The Effectiveness of Agilent ICP-MS and ICP-QQQ for the Resolution of Spectral Interferences on Analytes of Geochemical Significance

PAMELA WEE[1]

SÉBASTIEN SANNAC[2]

[1]Agilent Technologies Canada, 6705 Millcreek Drive, Unit 5, Mississauga, On, Canada, L5N 5M4

[2]Agilent Technologies France, 3 avenue du Canada, 91978, Les Ulis, France.

This paper describes the use of the Agilent ICP-MS and ICP-QQQ for the control of four types of spectral interferences. The Agilent ICP-MS spectrometer consists of a collision reaction cell (CRC) and one quadrupole mass filter (QMF). The Agilent ICP-QQQ has an additional QMF preceding the CRC. Both Q1 and Q2 are of unit mass resolution. When operated in MS/MS mode, an abundance sensitivity (based on $^{133}Cs^{+}$) of 1 x E-10 is guaranteed.

The CRC can be pressurized with a gas that discriminates interfering ions from analyte ions using a collision and/or reaction mechanism. Pure helium is used as a collision gas for the kinetic energy discrimination (KED) of polyatomic interferences on many elements. KED, however, cannot resolve isobaric or doubly-charged interferences.

Pure hydrogen in the Agilent cell resolves polyatomic and doubly charged ion interferences for several elements (such as $^{28}Si^{17}O^{+}$ and $^{90}Zr^{2+}$ on $^{45}Sc^{+}$). In some cases, such as $^{78}Se^{+}$, H_2 resolves $^{156}Gd^{2+}$, $^{40}Ca^{38}Ar^{+}$, and $^{39}K_2^{+}$ by reaction with the interferences.

KED improves the signal-to-background ratio albeit at the expense of signal intensities. The optimization of KED for trace analysis is a trade-off between interference reduction and loss of analyte signal. When the compromise is unacceptable, reaction mode using pure O_2 or a 1:9 blend of NH_3/He are superior alternatives. Simple and successful implementation hinges on the use of the QQQ configuration. Q1 rejects all non-selected masses to 1u resolution, only allowing the analyte and its respective interferences to enter the cell. This assures and enables only targeted chemical reactions to occur. Many examples will be shown. These include the resolution of 1) polyatomic nterferences on REE^{+} and noble metals, 2) polyatomic ion and doubly-charged ion interferences on Sc^{+}, Ga^{+}, Zn^{+}, 3) isobaric atomic ion interferences ($^{176}Lu^{+}$ on $^{176}Hf^{+}$) and 4) wing overlaps ($^{238}U^{+}$ on $^{236}U^{+}$, Ni^{+} on Co^{+}).