# MODELING THE EFFECTS OF DRILLING FLUIDS WITH HEAT TREATED CORE SAMPLES

BORS, V.[1]* & TÓTH, J.[2]
[1] Department of Mineralogy, Eötvös Loránd University, Pázmány Péter sétány 1/c, H-1117 Budapest, Hungary
[2] Engineering and Technology Development, MOL PLC, EPD IFA, Hungary
* E-mail: bors.viktoria.orsolya@gmail.com

**The aims of the modeling/work**

The first and most important task of the selected drilling fluid is to prevent the reservoir rocks, namely to avoid damage, preserve the initial features and parameters of reservoir rocks (CAENN & CHILLINGAR, 1996; VAN OORT, 2003; ANDERSON *et al*, 2010). The modeling of the conditions inside the borehole has two pillars; one is to recognize in large scale the traits of the reservoir rocks and the applied drilling fluid; the other element is to relate and interpret their features (DORMÁN, 2010). Our primary aim is to recognize and evaluate the initial composition of samples and to demonstrate the possible mineral changes in the heat treated core samples.

**The experimental conditions**

The initial core sample was a grey, middle hard, micaceous mudstone. The mineral phase composition of the samples in order of decreasing quantity: illite/muscovite, quartz, chlorite, albite. During the experiment the chemical agent was designed to be more and more similar to the field-used water based drilling fluid. There were four agents applied: distilled water, 0.1% NaOH + 0.3% $Ca(OH)_2$, 0.1% KOH + 5% KCl and Synthetic HPHT fluid. The heat treatments were done at 175°C, 200°C and 220°C in runs of 24 and 72 hours.

**Results**

In heat-treated samples, mineral phase changes were monitored by X-ray powder diffraction. Sylvine appeared in samples treated by synthetic HPHT fluid and KOH + KCl agent at almost all temperatures. Analcime and calcite appeared as new phases in the sample which was treated by KOH + KCl at 220°C. In connection with the original clay fraction reactions, new phases (mainly zeolite) were recognized in several samples.

Though changes in the ion concentrations between the agents and samples were expected during the experiments, only in a few cases were found correlations between the ion changes and the appearance of the new mineral phases.

Scanning electron microscopy was used for characterising both the untreated, initial samples and the samples treated at 220°C, where particularly the shape and size of the new mineral phases were studied.

The impact of the drilling fluid on the swelling clays, namely whether it prevented or reduced the clay-swelling, was studied as well, with particular interest on the different dissolution marks on the surface of the samples.

Interesting phenomena occurred during the experiment when the heavy metals accumulated on the illite/muscovite dissolution surface. The reason for those phenomena was that the samples which were treated with the "simply" agent could not stabilize adequately the clay minerals. Therefore, during the heat-treatment the samples could disintegrate and the heavy metals could be fixed on the illite/muscovite surface on drying.

**Conclusions**

During our model experiments only a small amount of new minerals were formed in the heat-treated samples, and even these new phases appeared on the surface of the samples and not as void-fillers. Therefore, the above mentioned chemical agents are suitable drilling fluids, as their components have only a minimal effect on the reservoir rocks and even that effect is not long-lasting.

That modeling was just a first step in these testing, our methods should be improved in the future.

**References**

ANDERSON, R.L., RATCLIFFE, I., GREENWELL, H.C., WILLIAMS, P.A., CLIFFE, S. & COVENEY, P.V. (2010): Earth-Science Reviews, 98: 201–216.
CAENN, R. & CHILLINGAR, G.V. (1996): Journal of Petroleum Science and Engineering, 14: 221–230.
DORMÁN, J. (2010): MOL Scientific Magazine, 2010/3: 4–12.
VAN OORT, E. (2003): Journal of Petroleum Science and Engineering, 38: 213–235.