08.20: Experimental Results of Smectite to Illite Transformation

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ABSTRACT

Predicting pore pressure is an important job in the petroleum industry. Standard methods for estimating pressure do not apply to the basin where overpressure is often observed. My research aims to look at the relationship between smectite-to-illite transformation and overpressure generation.

To study the environment that causes transformation, GoM-EI material is cooked at elevated temperature for 18 days (one sample 29 days) in a hydrothermal reactor with 3 mol/L KCl. The smectite-to-illite transformation reacts with a faster rate as the temperature goes higher. As a general trend, discrete smectite and discrete illite decreases and are represented by I/S phase. As transformation progresses the smectite content in the I/S phase decreases and the illite content in the I/S phase increases.

In addition to temperature variation, KCl concentration slightly changes mineralogy but cell pressure does not have effect on transformation.

To quantify the water release during the transformation, the cooked and original GoM-EI samples were evaluated using thermogravimetric analysis (TGA). Thermogravimetric water release agrees with changes in mineralogy from XRD analysis.

CLICK ON IMAGE FOR LARGER VIEW

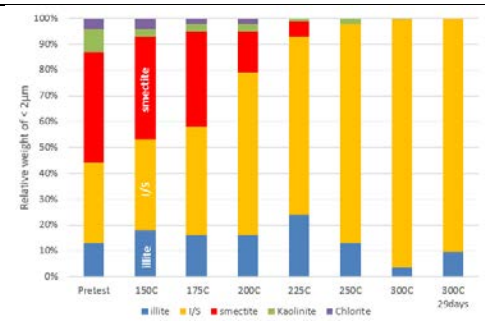

Fig 1: Mineralogy analysis of cooked GoM-EI mudrock (XRD and XRD interpretation was done by Shell). The smectite content decreases at the temperature increases.

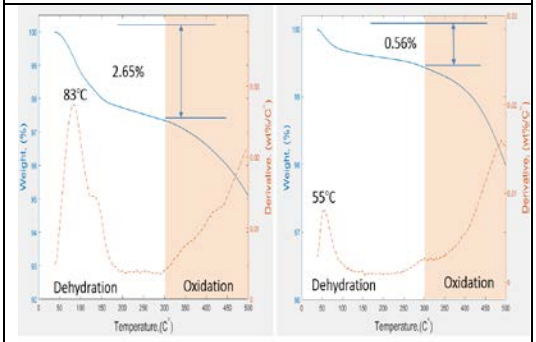

Fig 2: Original and cooked samples were sent to Schlumberger for thermogravimetric analysis. From 0 to 300C, the weight loss (the blue curves) is due to adsorbed and interlayer water. The original GoM-EI loses more water than cooked material. Through calculation using mineralogical composition, the thermogravimetric water release agrees with changes in mineralogy.

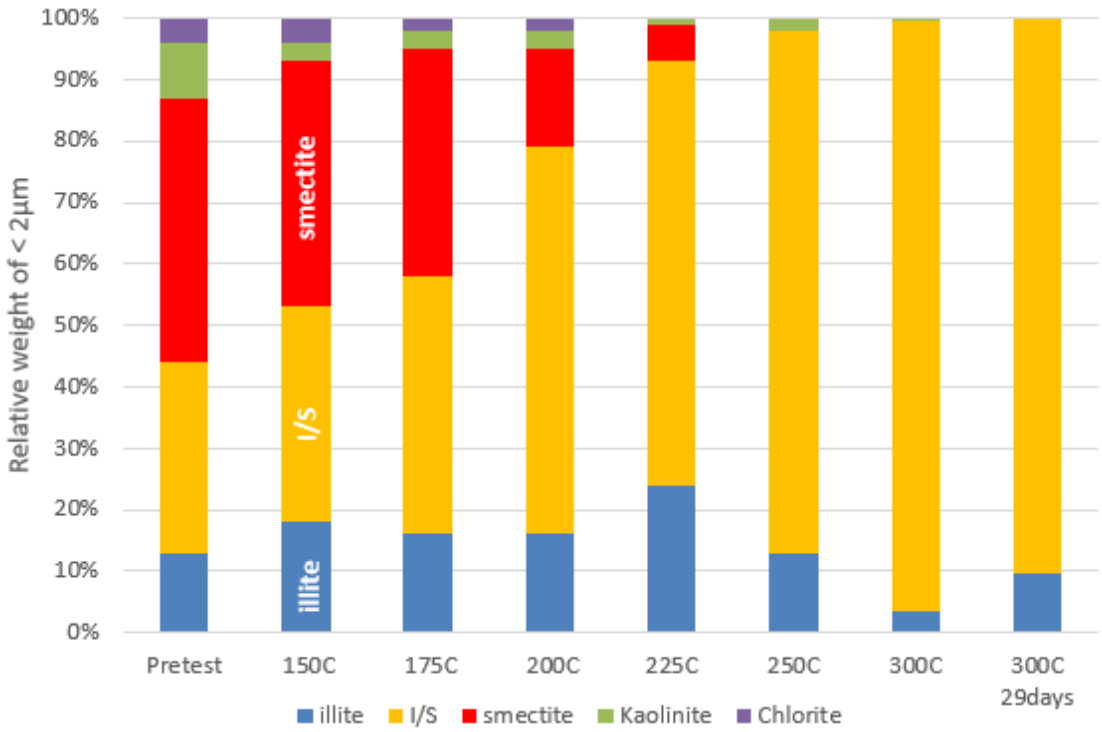

Fig. 1: GoM-EI material were cooked at elevated temperature for 18 day (one sample 29 days) in a hydrothermal reactor with 3 mol/L KCl. Minerology analysis of cooked GoM-EI mudrock (XRD and XRD interpretation was done by Shell). The smectite content decreases at the temperature increases.

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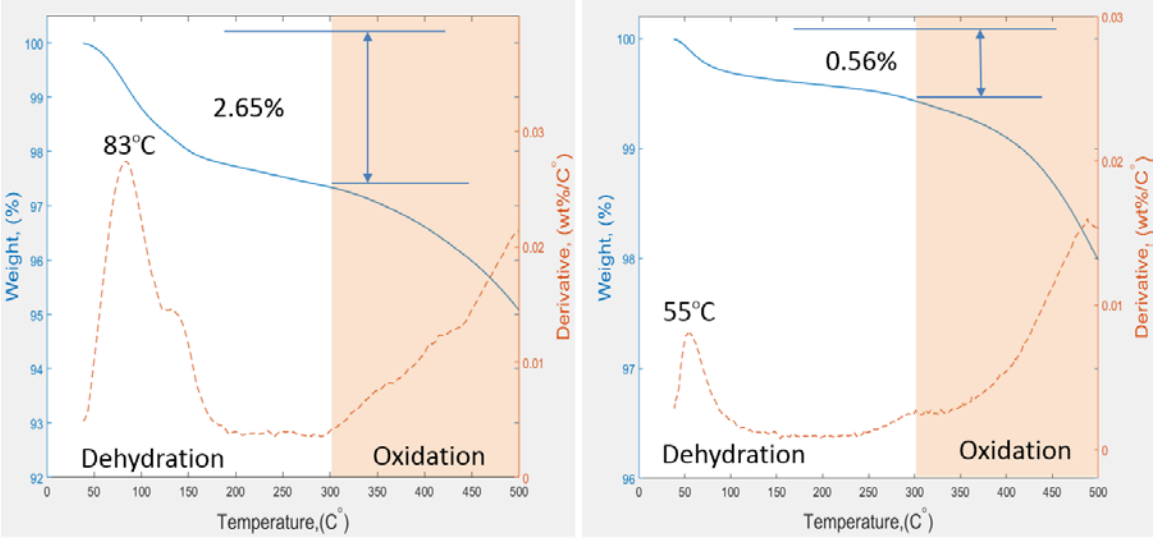

GoM-EI Pretest Sample

IS02 Sample 250C 18days

Fig. 2: Original and cooked samples were sent to Schlumberger for thermogravimetric analysis. From 0 to 300C, the weight loss (the blue curves) is caused by evaporation of adsorbed water from clay mineral surfaces and interlayer water. The original GoM-EI loses more water than cooked material. Through calculation using mineralogical composition, the thermogravimetric water release agrees with changes in mineralogy.

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