

BENZONAPHTHOFURAN RATIO AS A NEW THERMAL MATURITY PARAMETER FOR COALS AND CORRELATION TOOL

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For the past few years, coal organic matter and its oil/gas generation has been a subject of wide discussion (Wilkins and George, 2002). To calculate generation and conduct oil (condensate)–source rock correlation, it is necessary to have a set of thermal maturity molecular parameters and other genetic parameters. However, the majority of hydrocarbon indicators for thermal maturity in coal extracts depends on the coal type and its sedimentation conditions (Dzou et al., 1995; Norgate et al., 1999). Gas chromatography-mass spectrometry analyses results of 73 Upper Jurassic chloroformed coal extracts from West Siberia (Russia) also confirm this fact. Widely-applied thermal maturity parameters, such as MPI, DNR, 4MDBT/1MDBT, CPI, Pr/C17, and Ph/C18 do not distinctively alter accordingly to thermal effect increase, especially in early catagenesis zone. Thus, it is necessary to find new parameters less dependent on coal type and facial conditions.

Based on systematic investigations of extracts from coal and genetic related oil found in significant amount, three benzonaphtofuran (BNF) isomers were identified: benzo[b]naphto[2,1-d]furan, benzo[b]naphto[1,2-d]furan, benzo[b]naphto[2,3-d]furan.

It was found that in coal with different degrees of thermal maturity there exists a definite regularity in the distribution changes of these three compounds with thermal maturity increase. In samples with low thermal maturity BNF [1,2 -d] content is less than on the other two. Under catagenesis development BNF [1,2 -d] content increases, while BNF [2,3 -d] content decreases. As a result, a new thermal maturity parameter for organic coal matter is suggested – BNFR: benzonaphtofurans ratio, based on the content ratio of different benzonaphtofuran isomers (Fig.1).

In comparison to other thermal maturity molecular parameters, BNF ratio specifies smaller value variations along coal bed cross-sections and to a less degree depends on the hydrogen saturation of coal samples. Comparatively small variation is from 1.4 to 5.7% along 2/3 - meter coal bed cross-section. BNF ratio in comparison to MPI-1 shows good correlation with vitrinite reflectance.

In paraffin oil, genetic connected with non-marine organic matter, high Pr/Ph, predominately in steranes compound C₂₉, there is a distinct change between MPI-1 and BNFR. This proves the fact that this parameter is highly effective.

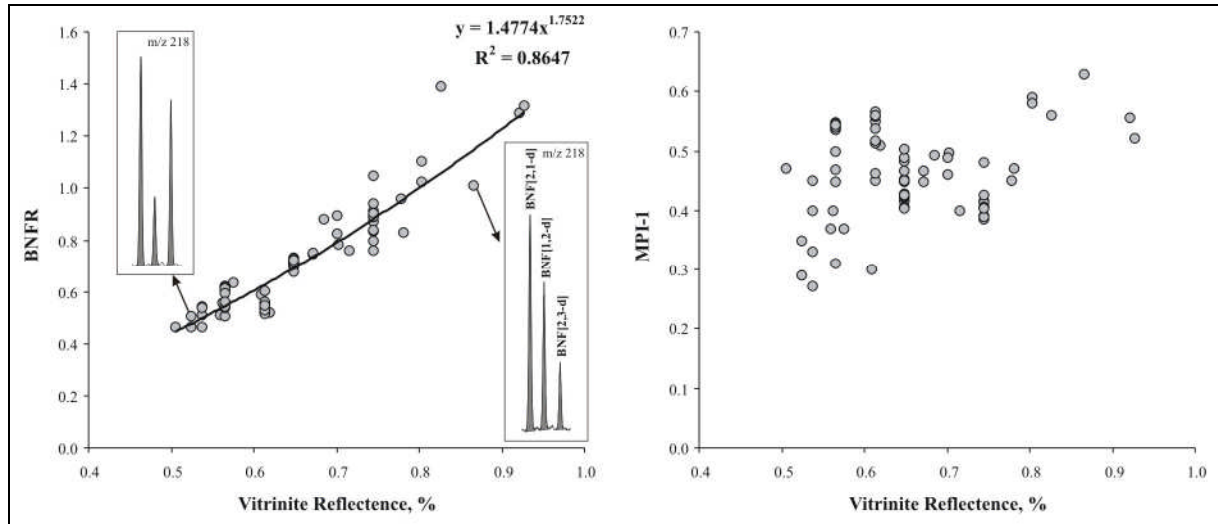


Figure 1. Relationship between vitrinite reflectance, BNFR and MPI-1. MPI-1 – methylphenanthrene ratio = $1.5 \cdot (2MP + 3MP) / (0.69 \cdot P + 1MP + 9MP)$, using response of m/z 178 and 192; BNFR = $\lg((BNF[2,1-d] + BNF[1,2-d]) / BNF[2,3-d] + 1)$, using response of m/z 218, where lg is a common logarithm.

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