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The Spike of Damocles: Availability of ^{205}Pb and ^{202}Pb threatens the future of U-Pb and Pb-Pb ID geochronology.

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Modern U-Pb and Pb-Pb isotope dilution-based geochronology is possible at the current precision because of the use of ^{205}Pb, ^{202}Pb, or both, as spike isotopes. The use of these isotopes permits the Pb amount and isotopic composition of a natural sample to be determined with a single measurement, which is critical for the highest precision and smallest sample sizes. Unfortunately, no new synthetic Pb has been produced since the 1980s and they are unavailable for purchase. The EARTHTIME initiative re-accumulated a large amount for community use, but the availability is limited and the amounts are finite. Combining both synthetic isotopes yields the highest precision Pb isotopic analyses - critical for early solar system studies, for example - but the scarcity of ^{202}Pb relative to ^{205}Pb means few laboratories can even attempt to make these measurements. Lead-205 has been produced by either neutron irradiating highly enriched ^{204}Pb followed by electromagnetic enrichment, done once by ORNL in the 1970s[1], or by proton irradiating highly enriched ^{206}Pb, done twice, once as a pilot experiment at ORNL in the 1970s, and as a production run at TRIUMF in the mid-1980s[2]. All current ^{202}Pb was obtained as a byproduct of ^{201}Tl production (a medical isotope no longer commonly produced) in the early 1980s and enriched using capabilities no longer available in the USA[3]. Due to shifting priorities at the US national labs, stocks of enriched natural Pb isotopes have been depleted, and the technology and expertise capable of making high-yield enrichments of small quantities of material have been retired or lost.

New enrichment and production technology and pathways are required to produce these isotopes, which will be slow and expensive. If the geoscience community wishes for high precision ID U-Pb work to continue into the next generation, serious effort needs to be made to secure a source or sources of new ^{205}Pb and ^{202}Pb.

[1]Newman et al., 1976. Nucl. Instrum. Methods 139, 87–93. doi:10.1016/0029-554X(76)90660-1

[2]Parrish and Krogh, 1987. Chem. Geol. 66, 103–110. doi:10.1016/0168-9622(87)90033-9

[3]Todt et al. 1996. Earth Processes: Reading the Isotopic Code. American Geophysical Union, pp. 429–437. doi:10.1029/GM095p0429