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AVACLAYBLOCK

Inhibitive System for Drilling Sensitive Shales

CASE STUDY

"The higher penetration rate resulted in 10 days being cut from the drilling curve as compared to programmed"

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INTRODUCTION

This case study refers to the application of two water based mud system used by AVA S.p.A (Rome, Italy) for two sections (28" and 23") of the SP1 well drilled in 1998 in the Central Apennines, Italy. The closest offset wells, the PPN1 and PPN2 were drilled in 1980 and provided geological data useful to outline a drilling program.

The 28" section required the crossing of a 200-300m limestone formation (Ateleta Limestone). The following section (23") would be drilled in the shale formation of "Argille Varicolori" (50-100m), and into the Tortonian Flysh (1300m).

The expected problems related to the drilling of these sections included:

- Loss of circulation which would likely pollute the aquifer and overheads during the 28" section
- Hole instability due to hydration of the highly reactive clay fraction in the clastic formations of the 23" section

The formulation of a proper mud program allowed us to overcome these difficulties, and both intervals were drilled with substantial time and cost savings.

OBJECTIVES

The objectives of the operator were to:

a) Drill the sections quickly and efficiently while minimizing cost. Provide a drilling fluid that will ensure shale inhibition while at the same time minimizing the chance of lost circulation through the carbonate formations.
b) Minimize the resulting impact to the environment, as required by the particular hydrogeological situation (the Ateleta aquifer of limestone feeds many springs downstream), as confirmed by water flow observed while drilling the 42" hole for the conductor.

Referring to point "a", for the considered sections the operator estimated a daily overhead of $55,000 USD.

More difficult to calculate is the economical evaluation of damage in the event of an adverse environmental impact (negative advertising, sanctions for the infringement of environmental laws, investment restoration, and increased difficulty in obtaining new permits).

ACTIONS

To drill these sections AVA recommended the following mud systems:

28" Interval:

A fresh water gel polymer, biodegradable mud system was designed with a 1.14 s.g. The primary products were regular bentonite, xanthan gum biopolymer (Visco 84) as a viscosifier, and polyanionic cellulose (Policell SL) as a filtrate reducer.

The operative conditions on the rig allowed maintaining an s.g. between 1.03 and 1.07 in order to minimize losses. Pumping LCM pills based on MICA F, MICA C and GRANULAR, successfully controlled lost circulation. Mud properties were maintained as programmed and no problems were encountered. At the end of this interval the existing mud volume (408m^3) was reconditioned and reused for the following 23" section.

23" Interval:

AVA recommended the AVACLAYBLOCK system, specifically designed to minimize hole instability problems encountered when drilling reactive shale. The key product in this system is AVACLAYBLOCK, a mixture of polymers, potassium salts and silicate dispersed in an aqueous solution, characterised by a marked inhibiting action that prevents clay hydration, consequent dispersion in the mud and hole instability problems. The product does not affect mud rheology and can be used at temperatures in excess of 150°C.

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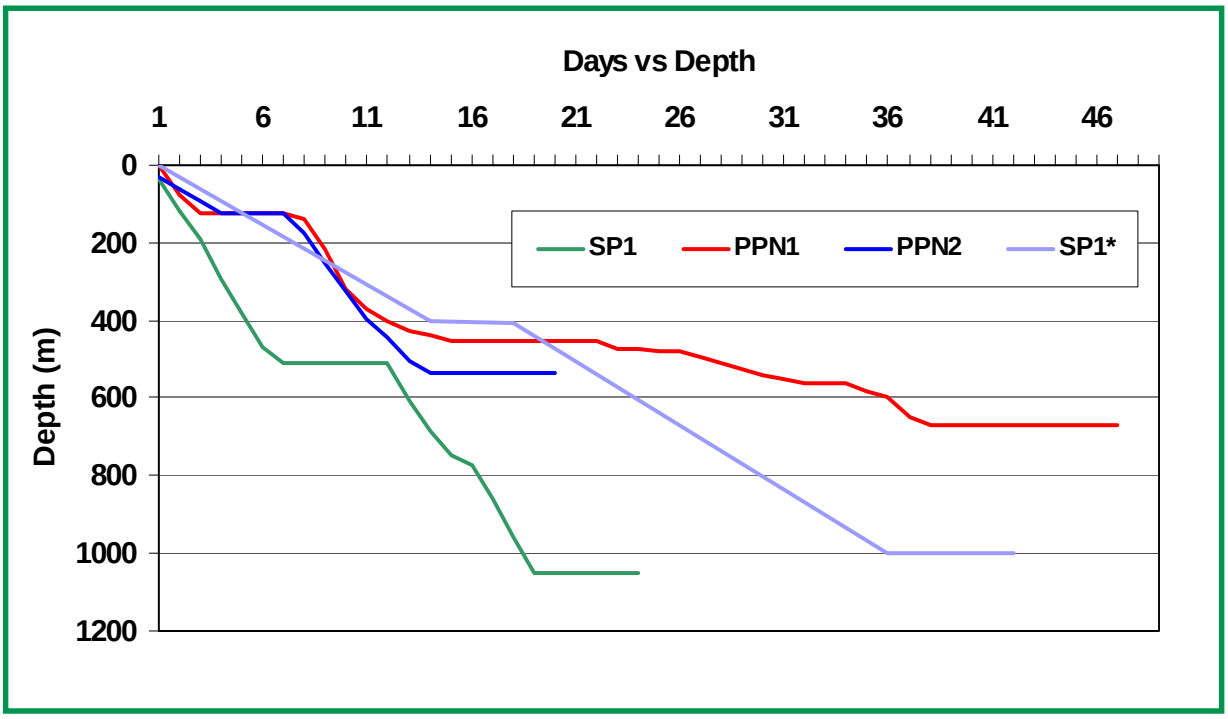
The AVACLAYBLOCK system is completed with the use of the AVABIOLUBE polyol. AVABIOLUBE is a totally water dispersible natural polymer acting as a lubricating agent as well as an inhibiting agent on clay platelets, modifying the mechanism of their hydration by "cloud point" behaviour ("cloud point" is the temperature forcing the polyol to separate from the water phase). The product, being totally natural, is environmentally friendly.

No significant hole problems were faced during the drilling of this interval. During the last 80m an increase in shale was noticed at the shakers indicating insufficient shale inhibition. The concentration of AVACLAYBLOCK and AVABIOLUBE was increased, solving the problem, and the rest of the interval was drilled without incident.

RESULTS

Fig. 1 summarises the days vs depth of the SP1 well; it includes data from the PPN1 and PPN2 wells, where no shale inhibitor was used. The 28" interval was drilled from surface to a depth of 512m in 7 days; the following section was drilled to a depth of 1,049m in 13 days.

The SP1 penetration rate was faster than programmed, and significantly faster than the PPN1 and PPN2 wells where a series of technical problems partially related to the mud system used, were encountered. The effectiveness of the AVACLAYBLOCK system used during the 23" section of the SP1 well is supported by the caliper logs which showed an essentially gauge hole. It is noted that better geological knowledge, and improved technology also contributed to the performance. The higher penetration rate resulted in 10 days being cut from the drilling curve compare to programmed, with an estimated savings of $600,000 USD.



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