

## **Carbonate weathering: processes, controls and rates**

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Carbonates are ubiquitous minerals on the Earth surface, present either as primary bedrock or secondary minerals produced by weathering reactions. As such, most rivers in the world carry a significant proportion of solutes inherited from carbonate weathering reactions because carbonates dissolve much faster than silicates. Quantifying weathering processes for any source rock from river chemistry thus requires a better understanding of the controls and rates of carbonate weathering processes. The French Jura mountains are an ideal setting to study carbonate weathering because they are 1) exclusively covered by Ca-carbonate rock, 2) characterized by strong environmental gradients (altitude, temperature, precipitation, vegetation) and 3) well-drained with multiple springs along the altitudinal gradient [1]. The spatial and temporal heterogeneities in water geochemistry (elemental and isotopic) of multiple springs from the Jura allow us discussing the potential controls on carbonate weathering signatures. While the multiple springs have contrasted chemistry, they all respond in a similar way to a change in flow regime. There is no strong dilution effect at high flow regime due to rapid dissolution of carbonate and preservation of near-equilibrium (calcite-solution-gas) concentration. At low flow regime, the process of secondary carbonate precipitation becomes predominant and impacts significantly water geochemistry. Using Sr isotopes, we estimate that the amount of secondary carbonate precipitation is several times larger than the amount of carbonate eventually transported by spring waters as solute. We then discuss the potential impact of this “hidden” secondary carbonate precipitation on global riverine geochemistry.

[1] Calmels et al., (2014) *Chem. Geol.*, **390**, p. 74-86.