TECHNICAL MEETING ON URANIUM FROM UNCONVENTIONAL RESOURCES,

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STATUS OF RADIOACIVE ELEMENTS IN UGANDA

By

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Presentation Layout

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- Geology of Uganda
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1. *Introduction*

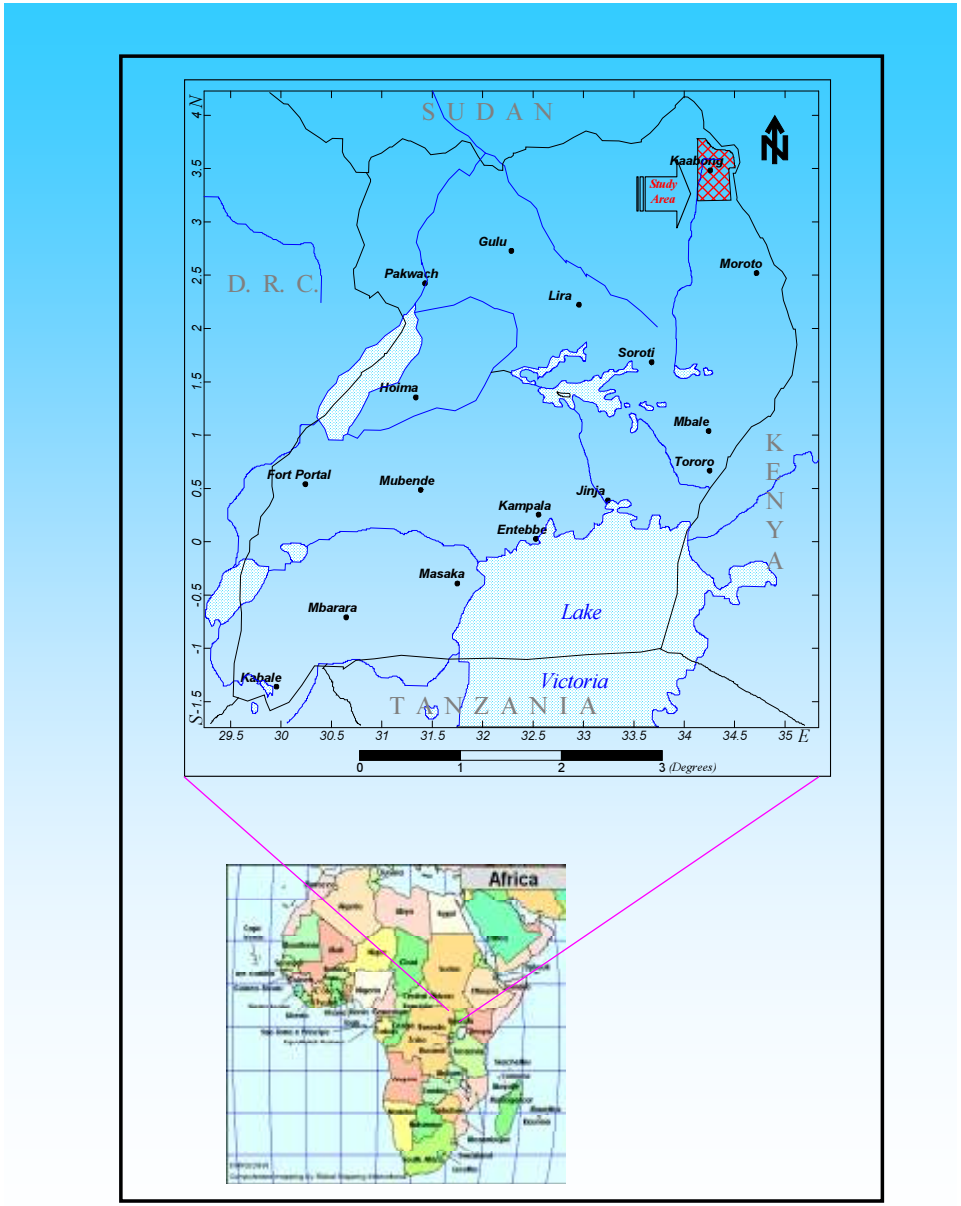
- Currently most of the electricity used in Uganda is generated from hydropower with the main source being the River Nile.
- Two power stations namely (Nalubaale and Kiira) are located on the source of the Nile.
- Current changing weather patterns in the world, is responsible for decreasing catchment areas of Rive Nile.
- This has resulted into less water available for hydropower generation.

- This phenomenon has triggered the search for alternative source of power.
- Radioactive elements were reported in Uganda as early as 1940's (Table 1) and no economic potential has since been reported.

- To that effect, airborne geophysical surveys at 200m interval and at 80m terrain clearance have been flown over 80% of the country.
- The data collected includes radioactive elements (U, Th and P) and data is captured in maps. With that background the Department of Geological Survey and Mines has embarked on ground follow up of the airborne geophysical radioactive anomalies.
- This exercise is expected to lead to the discovery of economic radioactive materials in Uganda. Subsequently, the material will be processed for peaceful use for power generation.

2. Geographical Features of Uganda

- Uganda covers 241,038 square km of which 197,097 square km is land and 43,942 square km is wetlands and water.
- Uganda shares common frontiers with Kenya to the east, Tanzania and Rwanda to the south, DRC to the west and Sudan to the north. In terms of geographical coordinates, Uganda is bordered by latitudes 4 and 1 degrees north, longitudes 29 degrees 30 minutes and 35 degrees east (Fig. 1)



Location of Uganda and the study area

3. The Geology of Uganda

- The geology of Uganda (Fig. 2) comprises Precambrian crystalline Basement, the Archaean Nyanzian and Kavirondian Systems, rocks of the Proterozoic and Palaeozoic ages, Cretaceous to Tertiary volcanics and sediments. Proterozoic rocks are referred to as a sedimentary cover sequence, and unconformably overlie the Basement Complex in the south, central and west of Uganda. The Proterozoic formations include Lower Proterozoic (Buganda-Toro System), middle-Upper Proterozoic (Karagwe-Ankolean System) and Upper Proterozoic (Bunyoro, Kyoga and Mityana series)

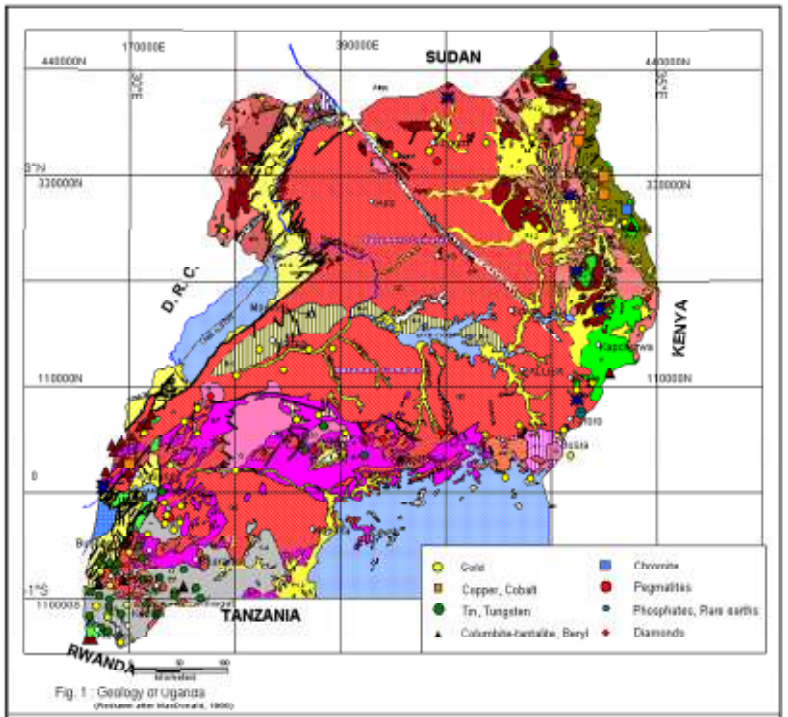


Fig. 1 : Geology of Uganda

4.PREVIOUS WORK

- Levinson, (1980) proved that uranium unless chemically combined in various minerals (often insoluble resistant forms) is highly mobile under oxidising conditions. It forms complexes in labile (not chemically combined). It can rarely be removed from weathering zones therefore easily mapped as in situ or be traced from its origin.
- Chemically bound uranium such as that in minerals may be soluble in oxidising solutions and most areas have been greatly affected by weathering hence all soluble uranium has been removed from surface environment in area of active erosion within parts of Uganda. Overall interpretation of the lithological changes, and weathering patterns give a clear signature associated with mineralization.

5. IDENTIFIED GEOLOGICAL FEATURES HOSTING URANIUM MINERALS

- Uranium minerals in Uganda include euxenite, microlite, betafite, kasolite, torbenite and uranosphaerite.
- These minerals occur in different geological environments namely:

(i) Pegmatites and granites in eastern and western regions, Buganda and Karamoja.

(ii) Sandstone in the Rift Valley and Buhweju plateau

(iii) Unconformities in the metasediments of Buganda-Toro System, Karagwe-Ankolean System, Kyoga Series and Singo-Mityana Series

(iv) Springs along Rift Valley margins and

(v) Volcanic tuffs in Fort Portal area

Uranium minerals from unconventional resources

Uranium bearing minerals	Description	These occur in many pegmatites and granites in many localities such as Kamacharkol-Apeykale, northeast of Kaboong in Karamoja, Mpuywi in Mubende, Gamba in Mpigi, Nanseke in Toro and in Moyo. Nanseke euxenite is found around margins of quartz-mica pegmatite and its grade is 11% U_3O_8 (Barnes 1961).

Betafite	*A greenish black hydrated titanate-columbite of Ca, U, etc.*	These are found disseminated in the volcanic tuffs of Ndale volcanic fields south of Fort Portal, in Granitic masses of Lunyo, Busoga/Bukedi border and in pegmatites at Lunyo Mukono district.
Torbernite and Metatobernite	*An emerald green hydrated phosphate of copper and Uranium-* $Cu(O_2)_2(PO_4)_2.8\text{-}12H_2O$.	This mineral has been identified from Bulema pegmatite-Kigezi and Kilembe near Nyalusegi creek (0.05-0.23% U_3O_8).
Kasolite	*A lead-uranium oxide.*	Identified from the pegmatites associated with the Lunyo granite in Bukedi.

Uranosphalerite	*Bismuth-uranium oxide-$Bi_2O_3.2UO_3.3H_2O$*	Identified in small quantities from Lithium-Beryllium pegmatite's at Mbale Estate, Singo.
Davidite	*Iron-titanium-uranium oxide with some rare earth elements like vanadium*	Identified in trace amounts from pegmatites of Ndale volcanic field.
Fergusonite	*$Y(Nb, Ta, Ti)O_4$ with some uranium*	Identified from pegmatites at Nanseke.

Xenotime	*YPO_4 with some U, Th, Zr etc*	Identified in coarse-grained pegmatites intruded in fine-grained gneisses at Apeykale in Karamoja and in sands and gravels of river Kafu (Bunyoro Series).
Microlite	*It appears to be a product of metamictization of tapiolite (Fe, Mn)Ta_2O_6. and is about 4% U_3O_8 (Barnes, 1961)*	Identified from many pegmatites in western Uganda eg. Bulema pegmatite, Kigezi
Pyrochlore	*$NaCa)_2(Nb, Ta)_2O_6$ F with some uranium thorium, titanium, cercium etc*	This is the chief niobium mineral in Uganda and is found at many localities within the carbonatie complexes of eastern and northeastern Uganda eg. Sukulu hills in Tororo, Lokupoi near Napak (0.028% U_3O_8), Toror hills in Karamoja.

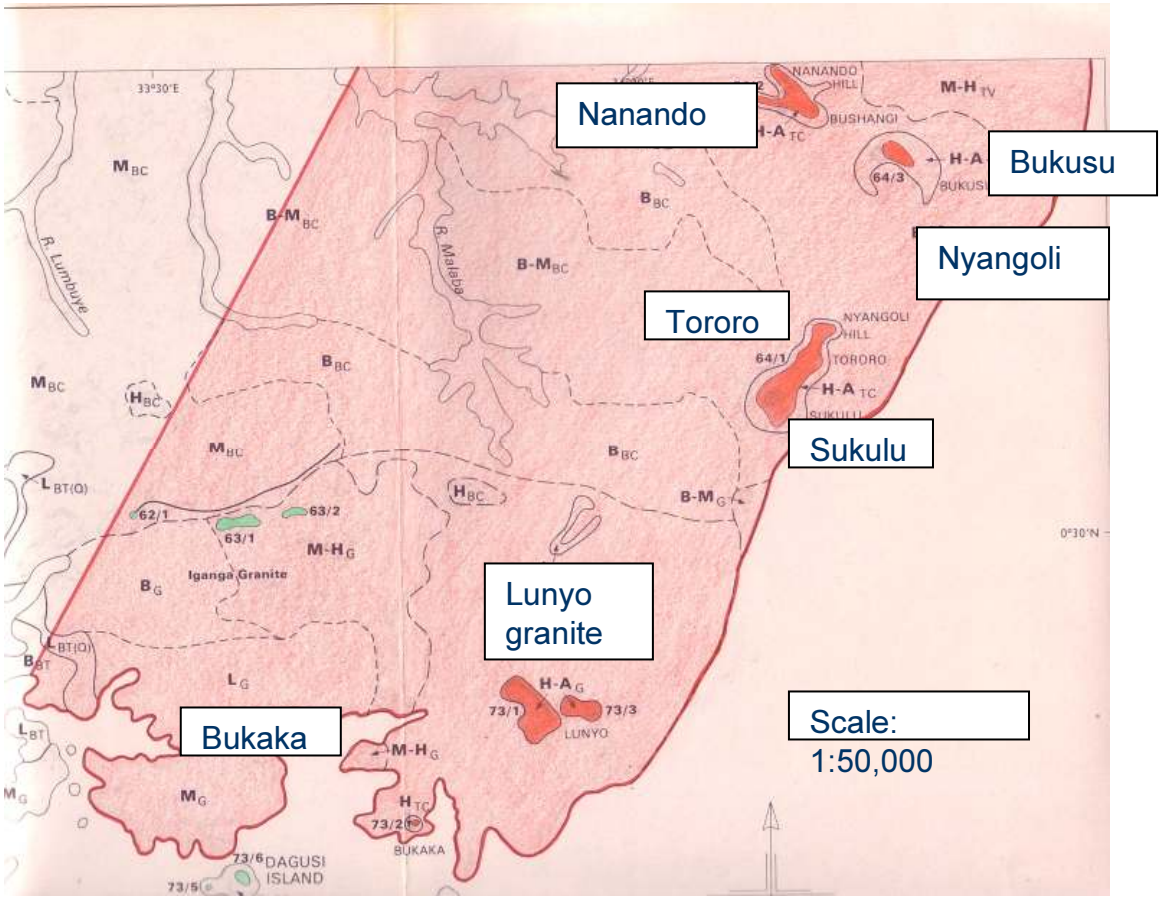
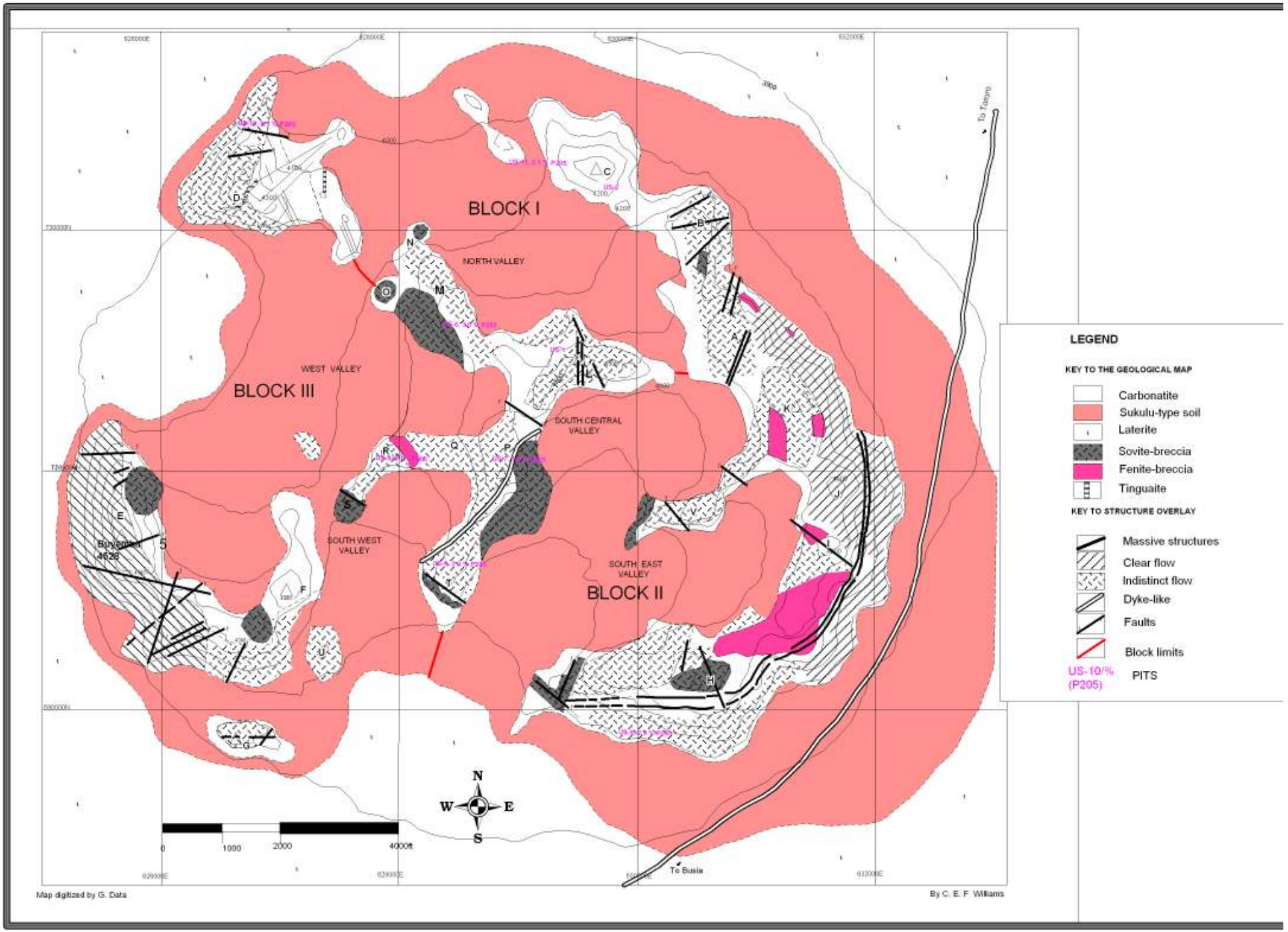


Fig. 3 Uranium prospects in eastern Uganda

- Pyrochlore concentrates from the dismantled pilot plant at Tororo factory, when analysed by IAEA was found to contain 0.35-0.5% U_3O_8 and 0.5-1.5% ThO_2 (Kaech, 1977).

- Earlier analyses of the crystals of the brown pyrochlore from the soils of the western valley at Sukulu hills (Campbell et al, 1952) gave the contents of U_3O_8 as 0.66%.


BLOCK I
BLOCK II
BLOCK III
NORTH VALLEY
WEST VALLEY
SOUTH CENTRAL VALLEY
SOUTH WEST VALLEY
SOUTH EAST VALLEY
To Tarpo
To Busia
N
W
E
S
0
1000
2000
4000ft
LEGEND
KEY TO THE GEOLOGICAL MAP
Carbonatite
Sukulu-type soil
Laterite
Sovite-breccia
Fenite-breccia
Tinguaite
KEY TO STRUCTURE OVERLAY
Massive structures
Clear flow
Indistinct flow
Dyke-like
Faults
Block limits
US-10/% (P205)
PITS
Map digitized by G. Data
By C. E. F. Williams

Resources of Sukulu complex

- The size and volume of apatite bearing soils differ in all the three valleys with the thickest reaching 67m (220 feet).
- The total soil reserves containing phosphate in the three valleys have been estimated at 230 million tons. It presumed that more reserves exist under the laterite which forms the perimeter of Sukulu complex.
- Based on the preliminary assessment, the country's potential for the uranium minerals in all the various occurrences is estimated at 105,000 tons of U_3O_8

6. Summary

- Detailed geological mapping, spectrometric survey, magnetometer and other methods would enable a precise geological model to be formulated and could lead to the discovery of radioactive targets and eventually to economic uranium mineralization.
- The radioactivity recorded over some parts of Uganda may be the surface indications of an existing uraniferous source at depth. Similar economically workable pegmatites and carbonatite uranium deposits have been found else where in the world.
- Uganda is currently carrying out geological mapping and exploration of radioactive elements potential.

THANK YOU