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Non-Retrievable Rotating Liner Drilling System Successfully Deployed to Overcome Challenging Highly Stressed Rubble Zone in a GOM Ultra-Deepwater Sub-Salt Application

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Abstract

Worldwide drilling and exploration activities offshore in deep and ultra-deep waters have increased significantly in the last few years. Many of the most attractive prospects are sub-salt or near-salt environments in the Gulf of Mexico (GoM), Brazil, and West Africa.

Operators are always looking for ways to reduce risks and maximize value in these extremely high-cost environments. Highly technical challenges include: drilling through depleted formations, lost circulation zones, weak formations, rubble zones, and tar/bitumen intervals. When encountered, these hazards lead to a significant increase in nonproductive time (NPT) and ultimately to significant financial losses.

This paper presents some of the geo-mechanical drilling hazards encountered in an ultra-deepwater well in the GoM Walker Ridge area, the impact of those hazards to the drilling operation, and the outcome of the deployment of a non-retrievable rotating liner drilling system. This drilling system, in conjunction with a specially designed liner drilling PDC bit, enabled operators to drill through and isolate a challenging highly stressed rubble zone found adjacent to a problematic tar/bitumen layer.

The result of this successful deployment and the high deepwater drilling operating costs show the tremendous potential to deliver value by providing a simple proven solution that saves drilling time and cost when in a hostile environment. Before running the liner drilling system, nonproductive activities accounted for a total of 26 days. These included attempts to overcome unexpected issues associated with a severe tar attack, and sidetracking the well, which represented millions of dollars in losses to the operator.

A successful liner drilling system solution was crucial, and it enabled the operator to finish the well and hit the proposed pay zone. Without the success of this operation, it is likely that an extra string of liner would have been required and that the operator's final objectives wouldn't have been achieved.

Casing and liner drilling has demonstrated to have the potential in a wide variety of other offshore areas where similar hazardous environments may be encountered.

Introduction

It is well known in the industry that, due to seismic acoustic wave velocity uncertainty across thick salt bodies and the high acoustic wave velocity contrast between salt and surrounding formations, the sub-salt environment characteristics and pressure regimes cannot be accurately determine by seismic models (Willson and Fredrich 2005; and Thomson et al. 2008).

As a consequence, unexpected events are commonly encountered, which include loss circulation, stuck pipe, highly stressed rocks, and tar zones below the salt body. Loss circulation and tar are among the most feared hazards in the sub-salt drilling scenarios, mainly in exploration and appraisal wells, where limited information about the area being drilled is available.