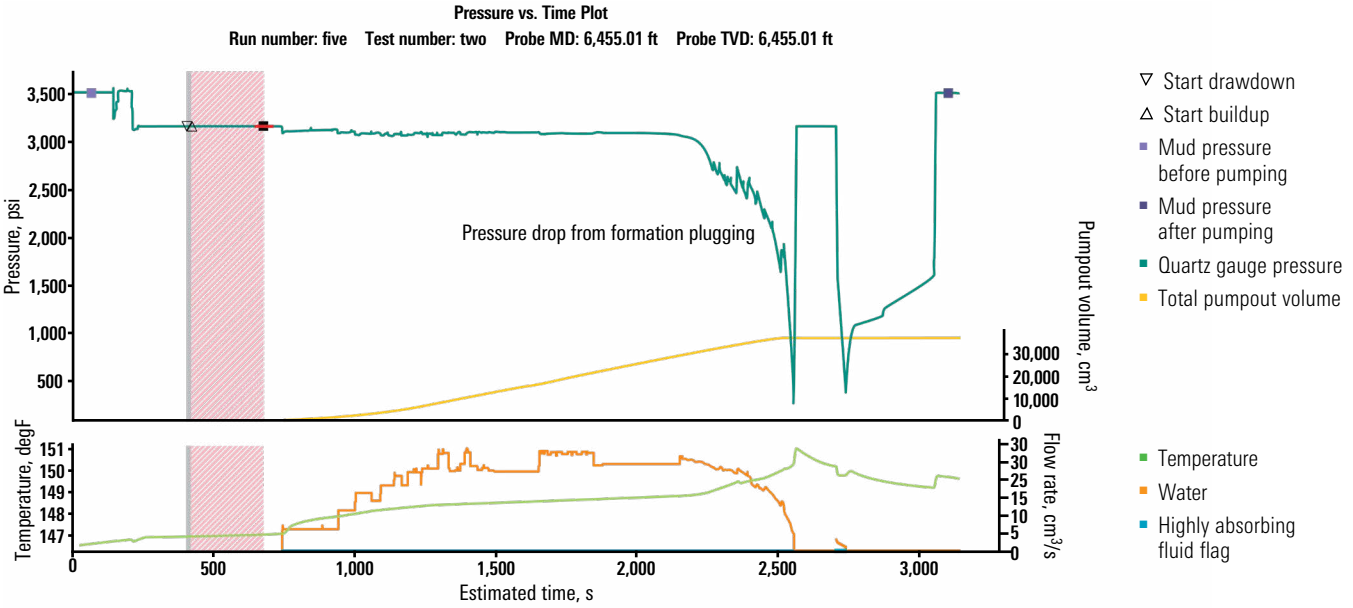
Reservoir requires a fit-for-purpose radial probe

Although the Saturn 3D radial probe's nearly 80 in^2 of surface flow area makes it ideally suited for the evaluation of tight, low-permeability reservoirs where conventional probes typically fail, this industry-leading feature also improves fluid extraction in unconsolidated reservoirs that are prone to sanding. The drain assembly circumferentially seals to the wellbore to ensure pressure isolation and reduce the likelihood of a lost seal. The combination of the reliable seal and large flow area would enable the Saturn probe to employ flow rates similar to those of the conventional probe but at a much reduced flow velocity in the formation pore space.

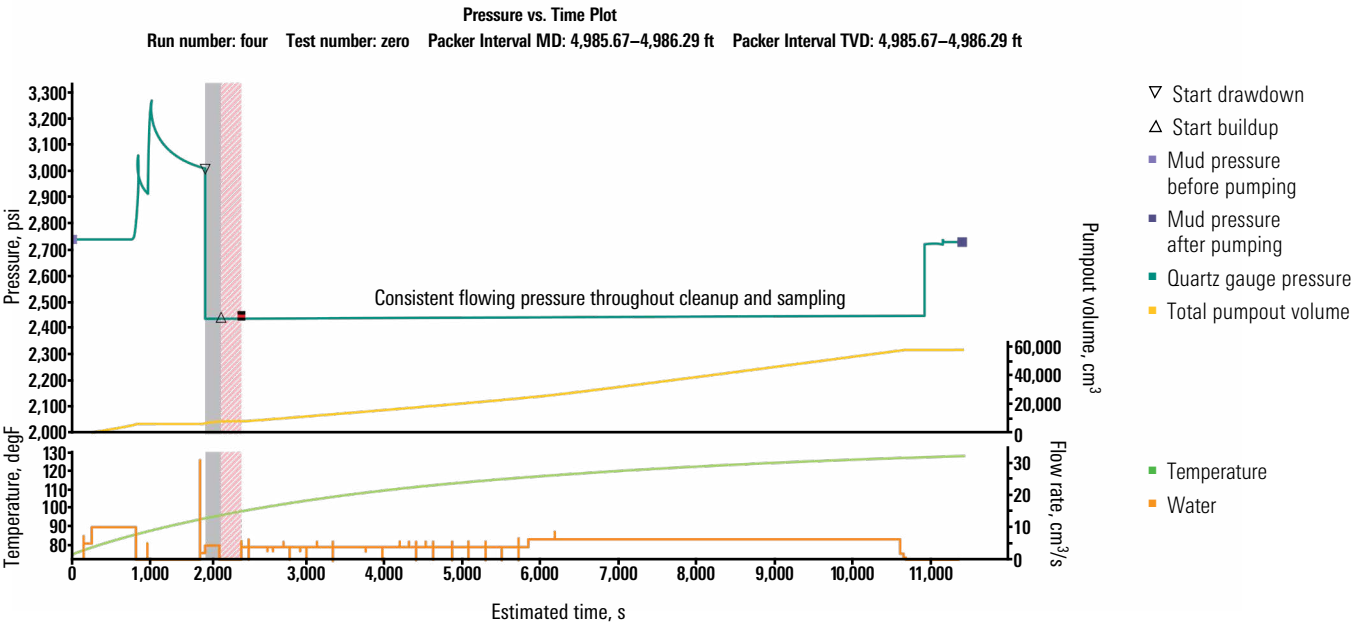
Saturn probe successfully samples low-contamination water without causing plugging

At each of the six sampling stations in the second well, the large flow area of the Saturn probe made it possible to generate flow from the formation to clean up the samples without mobilizing the fine particles that had previously invaded the reservoir. No plugging occurred, as shown by the uniform flowing pressure, and low-contamination water samples were collected.

The mechanical retract mechanism of the Saturn 3D radial probe reliably secures the drain assembly when not deployed.



Deploying a conventional probe in the first well resulted in a large pressure drop after the first 30 min of pumping to clean up the invaded zone. It was the formation that was plugging, not the tool, which prevented obtaining samples at the nine stations.



In the second well, the Saturn 3D radial probe easily flowed formation fluid without mobilizing fine particles that would have plugged the formation.

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