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DASA: AFRICA'S NEWEST WORLD CLASS URANIUM DEPOSIT IN NIGER, WEST AFRICA —A GLOBAL ATOMIC CORPORATION PROJECT

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SYNOPSIS

The DASA deposit is located in the north central part of the Republic of Niger, West Africa. It is 100 km north of the city of Agadez, 80 km south of the uranium mining areas of Arlit and 1000 km east of the capital Niamey. The project area is found within the sedimentary Tim Mersoi basin; one of the world's foremost uranium producing areas. The area is accessible using an all weather road connecting Agadez, Niger's second largest city with the town of Arlit. Global Atomic Corporation (GAC), a Canadian junior exploration company has six exploration permits in Niger. The DASA deposit is positioned within the Adrar Emoles 3 permit. The GAC head office is based in Toronto, Canada and a subsidiary office operates in Niamey, Niger.

The initial uranium mineralization was observed on surface in 1956 near Azelik, just west of the GAC property. An intensive geological exploration program was implemented between 1957-1967 by CEA (French Nuclear Energy Commission) and this resulted in the discovery of the uranium deposits of Azelik (1960), Madaouela (1964), and finally Arlit-Akouta (1966-1967). The CEA eventually became Cogema and is now known as Orano (formerly AREVA).

Global Atomic Corporation signed exploration agreements with the Government of Niger on six permits during 2007 totalling approximately 3500 km^2. The DASA deposit was discovered in 2010 through surface prospection which led to a high grade (>30%U^3O^8) outcrop.

Since 2010 GAC has conducted significant drilling programs (> 120,000 meters to date) in conjunction with other exploration surveys leading to the definition of the DASA deposit. The GAC Adrar Emoles 3 permit, on which DASA is located presently, comprises an area of 121.3 km^2. Exploration and drilling programs are ongoing.

Geology and Stratigraphy

The GAC permits are located predominantly over continental sediments of the Tim Mersoi basin which is bordered to the east by the metamorphic Pre Cambrian terrain of the Air Massif rising to an elevation of over 2000 meters. Most of the rocks here are intrusive and their erosion has provided much of the sediments in the basin. Uplift of the Air has tilted the sediments in the forelands shallow to the west.

Generally the sediments are clastic containing minor carbonates. The sediments were laid down in fluvial and deltaic settings. The general direction of transport is assumed to have been from east to west and in the area of interest a more NE to the SW direction of transport would have prevailed.

The sediments identified within the GAC permits range in age from Cambrian to lower Cretaceous.
The following strata -from bottom to top- as recognized in drill holes and surface mapping underlie the GAC property.

Pre Cambrian basement is exposed in the Air Massif some 15 km to the east. The oldest rock drilled on the GAC grounds is coarse grained granite inside the DASA graben at depths of over 700 meters. Cambrian to Devonian sediments exist in this part of the Tim Mersoi Basin. Some have also been identified in the drilling at DASA. These are predominantly sandstones and conglomerates, possibly including Devonian glacial deposits.

The Carboniferous fluvio-deltaic Tagora Formation of Upper Visean age can be observed in many of the deeper GAC drill holes. The lower Tagora, up to 180 meters thick, contains sandstones representing the Guezouman Formation. This is a major uranium carrier in the Akouta area (Cominak underground mine-Orano).

The upper Tagora, up to 140 meters thick, often commences with a thin layer of conglomerate overlain by the sandstones of the Tarat Formation. The uranium in the Somair open pit mines at Arlit (Orano) is hosted in the Tarat. The top of the Carboniferous is completed by sandstones and siltstones of the Madaouela Formation (Madaouela uranium - GOVIEX).

The Carboniferous in the entire basin is characterized by reducing conditions displayed in predominantly greyish colours; pyrite and organic matter providing ideal conditions for the precipitation of uranium.

Permian sediments are generally characterized by an abundance of arkosic sandstones containing significant volcanic debris. Reddish colours and abundant calcite are dominant. This indicates an oxidizing milieu. Around the project area the thickness of the Permian strata varies considerably and reaches a maximum thickness of some 300 meters.

Initially the Triassic shows a continuation of the Permian conditions commencing with conglomerates overlain by sandstones. The Triassic sediments, over 200 meters thick, contain masses of volcanic debris such as tuffs. Massive analcimolite intercalated with sandstone layers are found on top reflecting a very active eruptive volcanic phase.

The Jurassic commences with the Tchirezrine 1 Formation (Tch1) the channel sedimentation of a large river flowing from north to south. Graben syn sedimentary tectonic has caused variations in thickness. In general the Tch 1 is quite similar to the higher following Tchirezrine 2 Formation (Tch2) except that it does not contain uranium mineralization.

The Tch2 reaches thicknesses of 40 to 200 meters. It was laid down in a fluvial-deltaic and lacustrine environment. The sediments are predominantly coarse grained, poorly cemented sandstones and micro conglomerates with cross bedding at the base. The formation was affected by syn sedimentary tectonics and later by shearing. This has contributed to the considerable thickness reported in the GAC drilling in some drill holes. The rocks are rich in analcimolite and organic matter including coal beds; a most favourable environment for uranium precipitation. This formation contains much of the uranium discovered on the GAC property and in the huge Orano Immouraren uranium deposit nearby.

The Cretaceous begins with the Assaouas Formation, up to 30 meters thick, consisting of re-worked older quartz rich sediments and is overlain by fine grained sandstones and argillites. The following Irazher Formation consists of reddish mudstones and silts which cover much of the basin, but is confined within the GAC property to the Asouza Graben. The thickness, at times over 300 meters, is marked by syn-sedimentary tectonics within the graben with important lateral variations in thickness. The stratigraphic column of the project area culminates with the barren sandstones of the Tegama Formation which lies with a prominent unconformity on the Irazher sediments. Tegama sandstones are present in two bigger hills inside the Asouza Graben.

Structural Geology

The Tim Mersoi basin developed as a result of N-S and E-W compression with NNW-WNW sinistral shears originating from counter clockwise rotation in the NE of the basin. The intersection between these structures contains rotational deformation causing dome and basin structures. This mechanism has created horst and graben structures.

Major movements are related to N-S zones which strike parallel to the eastern and the western edges of the Air Massif. The compressional sinistral strike slip movements have caused three main structural directions which are N-S, N40°-80° and N90°-140°. Where these directions meet, their continual movement has opened up ideal pathways for circulating uranium bearing fluids; pre requisites for the formation of deposits.

The N-S fault system is a major crustal structure of regional scale and is displayed in the fold-fault of In Azaoua-Arlit. A N30° family of structures is most evident on surface in the basin. They appear in the Air Massif in the east and truncate at the In Azaoua-Arlit lineament in the west. In the sedimentary cover the deformation is characterized by flexures creating, in some instances, a substantial vertical displacement in the order of 100-200 meters.

The N70°-80° and N130°-N140°E series of faults are brittle structures. The N70°-N80°E faults are conjugate to the N130°-N140°E directions and are present mainly in the southern half of the Tim Mersoi basin. During the Carboniferous both families of structures controlled the sedimentation in the basin. These faults played a major structural role in the regional context of the basin by localizing large scale dextrous strike-slip faults. Fold-like structures are revealed along sectional variations in the dip of the strata. According to geological drilling data the thickness and dip variations in some strata from west to east are linked with synsedimentary tectonic activity.

The DASA site corresponds to a major structural intersection of the Adrar-Emoles flexure and the Asouza fault which has resulted in the doming and creation of the Asouza (DASA) Graben. Much of the uranium is found here, especially along its southern flanks. The intersection formed a dome and at its opening the Asouza Graben was created moving the Cretaceous formations to the same topographic elevation as the surrounding Jurassic sandstones.

Major NE-SW vertical faults are associated with the Asouza Graben and characterized by significant vertical displacement of several hundred meters between the centre of the graben and its shoulders.

The creation of the graben prevented the erosion of the Tegama and Irhazer Formations that are normally found much farther to the west in the deeper areas of the Tim Mersoi basin. The Tch2 Formation was also preserved here and is significantly eroded on the sides of the graben. This vertical displacement has had a major impact in the continuation of potential host rock geology and has also provided feeder faults and mineralization traps for ore forming fluids as evidenced by veining within the sandstones.

The NNW-SSE faults observed NW of the graben are particularly interesting. They cut the sandstone formations of the Tch2 inducing significant vertical displacement with evidence of fluid circulation enacting localized alteration and copper mineralization in analcimolite formation of the Tch2.

Paleography

The development of the paleography has had a major influence on the sedimentation and the lithology of the host rocks where uranium is found today. During the deposition of the Lower Carboniferous this part of the Tim Mersoi Basin was quite stable with very little subsidence. Volcanism commenced towards the top of the Lower Carboniferous in the Air Massif. Increasing precipitation in the Upper Carboniferous is manifested in the Tagora series with its fluvial-deltaic cycles. Paleo valleys and channels existed with marshy zones that were filled with fine grained sediments and large accumulation of organic matter.

In the Permian, desertic conditions usually prevailed while in the Triassic less desertic environments appeared. Structural activity caused lineaments to evolve which in turn created variations in the thickness and facies of the sediments.

During the Jurassic, tectonic adjustments occurred and a wide north-south trending trough developed. It was limited in the west by the N-S trending Arlit fault, the Madaouela fault in the north and the Magagi fault in the south. Volcanic activity was wide spread and the depositional environment changed to real fluviatile-lacustrine scenarios. The flow directions maintained their main SW to NE vector. During the Tch2 deposition large amounts of organic matter were incorporated into the sediments. The sandstones often show whitish greyish or greenish colours indicating a much higher reduction potential for uranium. This is most obvious in the massive mineralization seen at DASA.

Uranium Mineralization and Economics

All known uranium mineralization in Niger is located exclusively in sediments of the Tim Mersoi basin and occurs in almost every important sandstone formation, although not always in viable concentrations.

The uranium in many of the deposits of the basin is generally oxidized. Thin section work and petrographic studies on DASA samples have revealed that the uranium host rocks vary in oxidization. The original cement between the grains of quartz and feldspar consisted of sericite and carbonate which were replaced during later stages by goethite and amorphous Fe-hydroxides. The quartz and the feldspar grains contain micro fractures filled in part with U rich oxide. The latter also rim some of the silicates. Uranophane in the form of radiating aggregates forms cement between the silicates and partly replaces them.

Five main uranium bearing minerals have been identified in DASA samples:

Carnotite $K_2 (UO_2)_2 (VO_4)_2$ x $3H_2O$; Uranophane $(Ca(UO_2)_2 SiO_2O_7$ x $6H_2O$

U –rich titanite $(U,Ca,Ce)(Ti,Fe)_2O_6$: Torbernite $(Cu(UO_2)_2(PO_4)_2$ x 8 H_2O
Autunite $(Ca (UO_2)_2(PO_4)_2$ x 12 H_2O

All known uranium occurrences and deposits in Niger are classified as the sedimentary tabular and roll front sandstone type. Sandstone hosted uranium deposits are marked by epigenetic concentrations of uranium in fluvial/lacustrine or deltaic sandstones deposited in continental environments. They are located frequently in the transition areas of higher to lower flow regimes such as along paleo ridges or domes. Impermeable shale or mudstones often cap, underlie or separate the mineralized sandstones and ensure that fluids move along within the sandstone bodies.

DASA is unique amongst the uranium deposits in Niger. It shows higher grades and accumulations than virtually any other known deposits. It contains economic reserves in both of Niger's main uranium bearing formations (Carboniferous and Jurassic) and displays a very strong structural component (DASA graben) which has enhanced both grade and thickness of the mineralization.

The origin of the uranium at DASA is very likely from two main sources; leaching of uranium during the erosion of the Air Massif for the Carboniferous ores and leaching of the volcanic tuff and ash intercalations for the Jurassic ores. This began as pre-concentrations during the early sedimentation. Favorable reducing environments such as organic matter rich lower flow regimes containing sulfides, Fe minerals and amorphous humate as well as favourable lithological settings played their parts. The first strati form ore bodies emerged from this setting. Subsequent structural deformation and fluid movements within coarser grained organic and sulfide rich sediments initiated roll front like re- distribution and concentration over several stages. The uranium followed favorable lithological and structural surroundings and traps creating the present shape of the ore bodies.

The grade and thickness of the mineralized intersections differentiates DASA from most other sandstone deposits worldwide. Some of the better intersections assayed (XRF) are hole 476 with 4462 ppm U_3O_8 over 94.5 meters, hole 478 with 7033 ppm U_3O_8 over 42 meters, hole 256 with 3307 ppm U_3O_8 over 110 meters and hole 312 with 2811 ppm U_3O_8 over 76 meters. A NI 143-101 compliant report by CSA Global Pty. Ltd. in 2017 listed indicated reserves of 21.4 million pounds with an average grade of 2608 ppm U_3O_8 using a cut-off of 1200 ppm U_3O_8 . The inferred reserves were calculated as 49.8 million pounds at 2954 ppm U_3O_8 again using the 1200 ppm U_3O_8 cut-off. This makes DASA potentially a 70 million pound plus deposit. The deposit is open along strike NW-SE and down dip. Ongoing exploration work is expected to increase the reserves further.

It is possible to develop DASA within a short time frame producing ore from both open pit and underground operations. CAPEX to production would be low with an estimated investment of 50 million US dollars to development as the ore would be processed at the nearby Orano mine sites in Arlit where all necessary facilities, such as a mill already exist. To this extent GAC signed a Memorandum of Understanding (MOU) with Orano in 2017.

The infrastructure, both within and surrounding the GAC property is excellent. Easy access to a major road system linking to the port of Cotonou in Benin, West Africa is already being used for the shipment of the production from the Orano mines in Arlit. Electricity is available from an existing high power line crossing the property and a large pool of experienced mine workers provides a source of labour.

The discovery of the DASA deposit has given rise to new incentives for exploration in the Tim Mersoi basin. There is considerable potential to find additional DASA type deposits, not only on the GAC property, but also in other parts of the basin.

Country or International Organization

Canada

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