Influence of vitrinite types, facies associations and hydrocarbon generation on vitrinite reflectance analysis

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Vitrinite reflectance (VR) analysis is the most widely used technique for the assessment of thermal maturity. The maturity is a measure of the degree of chemical and physical changes experienced by coal and dispersed organic matter with increasing depth of burial. VR is a measure of the proportion of light reflected from the polished surface of a sample compared to that of a standard. This technique, however, tends to be taken for granted. The numbers generated, more often than not, are accepted unquestioned. This is a mistake as the technique, if not carefully managed, is open to several sources of error. This study discusses a number of factors that are found to be most critical and most likely to influence vitrinite reflectance measurement. These include:

1. Vitrinite types: Tertiary coals, in contrast to Carboniferous coals, contain a wide range of vitrinite types. Although measurements should be performed on telocollinite (or collotelinite)

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type of vitrinite, this is not always the case and as such variations in the values obtained may be significant. Which is the correct virinite to measure is therefore a fundamental question.

- 2. Inter-maceral facies effects: The presence of certain macerals, notably alginite, and also suberinite, can suppress vitrinite reflectance measurement. Vitrinite in close association with such macerals should be avoided.
- 3. Lithofacies association: Different lithologies enclosing the organic matter, may exert a partial control on the measured vitrinite reflectance. This may be ascribed to the varying thermal conductivities (for example of a sandstone compared to a shale). Also needed to be taken into consideration is the ease of escape of the coalification products such as volatile matter, and bitumen (or hydrocarbons) that may have impregnated the organic matter.
- 4. Hydrocarbon impregnation: Soaking of vitrinite in hydrocarbon leads to a lowering of its reflectance. This phenomenon is not all-pervading and can be avoided once recognised.
- 5. Plastic deformation: As a consequence of hydrocarbon generation, the vitrinitic coal fabric may undergo plastic deformation which subsequently alters the physical-chemical state of the coal and causes the reflectance to increase.

Besides these main factors listed, reasons for variation in vitrinite reflectance values may also be attributed to factors related to conditions of deposition such as microbial alteration and other biochemical influences within the coal depositional environment. All of these factors will effect VR measurements and need to be highlighted.