Goldschmidt 2026 Abstract
https://doi.org/10.46427/gold2026.37485

Groundwork for the Preparation of a New Batch of ^{205}Pb for Use in Precision Spikes

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We simulate the irradiation of enriched ^{206}Pb targets by MeV energy proton beams using FLUKA software to quantify the optimal production of ^{205}Pb by the (p,2n) reaction. Over a range of target geometries, proton fluences, and energies, our Monte Carlo simulations tally the production of ^{205}Bi that subsequently undergoes β^- decay to ^{205}Pb. ^{205}Pb is an important tracer isotope as a component of analytical spikes (e.g. the double-spike technique) used to correct for internal fractionation and achieve low-level concentration measurements in mass spectrometry. Parrish & Krogh (1986) first synthesized 100 g of clean ^{205}Pb via (p,2n) using the cyclotron and radiochemical separation facilities at TRIUMF (Vancouver, Canada) that was distributed globally for use in both the ^{202}Pb-^{205}Pb double spike and various mixed U-Pb spikes. With the existing Parrish & Krogh stockpile approaching its end, a new production of clean ^{205}Pb is required and essential for laboratories worldwide. Here we compare a range of different beam parameters including those used by Parrish & Krogh to determine an optimal set of target geometries combined with proton beam irradiations that yields the maximum amount of ^{205}Bi in the shortest time from a minimum number of runs. This work serves as an important first step to optimally produce a new batch of clean pure ^{205}Pb for geochronologic and environmental tracer use in precision geosciences worldwide.