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# Silicon isotopes fractionation in $SiO_2$ polymorphs formed in continental environments

**I. Basile-Doelsch** (1), J.L. Join (2), D. Nash (3), S. Ringrose (4), N. Skarpelis (5) and S. Ullyott (3)

(1) CEREGE, UMR 6635 Aix-Marseille Universités / CNRS / IRD / Collège de France, Europôle Méditerranéen de l'Arbois, BP 80 13545 AIX-en-PROVENCE Cedex 04, France, (2) LGSR Université de La Réunion, UMR 7154, 15 rue René Cassin, 97715 Saint Denis cedex 9, France, (3) University of Brighton, Lewes Road, Brighton. BN2 4GJ. UK, (4) HOORC, University of Bostwana, Private Bag 285, Maun, Botswana, (5) Faculty of Geology & Geoenvironment, University of Athens, Panepistimioupoli, 157 84 Zografou, Athens, Greece, (basile@cerege.fr / phone (33 4 42 97 17 71)

The use of silicon (Si) isotopes as a proxy of Si cycle has been recently successfully applied in various continental environments. It concerned for example Si uptake by plants (Opfergelt et al. 2006), budgets of weathered Si (Georg et al. 2007) or storage of Si through precipitation of stable $SiO_2$ phases (Basile-Doelsch et al. 2005).

Fractionation of Si isotopes in surface environments is mainly controlled by kinetic fractionation often combined with Rayleigh distillation processes. In the particular case of closed systems, this combination may theoretically lead to large ranges of isotopic compositions in a single system. Such a large range was clearly reported in biogenic $SiO_2$ precipitates of rice plants (Ding et al. 2005). In weathering systems of ultramafic rocks, we have performed analyses (SIMS Cameca 1270) on quartz precipitated in geodes (New Caledonia). One geode showed a unexpected centripetal $\delta^{30}$Si gradient varying from –5.8‰ (+/- 0.34‰ $2\sigma$) up to –1.9‰ which can be confidently interpreted as a Rayleigh distillation process.

However, most of the systems leading to $SiO_2$ polymorph precipitation are not closed systems and $SiO_2$ polymorphs thus mainly record the kinetic fractionation. For quartz, this fractionation was estimated to be 1.5‰ more negative relative to the initial

dissolved Si (Basile-Doelsch et al. 2005). Simultaneously, it was found that quartz (formed in a particular location in South of France during upper Cretaceous) represented an isotopic pool of strongly "negative" Si (depleted in $^{30}$Si). We extended the Si isotopes measurements to the global scale by analysing silicifications from New Caledonia, Madagascar, Greece, United-Kingdom, Botswana and South-Africa. These new results confirmed that surface $SiO_2$ polymorphs represent a very negative pool of Si in the continental environments.

Basile-Doelsch I. et al. (2005). Nature 433: 399-402; Ding T.P. et al. (2005). Chemical Geology 218: 41-50; Georg R.B. et al. (2007). Earth and Planetary Science Letters 261: 476-490; Opfergelt S. et al. (2006). Journal of Geochemical Exploration 88: 224-227