

# Uranium in Africa

(January 2010)

- Africa has considerable mineral deposits, including uranium.
- Exploration and mine development is proceeding in countries which have not hitherto supplied uranium.
- Gabon has been a significant uranium supplier in the past.

***Please note:***

The country papers on: **Namibia, Niger, South Africa** should be consulted for information in those areas.

This paper deals with other countries in Africa where uranium deposits having JORC or NI 43-101 compliant resources are known or understood to exist.

## Algeria

A lot of uranium exploration occurred in the 1970s, resulting in the discovery of the Tahaggart deposit, as well as other mineralisation. The government reports Reasonably Assured Resources of 26,000 tU in the under \$80/kg category. In September 2009 the National Mining Patrimony Agency put uranium exploration leases in the southern Tamanrasset province out for tender.

## Botswana

The Letlhakane project in the east of the country comprises three orebodies: Gorgon, Mokobaesi and Kraken, totaling 38,000 tU as of July 2008. Further uranium at Serule nearby is being evaluated. The ore is carnotite in calcrete, is shallow and amenable to alkaline heap leaching. Production from 2011 is envisaged by Australian-based A-Cap Resources, exported through Namibia.

Along strike from this, Impact Minerals based in Western Australia is exploring some prospective deposits including Sua Pan. Polo Resources owns 19.9% of Impact.

## Central African Republic

Having taken over UraMin Inc, Areva is proposing to develop the \$200 million **Bakouma** project, originally discovered by Cogema (Areva) and more recently taken forward by UraMin Inc of Toronto. It aims to start open pit mining in 2010, at 1200 tU/yr. Resources have been reported as 38,000 tU, though UraMin's web site (October 2007) said 16,000 tU as historic resource estimate reported by a previous owner. Areva Resources Southern Africa holds a 90% interest over ten discrete deposits, the government holds a 10% free carried share, and was disputing some aspects of the Areva takeover of UraMin's rights until an agreement was signed in mid 2008.

## Congo

The Belgian Congo, as it then was, provided much of the uranium for the Manhattan Project in the early 1940s, particularly from the **Shinkolobwe** mine, 25 km west of Likasi in Katanga. There was

some uranium mining subsequently by Union Miniere, to independence in 1960, when the shafts were sealed and guarded. About 25,000 tU was produced in the two decades until then.

The deposit has been unofficially mined since 1997 for cobalt. A UN report in 2004 described the situation as anarchistic. This has prompted some concern by the International Atomic Energy Agency on account of the possibility that some uranium might be finding its way to countries with illicit weapons programs. In the south-eastern region of Katanga the geology is contiguous with the Zambian copper belt.

In 2009 Areva signed a uranium exploration agreement for Katanga with the government.

The country ratified the Nuclear Non Proliferation Treaty in 1970.

## Gabon

No current uranium mining occurs in Gabon, but exploration continues. Historically, uranium mining in Gabon has been closely linked with Niger due to the role of the French Atomic Energy Commission and Cogema (now Areva NC).

The **Mounana** uranium deposits in southeastern Gabon were discovered in 1956 by French Atomic Energy Commission (CEA) geologists and were mined from 1960 to 1999, producing nearly 28,000 tonnes of uranium. The best known of these deposits is Oklo, discovered in 1968, which produced over 14,000 tU. (Oklo is famous for its [fossil nuclear reactors](#), which operated naturally in the wet sandstone orebody about two billion years ago.)

The Franceville Uranium Mines Company (COMUF) was formed in 1958 and undertook the mining and processing. It was 68.42% owned by Cogema and 25.8% by the national government.

The ore was mined largely in open cut operation but also underground, from five discrete orebodies with average ore grade of 0.37%. Milling was at Mounana. Production fluctuated from 400 to 1250 tU/yr, with a total of 12,147 tU coming from open pit mining and 15,725 tU from underground mining. Operations were shut down in mid 1999 due to a lack of economically recoverable reserves - Reasonably Assured Resources (RAR) of 4830 tU @ under US\$ 130/kg is quoted. The facilities were dismantled and the site is in the final phase of rehabilitation.

Extraction of the ore began at the Mounana open pit mine (1960-75), followed by the mine at Oklo (1970-85). Ore was also extracted from underground mines, first at Mounana, then at Oklo (1977-97), and at Boyindzi (1980-91). During the last two years, the open pit at Mikouloungou, 60 km away, was mined (1997-99).

Up to 1975 some two million tonnes of tailings were released into the local Ngamaboungou creek and Mitembe-Likedi River system, along with mill effluent. Then four million tonnes were emplaced in the Mounana pit. In 1990 a tailings dam was built across the Ngamaboungou creek for the balance.

In 1985 COMUF started works to stabilize the course of the Ngamaboungou creek with rock, and to cover the tailings deposits formed in the valley along the creek with a layer of 30 - 50 cm compacted laterite. The tailings deposit in the former Mounana open pit was covered with a cover of broken rock and laterite soil. Contaminated areas at the processing site were covered with a layer of 0.7 metres minimum of lateritic soil. The rehabilitation work was completed in July 2004, at a total cost of EUR 10.7 million including EUR 7 million from EU funds.

Gabon is party to the Nuclear Non-Proliferation Treaty and signed a safeguards agreement in 1979, but does not have a comprehensive safeguards treaty in force.

## Guinea

Several companies are exploring for uranium in Guinea. In August 2007 the government noted that Murchison United NL had encountered some encouraging mineralization (or even "commercially viable deposits") at its Firawa prospect, 600 km east of the capital, Conakry. Forte Energy, Toro Energy and Contico also hold exploration licences. Forte has announced a 4470 tU JORC-compliant inferred resource at **Firawa**.

## Equatorial Guinea

The government has commenced airborne geophysical surveys to locate uranium mineralization, and has launched a new mining code.

## Malawi

Paladin Energy, based in Perth, Australia, has developed the **Kayelekera** uranium mine in northern Malawi. As of late 2008 this has reserves of 11,265 tU at 0.04% cut-off, within 15,000 tU measured and indicated resources in average 0.08% ore (JORC and NI 43-101 compliant). The orebody remains open to the west and exploration is proceeding here and on nearby leases.

The deposit was discovered by UK's CEGB and a feasibility study was subsequently undertaken in the 1980s. Paladin acquired the deposit in 1997, accepted a Bankable Feasibility Study early in 2007, and following environmental approval undertook a US\$ 220 million mine development. The mine was opened and commenced production in April 2009. Paladin's interest following the Development Agreement with the Government of Malawi is 85%. Production is with a conventional acid leach treatment process, and will ramp up to 1460 tU/yr about mid 2012.

## Mali

The **Falea** uranium-silver deposit in western Mali is being explored by Rockgate Capital Corp of Canada, though some earlier work was done by Cogema in the 1970s. Indicated and inferred resources of 8533 tU (NI 43-101 compliant) were reported in May 2009, much of it at average 0.15% U grade, with about 5% of the deposit drilled. Mineralisation is in sandstones, and the project is 20 km north of the Guinean border.

## Mauritania

Forte Energy NL based in Australia expects release JORC-compliant figures for its **Bir En Nar** uranium deposit in granites in the north of the country near Western Sahara early in 2010. Areva holds 11.3% equity in Forte, and will join in any major development.

## Morocco

The government's Office National des Hydrocarbures et des Mines (ONHYM) is encouraging exploration for uranium to build upon that done by French and Russian geologists prior to 1982. Three areas are under investigation: Haute Moulouya, Wafagga and Sirwa. The first two have palaeochannel deposits. Toro Energy holds tenements in Haute Moulouya area.

In October 2007 Areva signed an agreement with Morocco's Office Cherifien des Phosphates (OCP) to investigate recovery of uranium from phosphoric acid. The amount of uranium in Morocco's phosphates is reported to be very large.

Morocco also controls Western Sahara to its south.

## Nigeria

In March 2009 Russia signed a cooperation agreement with Nigeria, including provision for uranium exploration and mining in the country. A further broad agreement in June 2009 envisaged the construction of a Russian power reactor and a new research reactor. See also [Emerging Nuclear Countries](#) paper.

## Tanzania

Several companies are exploring for uranium in Tanzania. Australia's Uranex NL reports inferred resources of 5850 tU in a shallow deposit at Manyoni, 80 km west of Dodoma, which it hopes to mine in 2010. The company has two uranium projects: Bahi (incorporating Manyoni and other deposits over some 30km) in central Tanzania, and Mkuju-Songea in the southwest. In September 2009 mining approval for Bahi was given by the government.

In September 2009 Australia's Mantra Resources Ltd was given government approval to mine after meeting all environmental requirements. Mantra is undertaking a feasibility study for its Mkuju River project, incorporating the Nyota prospect. Inferred resources of 13,800 tU are quoted.

## Zambia

Denison Mines of Canada is planning to develop its US\$ 118 million **Mutanga** uranium project in southern Zambia, with mine construction to start in 2011 and production in 2012. No production target is known. Denison announced a NI 43-101-compliant resource in March 2009, based on two shallow orebodies: Mutanga and Dibwe. Measured resources are 770 tU at 0.041%U, indicated resources 2230 tU and inferred resources 5070 tU. Following successful licence renewal, a feasibility study was undertaken for an open pit mine with acid heap leaching. Denison has applied for environmental approval from the Environment Council of Zambia. The Mutanga pit will be 750x550 m and the Dibwe pit 10 km southwest will be 1500x300 m. The project, formerly known as Kariba, was developed by OmegaCorp which identified an inferred resources of 4300 tU (JORC compliant) in 2006, prior to its acquisition by Denison.

Equinox Minerals, based in Perth, Australia, is operating the US\$ 762 million **Lumwana** project in NW Zambia. This is primarily a large copper mine, with two open pits 7 km apart. Following a bankable feasibility study on uranium recovery the company announced 3800 tU indicated resources at 0.079%U and 2570 tU in inferred resources. The uranium is in discrete uranium-enriched zones that will be mined separately from the copper ore and stockpiled. An environmental impact assessment of the uranium project was approved in December 2008 and treatment of uranium ore to produce 700 tU/yr was planned from 2010. However, investment in the \$230 million uranium mill has been deferred due to difficulty in financing this part of the project. The Malundwe open pit is the first of two uranium sources within the overall project, where the mineral is in discrete veins in the broader copper mineralisation. Uranium ore remains stockpiled.

The **Chirundu** project is focused on exploring the Njame and Gwabe deposits and reports 2850 tU

as measured and indicated resources. African Energy Resources holds 70% and Albidon Ltd based in Western Australia has 30% of the joint venture. A mining licence was granted for the project in October 2009. It includes the Slamboka prospect.

Zambia has upgraded its mining legislation to take in uranium, following detailed consultation with the IAEA. It started issuing uranium mining licences late in 2008. It is signatory to the NPT and has been a member of the IAEA since 1969.

**Main references:**

*OECD NEA & IAEA, 2006, Uranium 2005: Resources, Production and Demand.*

*Paladin Resources*

*UraMin*