A new way to solve thermal maturity of marine shales with high-over maturities

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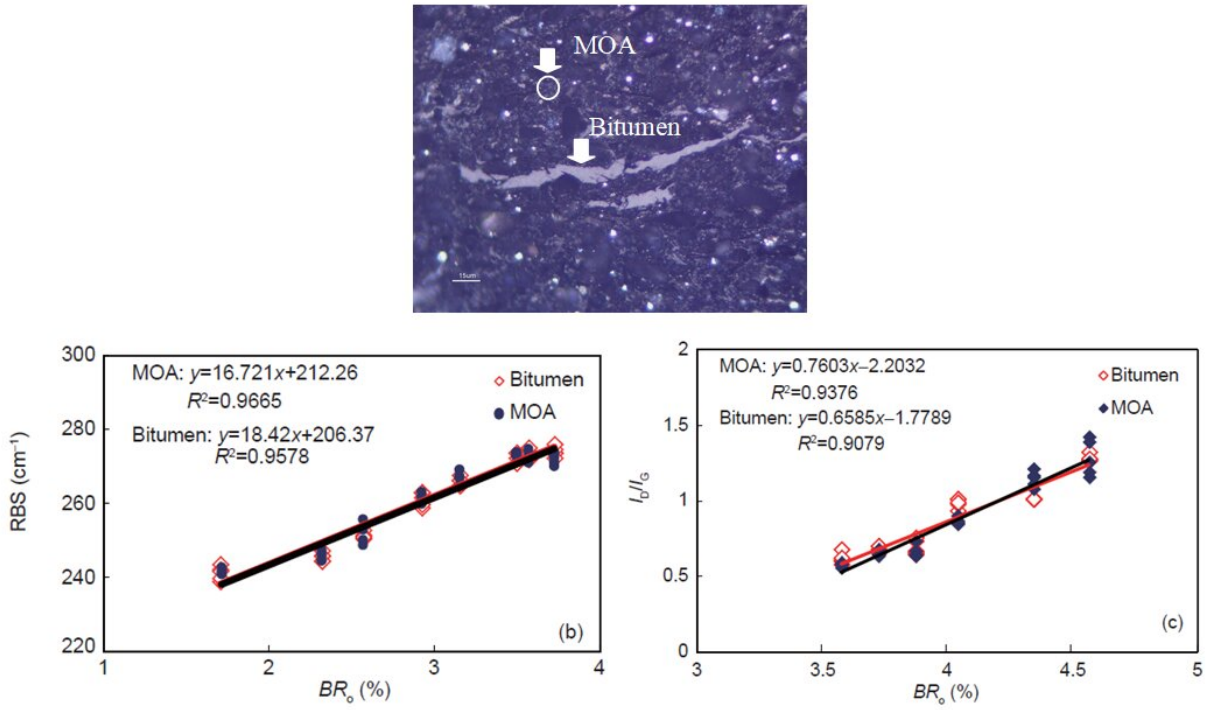

MOA and solid bitumen in shales, and relationships between their Ramm parameters (RBS?ID/IG) and bitumen reflectance (BRo). Credit: ©Science China Press

Laser Raman spectroscopy parameters of pure organic matter (e.g., vitrinite, solid bitumen) in sedimentary rocks have been widely applied for maturity determination, but there is a lack of relevant studies on

mineral-organic aggregation (MOA) directly based on shale whole rock samples. A recent paper has revealed a good correlation between laser Raman spectroscopy parameters of MOA and maturities for high-overmature marine shales, providing a new way to address maturity evaluation.

The paper entitled "Thermal maturation as revealed by micro-Raman spectroscopy of mineral-organic aggregation (MOA) in marine shales with high and over maturities," authored by Xianming Xiao, Qin Zhou, Peng Cheng, Jian Sun, Dehan Liu and Hui Tian, was published in *Science China Earth Sciences*. The researchers investigated the laser Raman spectra and parameters of MOA in marine shale samples with different organic matter contents and different maturities from southern China, and they believed that the laser Raman parameters of MOA can indicate the maturity levels, as do the pure organic matter in shales.

There are two Raman first-order bands for organic matter in shales: D band (representing disordered structure) and G band (representing ordered structure). With increasing maturity, the position, shape and intensity of the two bands change regularly, and the resulted parameters show a clear correlation with maturity. A large number of studies have shown that the laser Raman parameter is another rapid and damage-free technique for the maturity determination of organic matter in shales following the method of vitrinite reflectance measurement. At present, pure organic matter, such as vitrinite or solid bitumen, is mainly selected to determine the maturity of shales by laser Raman technique. Nevertheless, in the early Paleozoic and older marine shales, there is no vitrinite, and the solid bitumen is generally rare. The shale organic matter mainly occurs with a very small size (

In the suggested paper, the laser Raman spectra of MOA were systematically tested and the relevant parameters were calculated by using laser Raman technique. The results show the Raman spectral D and

G bands derived from organic matter can be detected in MOA in shales with a minor amount of organic matter (as low as 0.1 %). Perfect Raman spectra and effective parameters of MOA can be obtained where the shale TOC = 0.60 %. The Raman spectral parameters of MOA are comparable to those of its associated sold bitumen, having an equivalent value as thermal maturity indicators with solid bitumen .

The Raman spectral parameters of MOA provide an alternative way to estimate the maturity for shales in high and over maturity stages, especially for lower Paleozoic and Precambrian shales where microscopically identifiable organic matter are rare.

More information: Xianming Xiao et al, Thermal maturation as revealed by micro-Raman spectroscopy of mineral-organic aggregation (MOA) in marine shales with high and over maturities, *Science China Earth Sciences* (2020). DOI: 10.1007/s11430-020-9627-2

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