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Deployment of Advanced Sidewall Coring Technology in South Iraq as Efficient and Cost-effective Alternative for Coring

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SUMMARY

To achieve the production objectives, big number of deviated wells are being drilled in the study area in South Iraq where a lot of drilling-related challenges are observed when going deviated across some sections. And, due to planned sustained production over years seal integrity needs to be assessed as well against further production and injection objectives. Therefore, there is a need for geomechanical studies in the field. The advanced triaxial geomechanical analysis requires large-sized core-plugs. Advanced rotary sidewall coring on wireline saved a lot of time and money compared to conventional full-bore coring in the study area in a four-well project, while efficiently retrieving 3.0”x1.5” size core-plugs directly from the sub-surface based on log-interpretation guided depths in varying lithology of shale, salt and anhydrite in a single descent. Thus, the need for conventional coring is minimized with deployment of the new large-format sidewall coring technology for geomechanical studies in South Iraq.

Introduction

Conventional coring has been considered the gold standard for decades by geologist, petrophysicists and reservoir engineers for various analysis. However; the associated cost, time and operational complexities deter the operator especially in development field. A new sidewall coring technology was made available to achieve the objectives of the coring in a producing field in South Iraq, which proved efficient and cost-effective while providing large-sized core plugs through wireline logging for lab analysis. Recent advances in sidewall coring suggest various analyses are possible (Shrivastava, 2013) on the large-format cores.

High angled wells being drilled in the study area to achieve the production objectives faced drilling and stability issues while passing through a regional shale layer. Also, salt and anhydrite layers provided inherent drilling challenges. Further, the competence of the seal-rock was also one of the important aspect to be measured in the depleting reservoir to unlock the full potential for optimal exploitation. A comprehensive plan of taking representative samples from the subsurface was prepared, while understanding the log-response corresponding to those samples. Conventional coring was ruled out, and options for sidewall coring were discussed.

Challenges and Methodology

The legacy rotary sidewall coring technology would have provided tiny samples, with volumes not enough to perform geomechanical tri-axial testing. Also, the huge variation in formations strength (from salt to shale to anhydrite) would have required multiple descent downhole for the legacy technology. The high solid content (~40%) in the mud-program also made the logging complicated and prone to challenges while cutting the rotary sidewall cores.

A new and advanced sidewall coring technology for large-format plugs (3.0”x1.5”) was introduced with advantage of surface-controlled weight-on-bit (WOB) that helped in acquiring the representative samples in one descent. Also, the advanced mechanical assembly helped in overcoming the challenges of high solid-mud. The borehole images and quad combo data was acquired prior to the sidewall coring to optimize the coring process and select the representative depths for three different lithology of salt, shale and anhydrite. Four wells were identified for data gathering and vertical wells were drilled through the target formation and lithology.

Application for sidewall coring optimization was used to advise the sequence and priority of coring. Rigorous analysis of available data of image logs, sonic and triple combo was performed and decision was taken to take samples in anhydrite first, followed by shale and salt; going from bottom to top

Results

The large-format sidewall cores of 3.0”x1.5” (Figure 1) were successfully acquired with wireline logging; with good recovery and mechanical integrity providing enough volume for all advanced analysis. The operations were monitored by experts’ real time and the log-response (Figure 1) were analysed to ensure high-quality samples. And, the cost of the operations was way less than the conventional coring exercise, saving rig-time and possible issues. Compared to the legacy rotary sidewall coring technology, the new technology was not only cost-effective and efficient by reducing the number of descents to core various formation strength lithology of salt, shale and anhydrite (Figure 2); but also provided four times more volume; thereby providing full confidence on results of analysis while nullifying the need of conventional coring in this study.

Also, the success of this technology in very high solid content (~40%) also opens up a new frontier where the mud properties are not the dampener for such coring technology anymore. The legacy coring tools would not have worked till the end of program with such mud, and the recovery would have been thoroughly questionable. However, 80% recovery was achieved with this deployment for large cores with mechanical integrity.

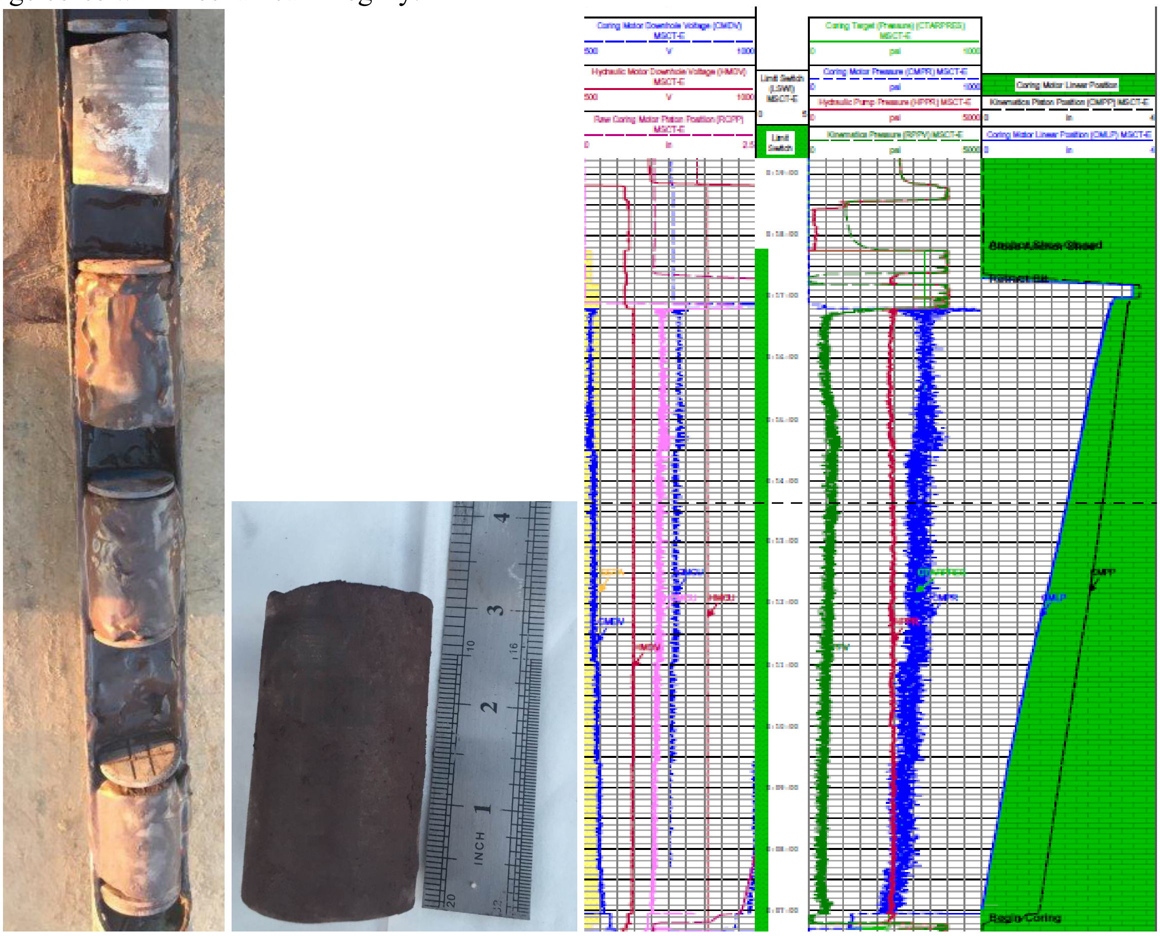

Figure 1 *This is an example of a core-tube with core samples intact within. One of the core plugs is taken out to show its dimension against a scale. The real-time logs show the smooth operations.*

Figure 2 *Please look at the nice core samples coming from anhydrite, shale and salt; all with intact mechanical integrity. The snaps show the cylindrical core length (3.0" long) and the circular top diameter (1.5" wide).*

Conclusion

This case study presents an excellent example of deployment of logging technology for data gathering in efficient and cost-effective way. The methodology and the operational standards also serve as a workflow for similar challenges elsewhere; where large-format sidewall cores can help in retrieving the representative samples for various analysis. The advanced rotary sidewall coring technology helped in minimizing the need of conventional full-bore coring where geomechanical stress-analysis needs to be performed for drilling issues.

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References

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