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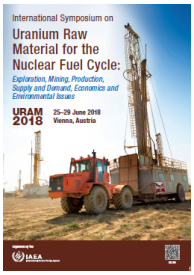

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The Karoo Sandstone-hosted Uranium Deposit at Dibwe East, Mutanga, Zambia

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INTRODUCTION

The late Carboniferous –early Jurassic Karoo rift basins of southern Africa are an important emerging uranium province. A number of sandstone-hosted deposits have been identified, although only Paladin Energy' s Kayelekera deposit in Malawi is currently being mined. The deposits are typically tabular, with variable proportions of primary and secondary uranium minerals. They generally occur at "energy drops"in fluvial sandstone successions, where organic material accumulated and subsequently acted as a reductant for uranium dissolved in basin waters (G.Yeo, 2011).

The Dibwe-East is part of GoviEx Uranium Zambia Limited, Mutanga Project licenses (13880-HQ-LML and 13881-HQ-LML) encompassing 457.3 square kilometers. The mining licenses a have a term of 25 years to April 2035. The mining licenses are located in Siavonga district in southern Zambia, approximately 180km south of the nation's capital Lusaka and 36km from Siavonga town.

Dibwe-East geologically, lies in the Mid-Zambezi Rift Basin of southern Zambia; the fluvial Escarpment Grit sandstones unconformably overlie the late Permian lacustrine Madumabisa Mudstone and are conformably overlain by the early Triassic fluvial Interbedded Sandstone and Mudstone Formation.

GEOLOGY

In the Mid-Zambezi Rift Basin of southern Zambia, the fluvial Escarpment Grit sandstones unconformably overlie the late Permian lacustrine Madumabisa Mudstone and are conformably overlain by the early Triassic fluvial Interbedded Sandstone and Mudstone Formation (Nyambe and Utting,1997). The Dibwe-Mutanga Corridor uranium deposits are located within the Zambezi Rift Valley which is hilly with large fault bounded valleys filled with Permian, Triassic and possibly Cretaceous sediments of the Karoo Supergroup. The Mid-Zambezi Valley is characterized by a series of NE-trending, fault-bounded cuestas or fault blocks, uplifted to the NW and dipping to the SE. Rocks of the Karoo Supergroup (late carboniferous to Jurassic) occupy the rift trough of the Zambezi Valley (Money and Prasad, 1977).

Dibwe-East is predominantly composed of Escarpment Grit Formation (EGF). The surface geology is characterised by a few scattered sandstone outcrops. Two major units can be distinguished, the "Braided facies" member (EGFb-f) of the lower EGF and the "Meandering facies"member (EGBm-f) of the upper EGF In core, the two units appear to be transitional from one another. The "Braided Facies"which covers mostly half of the northern prospect is distinguished in outcrop as gritstones, very-coarse-grained to coarse grained sandstones and pebbly sandstones. Ripple lamination is common and mudstone beds are laterally continuous.

The absence of any marker beds is typical of braided river successions. Broad lithologic features, however, including zones of largest average and maximum grain size, relatively abundant pebbles, mudstone beds and mudclasts can be matched from hole to hole. On the basis of these features, three subdivisions have been distinguished within the EGF (Lusambo, V., 2011):

The "Braided Facies", which is at least 120 m thick at Mutanga, was subdivided into three subunits:

• Unit A, bounded by the underlying Madumabisa mudstone and the lowest EGF conglomerate bed, is characterized by cross-bedded, low-angle cross-bedded and ripple-laminated, coarse- to medium-grained sandstones

with local mudchips, interbedded with mudstones and very fine-grained sandstones. Thickness variations in Unit A probably reflect deposition on an irregular paleotopographic surface. Whereas there is no apparent unconformity between Units A and B, that contact is the best datum to use in any stratigraphic reconstruction.

• Unit B is characterized by the presence of conglomerates, gritstones, very-coarse-grained to coarse grained sandstones and pebbly sandstones, locally with mudclasts derived from interbedded mudstones. The upper boundary of unit B can be defined by the last appearance of mudstone or mudclasts associated with pebbly sandstone. Whereas, the historic AGIP graphic logs did not distinguish mudclasts, on this profile the B/C boundary was taken as the highest mudstone bed. Unit B appears to thicken toward the southeast, presumably reflecting increased syndepositional subsidence in that direction, as noted above.

• Unit C is dominated by gritstones and coarse-grained, rarely pebbly sandstones. Mudstones are rare; hence mudclasts are uncommon in this unit. The scarcity of mudstones and mudclasts suggests that Unit C should be more permeable than Unit B. This may be a factor in localization of mineralization near the contact between these units.

The southern part for the prospect is mostly "Meandering Facies"reaching in excess of 8m and is distinguished in outcrop as massive, or trough and tabular planar cross-bedded, fine- to medium-grained sandstone, locally with scattered small pebbles. In core, the "Meandering Facies"sandstones show ripple lamination as well as cross-bedding. Sandstone beds typically grade up from coarse-grained bases to medium grained or fine grained tops (Lusambo, V., 2011). Mudclasts and pebble lag layers are common It is distinguished from the braided facies by scarcity of pebbly sandstones and conglomerates and by the presence of extensive mudstone beds.

MINERALISATION

The uranium mineralization identified to date appears to be restricted to the Escarpment Grit Formation of the Karoo Supergroup. Within the tenement area, the Karoo sediments are in a northeast trending rift valley. They have a shallow dip and are displaced by a series of normal faults, which, in general, trend parallel to the axis of the valley. The Madumabisa Mudstones form an impermeable unit and are thought to have prevented uranium mineralization from moving further down through stratigraphy. Mineralization is associated with iron-rich areas (goethite) as well as secondary uranium being distributed within mud flakes and mud balls as well in pore spaces, joints, and other fractures.

Mineralization at Dibwe East is similar to that at the Mutanga deposit in that it is composed of coarse Autunite in fracture zones within an upper oxidized horizon overlying more fine grained disseminated mineralization within a pyritic reduced zone. Coffinite is dominant at Depth (70 –100m zone) whilst Phurcalite (similar chemical formula as Autunite) is dominant (0 –40m zone and 40 –70m zone). Thus it appears primary mineralization is at depth giving the high grade zones with secondary mineralization at surface 0 –70m zone. Mutanga lies 40 km via all-weather road from a major paved highway and only 35 km from the Kariba hydro dam. There is strong local community and government support for the project.

EXPLORATION STATUS

Exploration for uranium in the Middle Zambezi valley during the early 1970's revealed the existence of several uranium deposits. The most interesting occur in the vicinity of Siavonga and are currently held by GoviEx Uranium Zambia Limited.

In 2006 a detailed aeromagnetic and radiometric survey (Symons & Sigfrid, Report on the Interpretation of Aeromagnetic and Radiometric data, 2006) was completed over the areas of interest which were revealed during an earlier pre-digital airborne survey. The 2006 survey has confirmed the position and tenor of the existing targets and identified additional, targets.

1. The EGF appears to have two clear radiometric signatures;

a. A reddish brown ternary radiometric signature indicates the presence of K in the Formation, consistent with description of the EGF as feldspathic sandstone. This part of the EGF was mapped and designated as D1
b. The areas marked as D2 appear to have a similar K response but with additional uranium producing a white ternary radiometric signature.

1. The structures identified indicate an extensional half-graben regime with normal faults trending in a generally NE direction. The movement on these faults appears to down throw blocks to the NW. Later faulting in a NW, WNW and NNE direction crosscutting the Karoo stratigraphy is also noted.

CONCLUSIONS

• Exploration data suggest that the likely environments of uranium mineralization are meandering stream depositional systems within paleochannels, with fine- to coarse-grained sands and silts containing some organic and pyrite material, which could serve as reductant for the precipitation of uranium.
• At least three mineralized zones ("sand packages") have been identified.

• A stacked series of three mineralized horizons extend from near surface down to nearly 150m along nearly a 4km NE-SW strike, with their thickness ranging from 2m to 14m.
• Coffinite is dominant at depth (70 –100m zone) whilst Phurcalite (similar chemical formula as Autunite) is dominant (0 –40m zone and 40 –70m zone). Thus it appears primary mineralization is at depth giving the high grade zones with secondary mineralization at surface 0 –70m zone.

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Country or International Organization

Zambia

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