Development of the La-Ce systematics : application to arc magmas

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In the 1980's, the ^{138}La-^{138}Ce systematics ($T_{1/2}$= 302 Ga) has been developed [1,2]. Since La/Ce fractionation is strong in some supergene conditions (due to the occurrence of Ce^{4+}), this isotope system is able to offer new information on the material involved in the genesis of magma in subduction zones. Here, we present Ce isotope data measured on Martinique lavas that have been thoroughly characterized in a previous study [3].

The Ce purification involves 3 steps: 1) REE isolation in HCl medium on cationic resin; 2) La-Ce-Pr-Nd separation using 2MLA acid; 3) purification of the Ce fraction using LnSpec resin. The Ce isotopic compositions were measured as the oxide species by TIMS, (Triton). In order to increase the signal size of the two minor isotopes (^{136}Ce and ^{138}Ce), ^{140}Ce was not measured. The oxygen isotope composition is determined *in situ* following the method developed by [4]. ^{138}Ce/^{142}Ce ratios are normalized to ^{136}Ce/^{142}Ce=0.01688. ^{138}Ce/^{136}Ce ratio measured in the AMES standard is equal to 1.33745±4 (n=10, or ^{138}Ce/^{142}Ce=0.0225761±7) in agreement with previous measurements [4]. The ^{138}Ce/^{142}Ce ratios measured on the standard basalts BHVO-2 and BCR-2 are 0.0225662±15 (n=13) and 0.0225684±13 (n=3), respectively. The ^{138}Ce/^{142}Ce ratios of the Martinique lavas define a large range (0.0225660 – 0.0225706) showing that the Ce isotopic system can be a powerful tool to trace heterogeneities in the source of arc lavas.

The Ce isotopic tracer applied to 30 Martinique lavas shows a clear correlation with Nd, Sr and Pb isotopes suggesting a varying contribution from sedimentary material. Complementary data on sediments located in front of the arc should provide further constraints on the mixing relationships between sedimentary components and the mantle wedge underlying the Lesser Antilles arc.

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Rb and Sr adsorption at the Quartz(101) – water interface

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Quartz is an abundant and ubiquitous rock-forming mineral in Earth's continental crust, and influences the chemistry of numerous aqueous systems [1]. The sorptive property of quartz changes the mobility of ions in water while its dissolution process controls long-term silica cycling through the earth system. Batch experiments [2, 3] showed that the dissolution rate of quartz at near-neutral pH increases substantially in the presence of cations while the degree of enhancement depends on the choice of cation. However, the detailed understanding on the mechanism remains unclear mainly because of the lack of atomic-scale information on the processes to explain the complexity of the interface chemistry. Molecular-scale investigation of the quartz surface-cation interaction is the first step in understanding this cation-induced mechanism. Here, we report on Rb^+ and Sr^{2+} cation adsorption at the quartz(101)-water interface observed in 10mM salt solutions at pH 10 using x-ray reflectivity (XR) and resonant anomalous XR measurements.

The best fit models of the experimental data suggest that Rb^+ adsorbs at an average height of 2.7 Å above the surface (defined as the average position of the two terminal oxygens), which may be a mixture of inner- and outer-sphere species. Adsorbed Sr^{2+} is prevalently located at 4.6 Å above the surface, suggesting the formation of an outher sphere complex. The occupancies of these complexes with respect to the unit cell area (UC) are 0.19 Rb^+/UC, and 0.07 Sr^{2+}/UC. The smaller coverage of Sr^{2+} compared to that of Rb^+ is likely due to the difference in cation valency. The charge of the quartz(101) surface calculated based on the coverages at pH 10 is approximately 0.14 to 0.21 e^-/UC or ~1 e^- for 5 to 7 UC.

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