

The early days of MC-ICP-MS in Lyon - 2024 H.C. Urey Medal Lecture

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This presentation will address the advent of multiple-collector inductively-coupled plasma mass spectrometry (MC-IPC-MS) the way it unfolded in Lyon, France, in the mid-1990s. It will review examples of some of the early ground-breaking Lu-Hf and Pb-Pb isotope work carried out using the new MC-ICP-MS technology and the chemistry protocols and measurement techniques developed with it, which led, first and foremost, to the first successful measurements of chondritic meteorites for their Lu and Hf isotopic compositions to benchmark the Lu-Hf isotope system as a chronometer and tracer of planetary evolution. The series of diverse studies that followed not only delved into existing fields of geochemistry, but also established new fields, such as Lu-Hf garnet geochronology with implications for crustal dynamics, and put the last nail in the coffin on demonstrating crustal recycling into the deep mantle. MC-ICP-MS further paved the way to large-scale mantle geochemistry by high-precision-, high-sample-throughput analysis of mid-ocean ridge and ocean island basalts and allowed a peak at early Earth geodynamics from the komatiite perspective. Furthermore, MC-ICP-MS revived Pb isotope cosmochemistry, including re-assessment of the Solar System primordial Pb isotopic composition and Th/U ratio, the latter of which was measured for the first time with high precision. MC-ICP-MS is a good example of how, when a new measurement technique emerges, which often happens hand in hand with technological innovations, it opens up new areas of research that until then had been beyond reach and in many instances not even conceivable.

Through this look in the rearview mirror, I will also attempt to extract the most important lessons learned from 35 years as a geochemist in the hope that my experiences, despite the generational differences, might help guide students and early-career scientists in today's research environment, which is no less challenging than it was three decades ago.

Today I take immense pride and satisfaction in seeing MC-ICP-MS machines humming along in hundreds of geochemistry, geology, and chemistry laboratories around the world measuring not only Hf isotopes, but the entire Periodic System. MC-ICP-MS has also helped bring isotope geochemistry to other fields, such as medicine, geoarchaeology, archaeology, anthropology, and numismatics.