Uranium Contamination from Abandoned Uranium Mines in the Navajo Nation

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Poor mining practices in the mid-late 20th century resulted in the abandonment of uranium mines in the Colorado Plateau region of the United States, partially located within Native American reservations. To date, members of the Navajo Nation, an indigenous tribe in the southwest U.S., are susceptible to exposure from these abandoned uranium mines (AUMs) through contact with waste piles, windblown radioactive dust, and contaminated groundwater, plants, and animals. Potential health impacts of uranium exposure include damage to the renal, developmental, and reproductive system as well as diminished bone growth [1]. A concerted effort involving universities, research organizations, and citizens of the Blue Gap/Tachee Chapter of the Navajo Nation seek scientific evidence that points to negligence at abandoned mine sites to aid the Navajo Nation in their requests for federal funding towards remediation.

The main objective of this study is to determine the uranium, lead, and other trace element concentrations in the soil surrounding one of the largest abandoned uranium mines within the Blue Gap/Tachee Region of the Navajo Nation using high-resolution inductively coupled plasma mass spectrometry (ICP-MS). Pb isotope compositions of soil samples were analyzed using multi-collector ICP-MS techniques so as to delineate natural vs. anthropogenic components.

Rare earth element concentrations for soil samples overlap those of the North American Shale Composite (NASC) [2], and thus indicate an origin from natural sources. Contrarily, uranium (range from ~4 to ~20 ppm) abundances are elevated compared to that for NASC (2.66 ppm). Preliminary lead isotope compositions for soil samples are extremely radiogenic and variable (e.g., $^{206}Pb/^{204}Pb$ range from ~18.9 to ~19.9), and define a well-constrained binary mixing line between natural (background) and anthropogenic (uranium mine) Pb. Elevated uranium concentrations, along with calculated ^{238}U-^{206}Pb dates (range from ~40 to ~5 Ma) are consistent with anthropogenic contamination and negligence at abandoned mine sites.

[1] Brugge *et al.* (2005) *Rev. Environ. Health* **20:3**, 177-194.
[2] Gromet *et al.* (1984) *Geochim. Acta* **48**, 2469-2482.