

PORTABLE XRF SPECTROMETER AS A FORMATION EVALUATION AND GEOSTEERING TOOL APPLIED IN THE POLISH PERMIAN BASIN

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Abstract. Development of hydrocarbon exploration involves sophisticated methods allowing for quick and precise reconstruction of lithological profile during drilling. Advanced geosteering procedures are set up on various methods (Morton, 2007, Stilwell et al., 2013, Yarbrough, et al. 2019). Our research was focused on Rotliegend formations from two boreholes: P4 and P5H. P4 with available archival core material was chosen as a reference borehole and P5H as a horizontal borehole for tests. Our team created a new core sampling methodology to obtain material comparable to cuttings collected on the rig site. Core data (XRF, XRD and ICP-OES/MS laboratory tests) were a basis for preparing mineralogical models built on geochemical analysis. The data were also utilised to calibrate handheld XRF spectrometer to obtain more precise geochemical results (Skupio, 2014). Lithological interpretation in whole P4 Rotliegend core section was conducted and used as a reference borehole profile. Sample preparation, XRF measurements and data interpretation were made in real time on the rig site during P5H realization. Comparison of results obtained from cuttings provided during drilling of the horizontal P5H well with core data from P4 was a basis to correct drilling trajectory of the horizontal well. XRF analyses allowed for precise lithological interpretation and showed chemical composition changes in examined profile. Real time results of P5H lithological modelling were employed for geosteering procedure. Quick sample preparation and analyses allowed for faster data acquisition than LWD measurement. Lithology interpretation for P4 and P5H boreholes was done only by modelling the XRF data according to reference well.

Morton, A.C., 2007: The role of heavy mineral analysis during drilling of high angle wells. In: Mange, M. and Wright, D.K. (eds), Heavy Minerals In Use. Developments in Sedimentology, 58, 1123-1142

Skupio R., 2014: Wykorzystanie przenośnego spektrometru XRF do pomiarów składu chemicznego skał, Nafta-Gaz nr 11, s. 771-777.

Stilwell H., Martinez N., Hildred G., Zaitlin B. 2013: Forensic Chemostratigraphy in Geosteering Multilateral Wells: An example from Devonian to Carboniferous-aged sequences in Southern Alberta Conference Paper of Unconventional Resources Technology Conference, Denver, Colorado, USA, 12-14 August 2013

Yarbrough L. D., Carr R., Lentz N. 2019: X-ray fluorescence analysis of the Bakken and Three Forks Formations and logging applications. Journal of Petroleum Science and Engineering 172 (2019) 764–775