

Fifty shades of black – nondestructive methods for the identification of Belgian black marbles

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The world-famous black marbles of Belgium are not marbles in the petrographic sense. Rather, they consist of fine-grained, well-cemented Paleozoic limestones devoid of veins or fossils. Consequently, they exhibit a uniform pure black color, and can be finely polished. Several detailed studies have been dedicated to these ornamental stones, including those focused on Basècles (Overlau, 1966) and Dinant (Mottequin, 2004) (see also Duser et al., 2009).

Five varieties of Belgian black marbles were recently investigated for discrimination purposes (Boulvain et al., 2020). They span in age from Frasnian (Golzinne) to Viséan (Dinant, Theux, Basècle, Lives). Three methods were employed: petrography, magnetic susceptibility (MS), and geochemical analysis of major elements and REE.

The MS results clearly differentiate the Frasnian black marble from its Viséan counterparts. However, MS fails to distinguish between the various Viséan black marbles. Petrographic analysis revealed various microfacies reflecting predominantly quiet environments, occasionally interrupted by more energetic phenomena such as turbidites or storms. These microfacies were integrated into two depositional models: a calm offshore setting, situated below or in close proximity to the storm wave base (Salet, Basècles), and a shallow yet highly sheltered zone protected from waves and currents (Lives and Golzinne).

Nevertheless, all these techniques are destructive and require sampling, with sample sizes ranging from approximately 1 g for geochemical analyses, around 10 g for MS, to the preparation of thin sections for petrography.

The aim of the present study is to evaluate spectrophotometry, a non-destructive method, for identifying black marbles. This method may be complemented by portable MS, eliminating the need for sampling.

Spectrophotometric analysis of 170 samples was conducted using a CM-700d/600d spectrophotometer from Konica Minolta. This device features openings with diameters ranging from 3 to 8 mm, allowing for averaging over a relatively large surface area. The parameters provided by this instrument include: L^* for luminance, a^* representing the position of the sample color on the red-green axis, and b^* representing the position of the sample color on the yellow-blue axis. The device employs a pulsed xenon lamp as its light source and covers a spectral range from 400 to 700 nm. Specular reflection can be either included or excluded.

Comprehensive tests were conducted using various parameters and capabilities of the device, with the best discrimination achieved through the L^* and a^* values. Experiments were also carried out to assess the effect of surface treatment on marble samples, revealing that the most favorable results were obtained from acid-etched or polished surfaces.

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