Precious Metals in the Arrow Uranium Deposit, Patterson Lake corridor, southwestern Athabasca Basin, northern Saskatchewan

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The Arrow deposit, located on the southwestern edge of the Athabasca Basin, is the largest undeveloped high-grade uranium deposit in the world, with an indicated mineral resource of 179.5 Mlbs U_3O_8 at a grade of 6.88% U_3O_8. The deposit lies within NexGen Energy's Rook I property and is hosted exclusively by the gneissic basement rocks below the basin. Uranium mineralization and alteration are hosted by brittle structures that developed by reactivation of a strike-slip dominated brittle-ductile fault system with a Riedel-style geometry, which forms part of Patterson Lake structural corridor. Fire assays of high-grade uranium mineralization (up to 75 % U_3O_8) have returned significant amounts of gold and silver; up to 90.4 ppm Au and 529 ppm Ag respectively, although the Au/Ag ratios vary significantly. In addition, partial digestion of these samples and ICP-MS analysis have yielded up to 1750 ppm Bi and 955 ppm Te. This study aims to determine the textural setting of these precious metals, their distribution with respect to the deposit, and provide constraints on their origin. Polished thin sections of samples with elevated precious metals were prepared and examined using transmitted and reflected light microscopy and electron microprobe at the University of Saskatchewan. Initial studies suggested that most of the sulphide minerals in the deposit post-date primary uranium mineralization. This include. pyrite, galena, chalcopyrite, and arsenopyrite. New evidence suggests some of these phases may also be earlier in the paragenesis. Other phases which appear to pre-date uraninite include covellite and cobaltite. Various tellurides containing Pb, Bi, and Cu-Se have been identified, but formal classification will be completed using wavelength-dispersive electron microscopy. Native gold and electrum have been identified spatially associated with telluride minerals. X-ray mapping will be used to determine the distribution of Au and Ag in the more common sulphide minerals. Variations of Au and Ag grade and Au/Ag ratio will be assessed in three dimensions to determine whether the precious metals are preferentially associated with specific structures, and their spatial and genetic relationship with uranium mineralization.