

Updates on Regional studies integrating Airborne EM, Airborne Gamma ray surveys, geology and collating borehole logs in the Lake Frome area

Des FitzGerald¹, Steve Hore² and Brian Minty³

Recent studies of the Callabonna Sub-basin in the Lake Frome area adjacent to the northern Flinders Ranges suggest the likelihood of significant undiscovered sandstone-hosted uranium deposits. Uranium in solution is sourced from erosion of granitic inliers in the northern Flinders Ranges; the behaviour of dissolved uranium in the relatively shallow Callabonna Sub-Basin is controlled by groundwater transport and REDOX – uranium ore forms where uranyl in solution is reduced to form mineralisation. Recent studies have recognised that the Beverley uranium deposit is located at a fresh/saline groundwater interface. This observation provides explorers using Airborne Electromagnetic (AEM) surveys with a novel approach to exploration targeting.

We have reprocessed and worked on the regional AEM, and the radiometric data. This follows a realization that more of the measured signals could be used to penetrate the near surface section responses for conductivity mapping. The Geological Survey has also worked hard on bringing more of the existing borehole logs to a stage where they can be more reliably used. The starting position was as little as 9% of the borehole logs could be reliably used.

Further technical innovations to re-process the Tempest™ AEM survey commissioned by the Department of State Development (South Australia) are reported on, with demonstrations of the improvements.

Recent innovations and new technologies will include:

1. A workable 2.5D AEM inversion scheme enabling better definition of 2D geology structures: Approximately 25% deeper resolution than conventional inversions allowing penetration below the clay-dominant Namba Formation. Experience has been used to recover both X & Z measured channels, to enable deeper formations and more realistic imaging of faults and synclines.
2. Normalisation of continental-scale radiometric surveys for Australia and standardisation of elemental surface concentrations of K, U and Th, enabling an ability to directly access the original point observations, working straight from the GADDS repository. Further calibration and standardization of this data type in the North Flinders has occurred in 2016. This facilitates the use of data mining techniques, such as automatic radioelement anomaly detection, to obtain additional insights into the geology and geochemistry of a study area covered by numerous individual surveys.
3. Building of a regional-scale 3D geology and structural model of the Lake Frome area in GeoModeller™ for use in multi-geophysics modelling.

Our continuing study from the Lake Frome area builds on previous experience modelling in the Mt Painter region. We demonstrate how new geological insights can be derived from multiple geophysical data sources, field mapping, and drill-hole logging. We present a working model in the Lake Frome area integrating some new, deeper AEM inversion results with 3D geology. These data and workflows can be used to host regional groundwater simulations - a starting point that will lead to better targeting for sandstone-hosted uranium.

1. Director, Intrepid Geophysics, 110/3 Male Street, Brighton VIC 3186. Email: des@intrepid-geophysics.com
2. Geological Survey of South Australia, DSD, Level 4, 101 Grenfell Street, Adelaide SA 5000
3. Minty Geophysics, PO Box 3229, Weston Creek ACT 2611; email: Brian.Minty@mintygeophysics.com