TECHNICAL FILE

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THE MEASUREMENT OF VITRINITE REFLECTANCE USING MATLAB

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The measurement of vitrinite reflectance is widely used as an indicator of coal rank and organic maturation in source-rock studies. This is due to the regular change in reflectance properties of the vitrinite group during coalification. Traditional coal petrographic studies', including rank determination, uses transmitted light microscopy. Vitrinite is differentiated from other macerals microscopically under an oil immersion lens using incident light on polished surfaces and taking into account properties, such as, colour, shape, relief, hardness and principally, reflectivity. The accurate measurements of vitrinite reflectance are achieved with the calibration of the microscope with, at least, two standards of known reflectance. The values of vitrinite reflectance are then registered analogically in a photo-multiplier apparatus or more recently in software packages that deal with image analysis treatment.

In this work we propose a method for vitrinite reflectance measurement that uses the techniques of image processing ready available in Matlab. We developed a dedicated graphical tool that runs within the Mirone suite (also written in Matlab, Luis, 2007), that calibrates a scale of 256 grey levels with standards of known reflectivity. The black and white images of the vitrinite particles are imported to this routine and its reflectance values are measured. In order to test the reliability of this method, several coal samples with a known rank, ranging from lignite to meta-anthracite (Flores, 2002; Marques 1993; Suarez et al., 2006; Marques et al., 2009), were re-studied and its vitrinite reflectance were measured using the new tool. The results of

this test (table 1 and figure 1) show that there is a very good correlation between the vitrinite reflectance measurements made with traditional methods (%Rm Literature) and the new Vitrinite tool. Although more tests are needed to ascertain the consistency of this new method, these results show that this method can be a more affordable alternative to the commercial vitrinite reflectance software packages.

Coal Sample Ref.	%Rm Literature	%Rm MatLab	SD	No. Points
1707/1719	0.19	0.21	0.03	50
950/954	0.30	0.29	0.05	50
1375	0.55	0.56	0.02	50
1501/1502	0.74	0.68	0.05	50
136/140	0.90	0.82	0.03	50
3156	1.14	1.18	0.05	50
3152	1.41	1.46	0.07	50
3182	1.63	1.66	0.09	50
2844	1.73	1.78	0.25	50
3160	1.96	1.9	0.15	50
1429/1431	2.30	2.38	0.16	50
742/745	2.47	2.53	0.17	50
1/47	3.20	3.16	0.19	50
219	3.39	3.19	0.16	50
3153	4.28	4.15	0.25	50
20	4.68	4.67	0.21	50
16/18	4.90	4.85	0.24	50
286/289	5.28	5.33	0.26	50
97/99	5.52	5.55	0.46	50
266/273	6.16	6.06	0.33	50
168/181	6.25	6.21	0.36	50

Table 1. Values attained for the coal samples. %Rm Literature indicates the vitrinite reflectance values for the coals measured with traditional methods; %Rm MatLab the vitrinite reflectance values measured with the new Vitrinite tool routine; SD – standard deviation and the number of points measured.

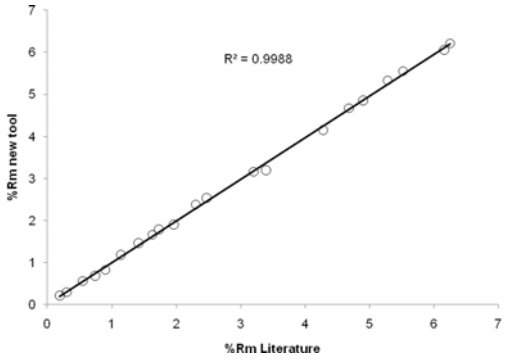

Figure 1. Correlation chart between the vitrinite reflectance values measured with the traditional methods and with the new Vitrinite tool. Note the very good correlation between the two sets of values with a regression line of $R^2 = 0.9988$.

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