

## From shale oil to shale gas: mineralogical and geochemical evolution of Barnett Shales

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Tight oil is a rapidly growing unconventional energy resource that is increasingly viewed as an abundant global commodity. An issue is that tight oil reservoirs are highly heterogeneous. As a result, fluid production assignments and mixing, drainage zone definition and reservoir performance remain poorly constrained. Here, we report the characterization of samples from the organic-rich Mississippian Barnett shale gas system (Fort Worth Basin, Texas, USA) at varying stages of thermal maturation. Using a combination of compositional organic geochemistry and spectromicroscopy techniques, including transmission electron microscopy (TEM) and scanning transmission X-ray microscopy (STXM - 5.3.2.2. ALS STXM Polymer beamline [1] - 10ID-1 CLS SM beamline [2]), we document the mineralogical and geochemical evolution of the investigated samples and evidence the net increase in sample geochemical heterogeneity with increasing maturity [3]. We distinguish kerogen from bitumen in samples of oil window maturity from the estimation of aromaticity and polarity using STXM-based XANES spectroscopy. The formation of nanoporous pyrobitumen has been inferred for samples of gas window maturity, likely resulting from the formation of gaseous hydrocarbons by secondary cracking of precursor bitumens. By providing *in situ* insights into the origin and fate of organic fluids as a response to the thermal evolution of the macromolecular structure of kerogen, the present contribution constitutes an important step towards better constraining reservoiring within unconventional systems.

[1] Kilcoyne *et al.* (2003), *J. Synchrotron radiat* **10**, 125-136,  
[2] Kaznatcheev *et al.* (2007), *Nucl. Instr. Meth. Phys. Res. A* **582**, 96-99, [3] Bernard *et al.* (2012), *Int. J. Coal Geol.* **103**, 3-11.

## Flux particle size and composition effects on the evolution of sanitary-ware vitreous body

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A combination of three industrial flux compositions (sodium feldspar > 67 wt.%, potassium feldspar > 69 wt.% and a 1:1 mix of them) and two particle size distributions (d<sub>50</sub> ≈ 45 and 75 μm) have been used to prepare sanitary-ware slips (flux amount about 25 wt.%). Samples have been fired up to 1200 °C, and then characterized in terms of water absorption, density, X-ray diffraction (at ambient and HT conditions) and micro-structure occurrence by Scanning Electron Microscopy.

Despite of the small differences in the samples, some trends have been observed. Water absorption and interconnected porosity (obtained by density measurements) are minimized if sodium feldspar is used, suggesting a better densification, in agreement with [1]. The same effect is achieved by decreasing the flux particle size, which leads to a higher reactivity of the starting slip, in keeping with [2]. The application of RIR-Rietveld method [3] to powder diffraction patterns shows that also differences in phase composition are present: in particular, the highest glass content has been observed if the smallest flux particle size is used, in combination with a sodium bearing feldspar. Moreover, observations from HT-powder diffraction experiments (thermal range 900-1100°C) do not yield significant differences in the feldspar thermal decomposition as a function of flux composition and particle size.

[1] Das & Dana (2003) *Termochimica Acta*, **406**, 199-206. [2] Alves, Melchiades & Boschi (2012) *Journal of European Ceramic Society*, **32**, 2095-2102. [3] Gualtieri (2000) *Journal of Applied Crystallography*, **33**, 267-278.