Differences in the relative abundances of Mg three stable isotopes, $^{24}\text{Mg}$ (78.99%), $^{25}\text{Mg}$ (10.00%), and $^{26}\text{Mg}$ (11.01%), could be expected because of the large relative mass differences between $^{25}\text{Mg}$ and $^{26}\text{Mg}$. However, Mg-bonds are dominantly ionic and while kinetic processes affect all elements, thermodynamic isotopic equilibrium has only been demonstrated for elements involved in strong chemical bonds. In addition, reliable measurements of $^{24}\text{Mg}/^{25}\text{Mg}$ and $^{25}\text{Mg}/^{26}\text{Mg}$ in natural systems have been limited historically by the $1\%$/amu reproducibility imparted by instrumental mass fractionation effects. As a result, with a few exceptions, studies of Mg isotope ratios focused on detection of non-mass dependent Mg isotopic effects rather than on investigations of mass-dependent fractionation. The principle outcome of this focus was the discovery of radiogenic $^{26}\text{Mg}$ in primitive meteorites 30 years ago.

**Evidence for equilibrium isotopic fractionation**

Differences between $\delta^{26}\text{Mg}$ in the water dripping from stalactites and that of the modern speleothem show that the low Mg-calcite is enriched in light isotopes by 2.7‰ and the dependence on temperature has been found to be less than 0.04‰/°C [6]. Given that 1) O isotopic equilibrium fractionation between the water and the carbonate is achieved in one case, 2) kinetics of speleothem formation are drastically different between the studied karsts; a kinetic-related isotopic fractionation would have induced a broader range of the observed isotopic fractionation. Further evidence that Mg-isotopes have reached equilibrium during formation of the speleothem is given by a value of the slope in the three-isotope plot of 0.5190 +/- 0.0029. This value is equals, within error, to the theoretical expectation [4].

**Conclusion**

These results have two implications. 1) during the weathering, Mg-isotopes will not necessarily only witness biological activity. 2) Mg-isotopic variations are induced by thermodynamic equilibrium reactions characteristic of common geological processes. Associated to more conventional isotopic systems (i.e. O and H), Mg isotopes appear to have a more widespread application than previously thought. Our understanding of processes involving isotopic fractionations is, however, crucial for a clear interpretation of new isotopic tracers.

**References**