

## **Dolomite fluorescence color variation, chemical or thermal effect, LA-ICP-MS evidence**

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This study presents preliminary results of laser ablation inductively coupled plasma mass spectrometry (LA-ICP-MS) analysis of scattered dolomite crystals in Upper Ordovician Utica Shale from southern Québec to investigate the cause of dolomite fluorescence zonation in samples of different thermal maturity. Utica Shale dolomite crystals show zonation under ultraviolet (UV) light, with a shift from higher red/green quotient (R/G Q) in crystal cores to lower R/G Q in the crystal rims. In addition, the R/G Q shows an increase with thermal maturity of the shale, where the cores of dolomite crystals of over-mature samples with equivalent vitrinite reflectance ( $VRO_{eqv.} > 2\%$ ) tend to have higher R/G Q in comparison to mature samples with  $VRO_{eqv.} \sim 1\%$  (red shift). These two parameters show a strong positive correlation that suggests that dolomite fluorescence color variation is possibly controlled by temperature [1].

LA-ICP-MS results shows that major and minor (Ca, Fe, Mn, Na), trace (Sr, Zn, Cu) and rare earth (La, Ce, Nd, Sm, Gd, Dy, Er, Yb) elements generally show consistently higher concentrations in crystal rims than cores, while the Mg concentration is consistently higher in the crystal cores ( $\sim 10\%$ ) than rims ( $\sim 7\%$ ). Concentrations of Fe show a decreasing trend from mature to over-mature samples, especially in the crystal rims. Over-mature samples have relatively higher concentrations of LREE (La, Ce, Nd, Sm) in the crystal rim, while the other elements do not show any trend with thermal maturity.

Consistently lower Mg concentrations in the crystal rims in comparison to the cores suggest Mg depletion of dolomitizing fluids during dolomite precipitation. Depletion of Mg, one of the major constituents of dolomite, likely causes increases in the concentrations of other elements. However, variations in concentration of Fe and LREE with thermal maturity suggest that temperature can possibly have an overarching effect on chemistry of dolomite that ultimately controls the crystal zonation.

[1] Haeri-Ardakani & Sanei (2015) *IJCG* **135** 165-171.