Silicon isotopes and magmatic evolution

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The Si isotopic composition of the continental crust is poorly constrained but is important for defining the global silicon cycle. Continental crustal rocks carry the history of the diverse processes of weathering, biogenic fractionation, diagenesis, anatexis, and magmatic differentiation, all of which can significantly affect Si isotopes [1 and refs. therein]. Therefore, magmas derived from the crust should be isotopically variable. This study focuses on the amount of Si isotope fractionation that accompanies the differentiation of a magma from basaltic to rhyolitic.

We analysed a suite of volcanic rocks ranging from 46 to 70 wt% SiO_2 using the methods described in [2]. The samples were taken from the volcano of Hekla, on Iceland, and from the Afar region; both sites provide fresh, recently erupted material that is generally aphyric and has undergone magmatic differentiation. The data fall between δ^{30}Si = -0.34 and -0.12 ± 0.05‰ (2s. e.) and display a strong positive correlation with Si content. Given the young mafic crust at both locations these data provide evidence that fractionation associated with deriving silicic (~70 wt% SiO_2) from more mafic magmas or source rocks is limited to ~0.2‰. Although the mafic δ^{30}Si values agree with previous work [3], our evolved samples do not exhibit Si isotopic compositions as heavy as those proposed in earlier, less precise, studies [4].

In principle, variations in δ^{30}Si as a function of SiO_2 may provide powerful new information on the amount of Si transferred from sediments to magmas. Melting or assimilation of pelitic sediments, which are isotopically light [e.g. 5], should result in a lowering of δ^{30}Si. Our preliminary work on sedimentary rocks and I- and S-type granites support this trend; in particular S-type granites can be isotopically very light (δ^{30}Si = -0.40 ± 0.01‰, 2s. e.).

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Accurate LA-ICP-MS calibration for magnetite analysis using multiple reference materials

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Magnetite is commonly present as an accessory mineral in ore deposits. Minor and trace elements in magnetite could be useful in classifying ore deposits and thus allow magnetite to be used as an indicator mineral [1]. LA-ICP-MS is the technique of choice for such analysis because it is fast and provides lower limits of detection compared to other *in situ* technique such as electron-microprobe (EMPA). Unfortunately, at this date, there is no certified matrix-match calibration material for LA-ICP-MS. The same problem is common in sulfides analysis [2].

To circumvent this problem, the combination of five reference materials (RM) was used: NIST-610, BCR-2g, GOR-128g, NIST-2782 and NIST-361. ^{57}Fe was used as an internal standard. Iron concentrations in the selected RM range 7%-96%, except for NIST-610 which is significantly lower at 0.046% Fe. The low abundance of Fe in NIST-610 produces large uncertainties on measurement (~20%) despite the homogeneity of the NIST-610 glass [3]. In addition, in other RM, some elements show a heterogeneous distribution at the 40-120μm scale and cannot be used for calibration although some values are certified. This justifies the use of multiple RM. Results obtained in natural samples using the multiple RM calibrations technique are in good agreement when compared to INAA and EMPA (Figure 1).

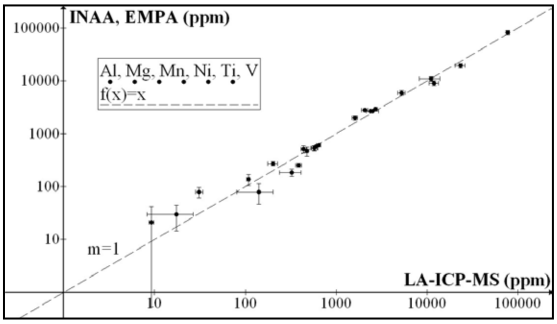

Figure 1: Results comparison (data from 4 samples).

[1] Nadoll, Koenig & Mauk (2009) *Geoanalysis 2009. Abstract book & final programme.* [2] Bédard, Barnes & Savard (2010) *GCA*, this volume. [3] Hinton (1999) *Geost. Newsl*. **23**, 197–207.