U-236 in the High-Grade Unconformity Type Deposits of the Athabasca Basin

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Canada accounts for 15% of the world's uranium production (World Nuclear Association). The highest-grade deposits of Uranium are found here in Canada, in the Athabasca Basin. These high-grade unconformity type deposits are situated in the southeastern side of the basin, at the unconformity between a graphitic crystalline basement and a series of sedimentary fluvial to marine sequences. Their genesis is still debated but research points toward a mix of Sodic and Calcic brines with a still unknown and questionable reducing agent. From visual examination of drill cores, a secondary black-red earthy hematite ore body caps the uranium mineralization and it can be theorized that the system has remained unmoved since its precipitation. The ore itself is composed of Uraninite and Pitchblend with very high concentrations of natural occurring primordial U-238 & U-235. Other radionuclides will be continuously produced within the uranium-bearing minerals when the uranium decays or fissions spontaneously or when a neutron is absorbed by another isotope. U-236 (half-life of 23.42 Myr) will be produced when U-235 absorbs a neutron and the nucleus does not fission. Because it is so long lived, a small amount U-236 can be maintained at equilibrium level in the natural uranium ores. By calculating the neutron flux, the elemental neutron cross-sections and abundances, we can estimate the amount of U-236 that is produced. This project will calculate and simulate theoretically the production of U-236 and then test the theoretical calculations using measurements of uranium isotopes by accelerator mass spectrometry (AMS). Once we understand the factors controlling the U-236 concentration, we hypothesize that the relationship between U-236 and U-238 can be used as a tracer for uranium exploration and this equilibrium level could possibly distinguish primary mineralization from secondary ore deposits.