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High-precision Hg isotopic composition measurements by MC-ICP-MS with mass bias correction using admixed Ir

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Recent advances in cold vapor-generation multiple collector inductively coupled plasma mass spectrometry (CV-MC-ICP-MS) have enabled widespread applications of both mass-dependent fractionation (MDF) and mass-independent fractionation (MIF) of mercury (Hg) isotopes in geochemical and environmental studies. Although thallium has been conventionally employed as an external standard for instrumental mass bias correction in Hg isotope analysis, its application is complicated by HgH^+ polyatomic interference, resulting in significant sensitivity to Hg/Tl ratios. This study introduces an innovative calibration approach using $^{193}Ir/^{191}Ir$ ratios instead of conventional $^{205}Tl/^{203}Tl$ for mass discrimination correction. Systematic evaluation shows that the values of $\delta^{202}Hg$, $\Delta^{199}Hg$, $\Delta^{200}Hg$, and $\Delta^{201}Hg$ do not vary with the Hg/Ir ratio within the uncertainty. Long-term analyses of in-house standard solutions and reference materials yielded precisions better than 0.12‰ (2SD) for $\delta^{202}Hg$ and 0.05‰ (2SD) for $\Delta^{199}Hg$, $\Delta^{200}Hg$, and $\Delta^{201}Hg$. The obtained isotope compositions show excellent agreement with published values within long-term uncertainties. Our results validate Ir as a superior calibrator for high-precision Hg isotope measurements in geological and environmental materials.