

## Raman Spectroscopy as a tool for magnesium estimation in Mg-calcite

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Despite their strong Raman scattering and importance in several applications in the geological and biological sciences, Mg-calcites have not been thoroughly investigated by Raman spectroscopy. In this study we investigated whether Raman spectra of carbonates are sensitive to structural and chemical changes occurring when Mg<sup>2+</sup> substitutes Ca<sup>2+</sup> in the calcite lattice. Different carbonate samples with variable Mg content (0 - 20 mole % MgCO<sub>3</sub>) of biological and inorganic origin, have been first beamed under a Raman spectrometer and then analysed by SEM-EDS and EMPA-WDS to determine their chemistry. Biological samples (foraminifers, coralline algae, barnacles, echinoderms) were collected from areas situated at different latitude, water temperature and saturation, factors affecting Mg content in biogenic calcite. Raman band positions are directly linked to the amount of magnesium present in the calcite lattice [1]: all peaks of Mg-calcite spectra show a consistent and linear increase in Raman shifts according to their Mg content, which is a consequence of decreased inter-atomic distances following the substitution of Ca<sup>2+</sup> with the smaller Mg<sup>2+</sup> ion. We propose an innovative work perspective in oil exploration, presenting a case study on MgCl<sub>2</sub> flooded chalk, under reservoir conditions. These rocks are one of the key samples to exercise Enhanced Oil Recovery in hydrocarbon reservoir at the Norwegian Continental Shelf. Chalk-fluid interactions are complex; mechanical strength, compaction, porosity and permeability of chalk are linked to calcite dissolution and to the recrystallization of Ca- and Mg-carbonate minerals, and all play an important role in the reservoir potential [2].

[1] Bischoff *et al.*, (1985) *Am. Mineral.*, **70**, 581.

[2] Madland *et al.*, (2011) *Transport Porous Med.*, **87**, 679.