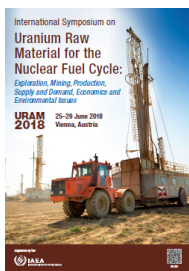


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## Exploration successes in the Tim Mersoï basin (Niger): a case study

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### INTRODUCTION

The Madaouela Uranium Project consists of a string of seven deposits located within the Tim Mersoï Basin, near the town of Arlit. Since 2008, GoviEx Uranium Inc (GoviEx) has been exploring for, and defining the mineral resources at the Madaouela Uranium Project. GoviEx has to date delineated a total resource of 117Mlbs of U (46 Mtonnes of ore at a grade of 0.115% eU) in the Measured, Indicated and Inferred categories [1]. On 25 January 2017, GoviEx received its MADAOUELA I mining permit, after completing an ESIA and a Feasibility Study as required by Niger regulation. After GoviEx acquired the licences, there was an intense period of delineation and validation of the previous work, followed by exploration along a perceived redox front towards the south. This led to the discovery and the delineation of a number of deposits to the south culminating with the Miriam deposit, broadly along the same trend [2,3,4,5]

### HISTORY

The CEA (Commissariat à l'Énergie Atomique) conducted drilling operations using drilling grids of 800 m over large areas, and down to 100 m over two contiguous mineralized zones termed Marianne and Marilyn. The discovery of the Marilyn deposit was then drilled locally at 50 m and less spacing, and an underground mining test was implemented for detailed sampling mineralogical studies, processing tests and investigations into the global rock quality from a mining perspective. CEA also discovered the other deposits that are the current active mines in the area (the Somaïr and Cominak operations), and subsequently ceased exploration work on Madaouela in 1967. [1]

The Japanese Power and Nuclear Fuel Development Corporation ("PNC") conducted additional uranium exploration work up to 1992 and produced a report on the feasibility of the Madaouela deposit in 1993, which was later updated in 1999. Historical mineral resources/reserves were stated at 5 to 15 Mlb U<sub>3</sub>O<sub>8</sub>, depending upon the cut-off used.[1] A total of 5 exploration licences were granted in 2007 and exploration and development activities have been ongoing since 2008.

### GEOLOGY

The Tim Mersoï Basin is defined by fluvio-deltaic sedimentary packages that host significant uranium mineralisation. A combination of structural, paleogeographic, paleo-hydrologic and sedimentary factors controlled the location of these deposits [6]. The main deposits occur within the Carboniferous Guezouman Formation and are differentiated on their gross morphology - a thin carpet type (basal deposit) which occurs right at the base of the Guezouman Formation- controlled by sedimentological features -organic accumulation at crossbed foresets and sulfide accumulation. It is also found within the basal conglomerate - the Teleflak which consists of pebbles from the Air basement, clay and phosphatic nodules. The other type, is described as having Christmas tree morphology (Roll front) with thick mineralised accumulations, up to 25m, and appears to be controlled by fractures.

Geological control is a combination of structurally controlled paleochannels - the N70 direction, with the associated development of the UA formation (feldspathic sandstone) within some of these channels and thickening of the Guezouman Formation. The mineralisation occurs at the contact between the reduced Talak Formation (dark mudstone) and the Guezouman Formation, a fluvio-deltaic sandstone and siltstone. [6]

The Miriam deposit is different to the others as it can be described a more of a classic roll front with Christmas tree like structures believed to be controlled by N140 expansion fractures, as opposed to carpet like morphology of the other deposits. These fractures can be seen on aerial photographs and aeromagnetic data, and are significant in the search for other Miriam type roll front deposits. Proximity to the N40 Madaouela Fault may be an essential control as the N140 fractures are more like riedel type fractures, located between the Izeretagen and Madaoulea Faults.

The other type occurs further up the stratigraphy, within the Madaouela Formation, near or at the contact with the Permian Tarat Formation, host to the nearby SOMAIR mine. This is more of classic roll front, associated with thin mudstones, and occur as stacked lenses.

Uranium mineralization typically occurs as coffinite and uraninite associated with molybdenum-rich and titanium-rich coffinite as interstitial grains in kaolinite-illite-chlorite-carbon-calcite cement to quartz-feldspar matrix of the sandstone. Sulfide minerals are associated with the uranium minerals, typically pyrite, nickeline, molybdenite and gersdorffite. Radiogenic galena is present associated with early phase uranium paragenesis.

Some surficial oxidation has occurred at La Banane and other localities with near surface-surface carnotite, umhoite and tyuyamunite occurring in calcite cemented shale in fractures.

#### CURRENT STATUS OF EXPLORATION

The discovery of the Miriam deposit represents the continuity of exploration which started from the Marianne-Marilyn deposit which have been re-discovered by reopening some old holes drilled by CEA-Cogema. The GoviEx geologists had suggested that at a certain stage it should be possible to encounter redox front of the Akouta model (Cominak). So, a grid of 400X400m has been defined on the basis of redox observation from surface geological formations, and structure. Unfortunately, no rich intersects were recorded but the scintillometric logs, and chips colors clearly show the possibility for a local redox front, albeit at low grade. These results encouraged the Goviex team to define the 200X200m grid and defined an important mineralization at 200ppm cut off, showing interesting continuities at an average depth lower than 100m and some rich intercepts suggesting the possibility of a "low grade openpitabile" deposit. Following up on this, the Miriam deposit was then drilled out to a 25 x 25m grid to define the known resource.[5]

For the La Banane deposit, this was purely a greenfields discovery following step out from the main trend to test the hypothesis that parallel redox fronts exist to the east of the one that runs through the Marianne to Miriam deposits within the Guezouman Formation. The work started by regional strip mapping along 800m lines to identify the geological structure and favorable redox zone in the eastern part of Madaouela fault. This was followed with the reopening of a few historical holes to verify the historical radiometric data and was followed up by drilling on an initial 3200m spacing grid with 1600m infill along sections, followed by further infill as anomalies were being identified. The redox interpretation was conducted mainly on rock chip observations (grain coating, colours of matrix, clay, organic matter, hematite, limonite) and the scintillometer anomalies. [3]

Further additional anomalies have been identified within the Guezouman (Marianne-Marilyn however the largest number of mineralized intercepts occur in the Madaouela arkosic channels. The geological continuity of mineralization within the Madaouela was confirmed by closing up the drill spacing, and several elongated mineralized bodies 300-400m were delineated. GoviEx finally infilled drilling at 100m spacing to control extension and to carry out the correct sequential correlation and to sustain the geological model. [1,2]

#### CONCLUSIONS

This case study demonstrates that the geology of the Tim Merso basin is still largely unknown. The basin is large and has a complex geology but is similar to other sedimentary basins elsewhere in the world known to host uranium. Current discoveries and exploration activity indicates potential for further development in the region.

#### ACKNOWLEDGMENTS

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## **Country or International Organization**

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