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Solving interference on ^{30}Si with a Nu Plasma MC-ICP-MS

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Both silicon isotope ratios (δ^{29}Si, δ^{30}Si)[1,2] can now be measured to very high precision using the High-resolution 1700 Nu Plasma or pseudo-high-resolution Finnigan Neptune MC-ICP-MS instruments while the standard Nu Plasma instrument was limited to δ^{29}Si determinations[3] due to unresolved interferences on the ^{30}Si peak. Potential molecular mass interferences are $^{14}N_2$ and $^{12}C^{16}O$ for the ^{28}Si peak, $^{12}C^{1}H^{16}O$, N_2 and $^{14}N_2^1H$ for the ^{29}Si and $^{14}N^{16}O$ for the ^{30}Si peak. For the first time we have carried out δ^{30}Si measurements on silica reference material on a Nu Plasma? instrument operating in dry plasma mode and pseudo-high-resolution. The new configuration involves: (1) a new designed entrance slit fixed at medium resolution (0.05 mm); (2) a more efficient vacuum rotary pump (Big 80) and (3) two adjustable and interconnected collector slits put in front of Faraday cups receiving the m/z 28 and 30 respectively. With those upgrades, we can now efficiently separate the slightly heavier polyatomic interference from the single ^{30}Si ion applying a medium resolution (m/Δm$\sim$1200) on the entrance slit and tight collector slits. Tuning the collector slits at their highest resolution results in a loss of plateau on the peaks and prevents accurate Si isotopes measurements. However, with an intermediate setting of these slits, the new pump helps maintaining an excellent peak plateau and the $^{14}N_2$ and $^{14}N^{16}O$ interferences are sufficiently separated from ^{28}Si and ^{30}Si respectively to produce reliable and accurate δ^{30}Si on reference materials (diatomite and Big Batch). Moreover, thanks to the Big80, this new configuration does not result in a large sensitivity loss when compared to low resolution.

At such resolution, for the standard Diatomite, we achieved preliminary results of +0.64 per mil and +1.25 per mil for δ^{29}Si and δ^{30}Si respectively with a δ^{30}Si/δ^{29}Si of 1.94. The values are consistent with recommended values for this recently inter-calibrated standard (0.64 per mil and 1.26 per mil respectively)[4]. For the Big Batch standard, we obtained preliminary results of –5.37 per mil (δ^{29}Si) and –10.60 per mil (δ^{30}Si) which also fit to the recommended values (-5.35 per mil and –10.48 per mil)[4].

Considering that mass fractionations for δ^{30}Si are twice larger than for δ^{29}Si, this analytical improvement will enable us to better constrain tiny natural isotopic fractionations recently discovered within cherts[5,6], altered basalts[5], igneous rocks[2], soils[7], silcrete[8] and plants[9]. From this, we expect to improve our understanding of terrestrial silicon cycle.

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