Organic compounds in produced water from coal and shale

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Disposal of produced water from natural gas production is an environmental concern because of both large volumes of and potentially poor water quality. Most studies of produced water quality have focused on inorganic composition [1, 2], but we have recently examined naturally-occurring organic compounds in produced water [3]. Our work shows a number of different organics in produced water from several different coal and shale natural gas operations, including naturally-derived polycyclic aromatic hydrocarbons (Fig. 1).

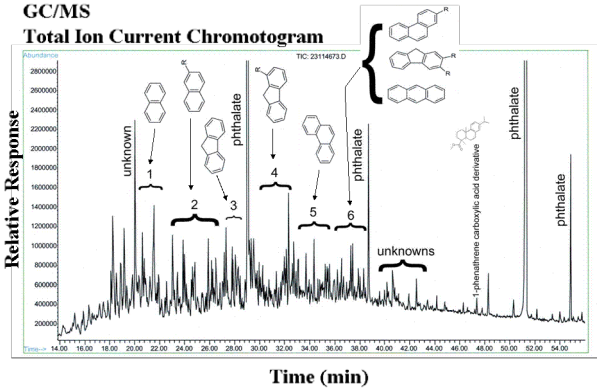

Figure 1: Polycyclic aromatic hydrocarbons in coalbed methane produced water from the Powder River Basin, Wyoming, USA.

Some of the organic compounds identified are potentially toxic and produced cell death in human kidney cell lines relative to the controls.

[1] McBeth *et al*. (2003) *J. Am. Wat. Res. Assoc*. **39**, 575–585. [2] Van Voast (2003) *Am. Assoc. Petrol. Geologists Bull*. **87**, 667–676. [3] Orem *et al*. (2007) *Appl. Geochem*. **22**, 2240–2256.

High temperature cooling history of two Variscan late- to post-kinematic granitic plutons from Aguiar da Beira (NE Portugal)

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Zircon and monzite U-Pb ages and K-Ar dating of biotite and muscovite were gathered in order to reconstruct the cooling history of two Portuguese Variscan plutons from the Aguiar da Beira area: the late-kinematic, coarse- to medium-grained porphyritic biotite-muscovite granite of Touro, and the late- to post-kinematic medium-grained porphyritic biotite-muscovite granite of Pera Velha / Vila da Ponte. They show similar cooling patterns, characterized by an early stage fast cooling rate of ~ 59°C/Ma from 900° to 350°C, followed by a decelerated stage cooling rate of ~ 2.5°C/Ma from 350° to 270° C (Fig. 1). The fast cooling rate seen on the initial stage of both patterns is probably due to the large thermal contrast between granite bodies and the country rocks, while the final segments of the curves represent slow cooling after thermal equilibrium with the surrounding rocks has been reached.

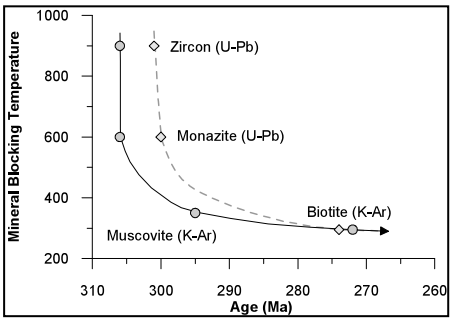

Figure 1: Cooling history of the Touro granite (solid line), and the Pera Velha / Vila da Ponte granite (dashed line).

The fast cooling patterns exhibited by both plutons are in perfect agreement with the high exhumation rates that characterize the final stages of the third deformation phase of the Variscan orogeny, during which these magmas were emplaced.