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Geolocation of uranium ore concentrates through $^{143}Nd/^{144}Nd$ measurements

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The field of nuclear forensics seeks to identify the origin and process history of nuclear materials found outside regulatory control, such as uranium ore concentrates (UOCs). UOCs are materials from the early-stage of the nuclear fuel cycle, and the capability to geolocate UOCs makes them objects of interest in nuclear forensics [1]. Multiple isotopic systems have been established as potential signatures in nuclear forensics, however, because each technique provides different information, these signatures must often be used in concert to pinpoint a sample's origin [1-2]. As such, new nuclear forensic signatures are continually being sought after, with a particular interest in those that can isolate and identify a UOC with as little additional information as possible [3].

Variations in $^{143}Nd/^{144}Nd$ of UOCs have previously been targeted as a forensic signature to identify the origin of the parent U ore deposit. Whereas $^{143}Nd/^{144}Nd$ variations have been utilized for decades in various chronology and provenance studies in earth and planetary sciences, applications to UOCs as a forensic signature is limited [e.g., 4]. Previous work found highly variable $^{143}Nd/^{144}Nd$ compositions and most of the values for different deposit groups overlapped within the stated uncertainties. In this work, we refined the method of Nd removal and isotopic measurement from UOCs to improve uncertainties, and using MC-ICP-MS, analyzed a set of 28 UOC samples, many of which have been analyzed in other nuclear forensic studies using different isotope systems [5-7]. This work shows that $^{143}Nd/^{144}Nd$ can be a valuable tool in UOC forensic studies, particularly when layered with additional isotopic data from the same sample.

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