

THERMO-DESORPTION ON CUTTING SAMPLES: A REAL CASE STUDY OF HYDROCARBON IDENTIFICATION WHILE DRILLING

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Introduction

During the current economic downturn the mantra developed in the industry is efficiency increase – both economically and operatively. With this mindset a technique for quasi-realtime detection and speciation of hydrocarbons absorbed onto rock was developed and applied at wellsite. This abstract portrays a commentary on the direct comparison between the results obtained in realtime at the wellsite and data obtained later in a geochemical lab on the same samples. The impact of the technique on operational decisions, its benefits and its shortcomings are discussed.

Discussion & Results

The study was carried out in an exploratory well in North Africa, a context in which the extraction of the maximum amount of information in the shortest time is crucial. Most of the hydrocarbon-bearing formations are thin, rich in quartz and the state of the fluids contained therein is unknown. The well featured oil-based drilling fluids, very fast ROPs, and the employment of PDC bits.

Samples were collected directly at the shale shakers, washed with water, dried at low temperature for a short time, ground in a mechanical mill and analysed. The frequency of sampling is strictly dependent on the rate of penetration; with an ROP of ~60 m/h the mudlogging crew managed to collect 1 sample every 10 meters, i.e. 1 every 10 minutes.

The 24/7 onsite analysis exploited the principle of thermal desorption gas chromatography. Whereas the technique is known³, its application at the wellsite was not documented until now. The information collected were compiled in a daily report featuring several surface logs. Daily fingerprints of the mud were collected and analysed to correctly baseline the chromatographic results.

Data obtained at the rigsite were compared at a later date with the analysis performed in a geochemistry lab 3 months after the drilling had finished. In this case, the same samples were ground in a planetary mill, solvent-extracted using a dichloromethane/methanol mixture and analysed in a standard GC-MS instrument.

It is important to notice that due to borehole instability some formations could not be sampled with downhole tools. In this case the formation evaluation mainly used data coming from the surface logging, and the wellsite technique was able to pinpoint the presence of natural hydrocarbons in the specific interval.

Even if the analysis techniques were thoroughly different, the results obtained were comparable, as shown in Figure 1. The signature of the synthetic oil-based drilling fluids obscured a sizeable part of the chromatogram, but any component of the hydrocarbons falling

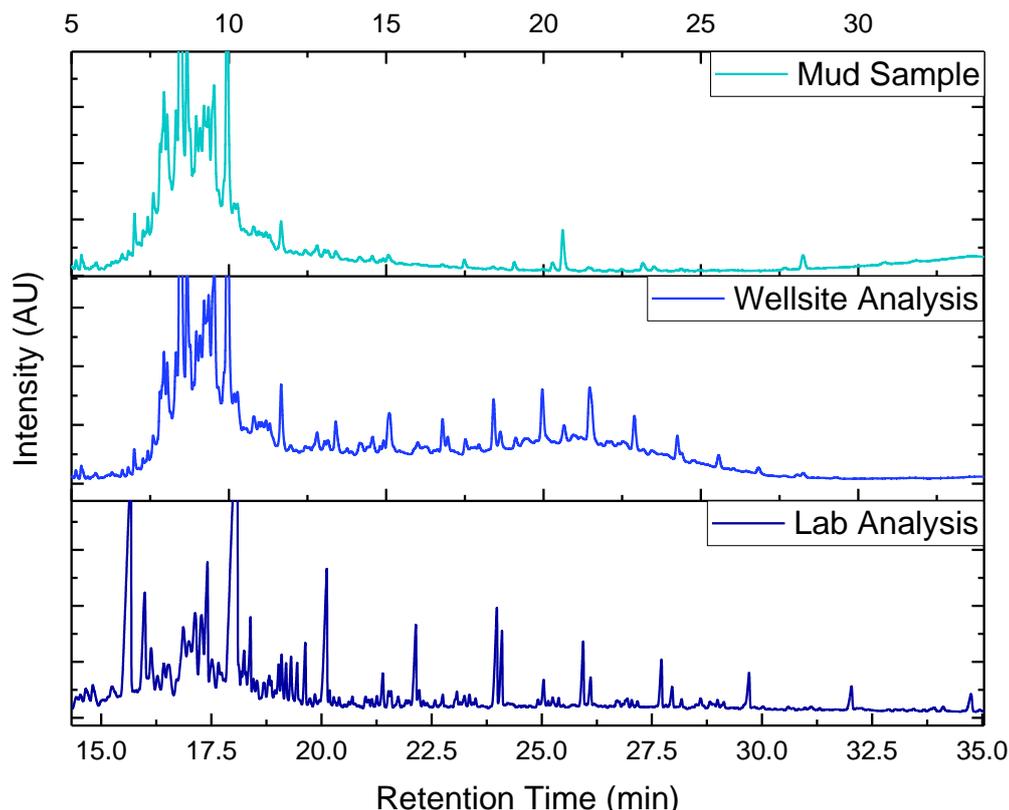


Figure 1: comparison between (top) mud signature; (b) oil-rich formation sample analyzed at well-site; (c) oil-rich formation sample analyzed in the lab.

outside of the C₁₂-C₁₅ area could be analysed, providing good proxies for the identification of naturally occurring hydrocarbons downhole.

The technique has its shortcomings: extensive contamination (e.g. base oil) can impair analytical capabilities; a high ROP can cause low sampling frequency; excessive fragmentation of the cuttings might cause partial losses in absorbed hydrocarbons; etc. Nonetheless, this is a common problem for many laboratory geochemical techniques. Therefore, when these aspects are manageable and can be accounted for in the final evaluation of the results, the techniques has proven reliable and on-par with laboratory techniques.

Conclusions

The comparison between the results obtained with two different techniques in two completely different environments were compared and the results showed a fundamental agreement between the two datasets. The wellsite analysis was extremely useful to identify hydrocarbons in real time even when standard downhole tools failed. Further details will be provided at a later date.

References

3. A. Maende, D. Jarvie, "Finding Bypassed or Overlooked Pay Zones Using Geochemistry Techniques", IPTC 12918 (2008).