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ORIGINAL PAPER

Silicon isotopic fractionation by banana (*Musa* spp.) grown in a continuous nutrient flow device

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Abstract The determination of the plant-induced Si-isotopic fractionation is a promising tool to better quantify their role in the continental Si cycle. Si-isotopic signatures of the different banana plant parts and Si source were measured, providing the isotopic fractionation factor between plant and source. Banana plantlets (*Musa acuminata* Colla, cv Grande Naine) were grown in hydroponics at variable Si supplies (0.08, 0.42, 0.83 and 1.66 mM Si). Si-isotopic compositions were determined on a multicollector plasma source mass spectrometer (MC-ICP-MS) operating in dry plasma mode. Results are expressed as δ^{29}Si relative to the NBS28 standard, with an average precision of ± 0.08‰ (±2σ_D). The fractionation factor $^{29}\varepsilon$ between bulk banana plantlets and source solution is –0.40 ± 0.11‰. This confirms that plants fractionate Si isotopes by depleting the source solution in ^{28}Si. The intra-plant fractionation Δ^{29}Si between roots and shoots amounts to –0.21 ± 0.08‰. Si-isotopic compositions of the various plant parts indicate that heavy isotopes discrimination occurs at three levels in the plant (at the root epidermis, for xylem loading and for xylem unloading). At each step, preferential crossing of light isotopes leaves a heavier solution, and produces a lighter solution. Si-isotopic fractionation processes are further discussed in relation with Si uptake and transport in plants. These findings have important implications on the study of continental Si cycle.

Keywords *Musa* · Phytolith · Silicon · Si cycle · Si-isotopic fractionation · Si transport in plant

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Introduction

The external silicon (Si) cycle is closely linked to the C cycle through CO_2 consumption by diatoms growth (Smetacek 1999), and silicate weathering (Raven and Edwards 2001). Plants readily contribute to weathering (Hinsinger et al. 2001), and induce a strong biological imprint on the terrestrial Si cycle (Lucas 2001). Only recent studies however concern the contribution of plants to the Si continental reservoir (Alexandre et al. 1997; Conley 2002; Derry et al. 2005). In this respect, the study of silicon stable isotopes is highly promising