Ore Characterization Workflow for Pegmatite Hosted Uranium Mineralisation

Otto, A.1

1. Chief Geologist, alex.otto@deepyellow.com.au

Keywords: uranium, pegmatite, micro-xrf, SEM

ABSTRACT

Recent advances in core scanning technology allow to bridge the gap in scale between drill hole datasets (e.g. assay data, geology logs) and the micro-scale (e.g. QEMSCAN, SEM). This study uses the Bruker Tornado M4 micro x-ray fluorescence (microXRF) instrument. The microXRF was used to scan core and hand samples of up to 25cm in size at a resolution of 50µm. Subsequent investigation at the micro-scale uses Scanning Electron Microscopy (SEM) methods and Computer Tomography (CT). Several samples of uraniferous leucogranite from the Erongo region in Namibia were investigated to better understand the mineralogical variability. The microXRF scans demonstrated the ability to confidently identify major and minor mineralogy along with textural insights. Combining chemical maps with images allowed to identify trace minerals (uraninite, betafite, thorite) and their relationship to the major minerals (quartz, K-feldspar, albite, biotite). In some samples the primary magmatic uranium phases such as uraninite and betafite were altered by later fluids. In particular uraninite is altered to pale yellow uranyl silicates (uranophane, boltwoodite). The replacement and veining of these uranyl silicates is accompanied by the replacement of biotite by chlorite and a Ti-oxid phase. Detailed SEM work further highlights the nature of the hydrothermal alteration. The fluids were capable to oxidise the uranium in order to form uranyl silicates or to transport the uranium out of the magmatic host mineral uraninite. The fluid was clearly not capable to mobilise significant amounts of thorium, which forms skeletal remanent of the former uraninite grain. It can be shown that thorium and rare earth elements form hydrous minerals that contain significant amount of fluorine. This study demonstrates the advantage of using core scanning instruments (e.g. microXRF) to guide subsequent investigations at the micro-scale. It enables geoscientists to confidently select fewer samples for SEM based methods while gaining higher confidence in their representativeness