Geochronology and Fluid-rock Interaction Associated with the Nopal I Uranium Deposit, Peña Blanca, Mexico

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The Nopal I uranium (U) deposit, Peña Blanca District, Mexico, largely consists of secondary U^{6+} minerals, which occur within a breccia pipe mainly hosted by the 44 Ma Nopal and Colorados volcanic formations. These two units overly the Pozos conglomerate formation and Cretaceous limestone. Three new vertical diamond drill holes (DDHs) were recently drilled at Nopal I. DDH-PB1 with continuous core was drilled through the Nopal I deposit and two additional DDHs were drilled ~50 m on either side of the cored hole. These DDHs terminate 20 m below the current water table, thus allowing the detection of possible gradients in radionuclide contents resulting from transport from the overlying uranium deposit. Primary uraninite within the main ore body is rare and fine-grained (~50 micrometers), thus making geochronology of the Nopal I deposit very difficult. Uranium, lead and oxygen isotopes can be used to study fluid-uraninite interaction, provided that the analyses are obtained on the micro-scale. Secondary ionization mass spectrometry (SIMS) permits *in situ* measurement of isotopic ratios with a spatial resolution on the scale of a few μm. Preliminary U-Pb results show that uraninite from the main ore body gives an age of 32±8 Ma, whereas uraninite from the uraniferous Pozos conglomerate that lies nearly 100 m below the main ore body and 25 meters above the water table, gives a U-Pb age that is <1 Ma. Oxygen isotopic analyses show that uraninite from the ore body has a $\delta^{18}O$= -10.8‰, whereas the uraninite within the Pozos conglomerate has a $\delta^{18}O$= +1.5‰. If it is assumed that both uraninites precipitated from meteoric water ($\delta^{18}O$= -7‰), then calculated precipitation temperatures are 55°C for the uraninite from the ore body and 20°C for uraninite hosted by the Pozos conglomerate. These temperatures are consistent with previous studies that calculated precipitation temperatures for clay minerals associated with uraninite.