

# Advances for high precision isotope ratio analysis in Cosmochemistry applications with the Thermo Scientific Neoma MC-ICP-MS.

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It took less than five years from the initial introduction of multicollector inductively coupled plasma mass spectrometry (MC-ICP-MS) with the VG Elemental Plasma 54 for the technique to be applied to Isotope Cosmochemistry applications [1]; and for the potential these had to be recognized<sup>1</sup>. Early work focused mostly on the <sup>182</sup>Hf-<sup>182</sup>W chronometer, which had up until the introduction of MC-ICP-MS, been extremely difficult to measure with existing thermal ionization mass spectrometry (TIMS) techniques due to the extremely high first ionization potential of W.

In the subsequent 25 years the use of MC-ICP-MS for Isotope Cosmochemistry applications has expanded to feature numerous other isotopic systems, including, <sup>26</sup>Al-<sup>26</sup>Mg, <sup>146</sup>Sm-<sup>142</sup>Nd and <sup>60</sup>Fe-<sup>60</sup>Ni, and not just <sup>182</sup>Hf-<sup>182</sup>W. A general feature of these measurements has been a reliance on the highest, most excellent, precision, often on the order of a few ppm, 2RSD [2]. The high count rates required to achieve such excellent precision usually take some time to achieve, given typical sample concentrations and dynamic range limits of detectors. Excellent precision over such time scales require a high performance mass spectrometer, capable of high sensitivity, stable throughout the course of the measurement and equipped with a low-noise detection array.

For over 20 years Thermo Fisher Scientific™ has pioneered developments in multicollector inductively coupled plasma mass spectrometry (MC-ICP-MS). The latest generation Thermo Scientific™ Neoma™ MC-ICP-MS, blends cutting-edge and field proven technology from the Ultra™ HR-IRMS and iCAP Qnova™ Series ICP-MS and has the capability to complement and enhance Isotope Cosmochemistry applications [3]. Here we report our investigations into using the Neoma MC-ICP-MS and Neoma MS/MS MC-ICP-MS for a selection of Isotope Cosmochemistry application, including high precision Mg, Fe, Cu, Zn and W measurements.

[1] Halliday, Lee, Christensen, Rehkämper, Yi, Luo, Hall, Ballentine, Pettke & Stirling (1998), *Geochimica et Cosmochimica Acta*, 62, 919-940.

[2] Goderis, Chakrabarti, Debaille & Kodolányi (2016), *J. Anal. At. Spectrom.*, 31, 841-862.

[3] Deng, Schiller, Jackson, Millet, Pan, Nikoljensen, Saji, Huang & Bizzarro (2023) *Nature*, 621, 100-104.