

# Kayelekera Mine

Malawi, Africa

*(currently on care & maintenance)*



PALADIN (AFRICA) LIMITED  
A Member of the Paladin Energy Ltd Group of Companies

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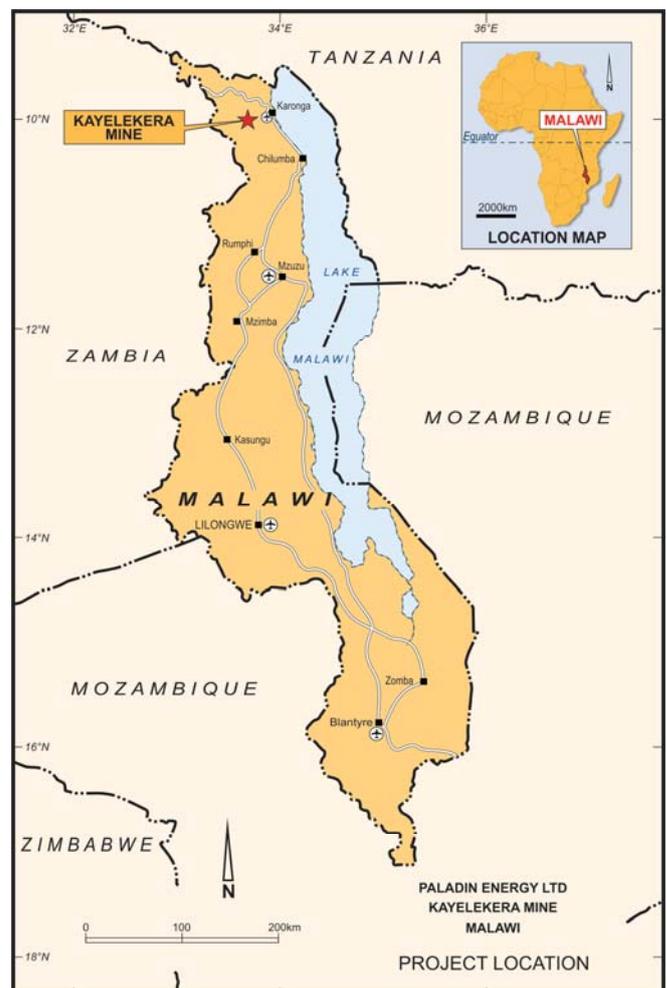
Paladin holds an 85% interest in the Kayelekera Mine (KM) in northern Malawi through its 85% ownership of Paladin Africa Limited. Kayelekera is a sandstone hosted uranium deposit. The mine was permitted, constructed, commissioned and operated by Paladin between 2007 and 2014 and produced 10.9Mlb of  $U_3O_8$  from open pit mined ore processed through a RIP acid leach processing plant. In early 2014, KM was placed on care and maintenance due to the depressed uranium market. Internal studies have determined that an improved uranium market will provide an opportunity for KM to again produce uranium from its remaining 31Mlb resource.

The Government of Malawi (GoM) owns 15% of KM and provided support for the project by executing a Development Agreement prior to construction to provide a stable fiscal environment for the first 10 years of operation. The GoM is committed to supporting and encouraging the private sector to assume a leading role in the economic development of projects in the mining sector.

KM has made a substantial fiscal contribution to Malawi and opened up opportunities for employment and improvements to social infrastructure, particularly in northern Malawi.

## Location and Access

KM is located in northern Malawi, southern Africa, 52km west (by road) of Karonga. Karonga is approximately 600km north of Lilongwe, Malawi's capital city and is accessible by a national highway and by charter plane from the sealed runway in Karonga.



## Past Operation Description

Operating mine production was derived from a single open pit utilizing conventional drill and blast, load and haul methodologies. ROM ore was managed based on grade and ore type which is largely controlled by primary lithology (arkose or mudstone) and oxidation state (oxidised or reduced). A mining contractor was engaged for the period of active mining.

Ore was processed through a plant with 1.5Mt/a feed capacity with nameplate  $U_3O_8$  uranium production capability of 3.3Mlb/a. The ore was subject to crushing, grinding, acid leaching, resin in pulp extraction, elution, precipitation and drying to produce a saleable product.

Sulphuric acid required for processing was produced at KM's acid plant from sulphur delivered to the mine. In addition to acid produced on site, acid was recovered from the back end of the process plant by nano filtration which optimized use of acid at the operation. Electricity was generated on site from a series of diesel powered generators.

Product was transported by road through Zambia to Walvis Bay in Namibia for delivery to converters by sea.

Several operational efficiencies were achieved during the operation of the mine but, were not enough to combat the falling uranium price that placed the operation in care and maintenance in 2014.

## Geology

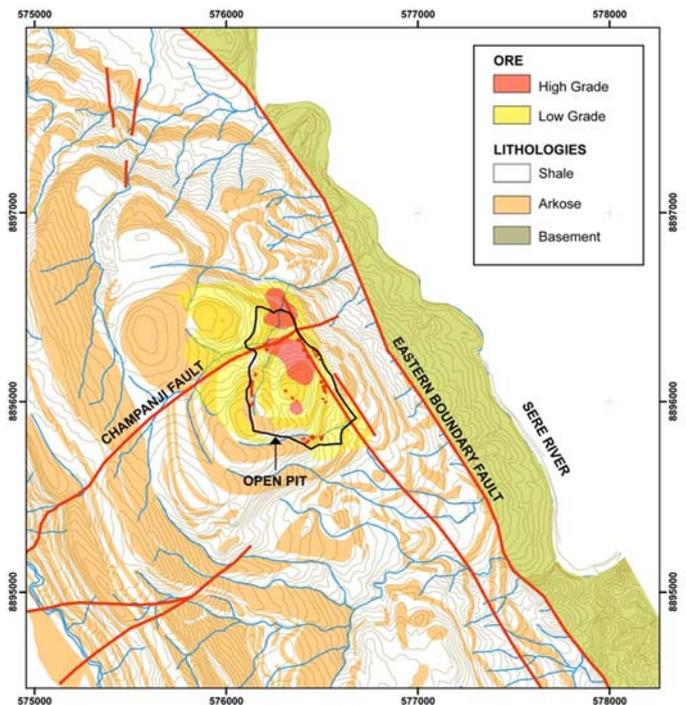
The Kayelekera Member (K4) of the Karoo sediments of the North Rukuru basin is about 150m thick and is the main uranium host. It is relatively well known due to numerous drillhole intercepts and exposure in the open pit. At least 10 arkose units have been identified which range in thickness up to 14m. Each arkose is assigned a letter of the alphabet, with production to date sourced mainly from the U, T and S units. Arkoses define the base of cyclothems and pass upwards into reddish to chocolate brown "oxide-facies" mudstone and then into "reduced facies" grey-black carbonaceous and silty mudstone. Thin coal rich horizons are present at the top of some cyclothems. The redox interface defined by the change from oxide to reduced facies mudstone is bedding-parallel and is probably indicative of fluctuations in redox potential during, or soon after, sedimentation. Several carbonaceous samples from the Kayelekera Member were dated as Middle Permian (Kazanian) using palynological evidence.

The arkoses contain poorly-sorted clasts of sub-rounded to sub-angular microcline, perthite, plagioclase, quartz, chert, polycrystalline quartz, biotite, muscovite, mudstone pellets, cellular plant material and unidentified carbonaceous material associated with minor framboidal pyrite. Feldspars are typically pink to red, with the red colouration is interpreted to have been inherited from source. Carbonaceous debris occurs as fine layers, as disseminations and as

individual woody fragments several centimetres in length. Discrete dark-coloured layers of <1mm thickness are defined by higher concentrations of carbonaceous material or heavy minerals such as ilmenite, zircon and rutile.

Mudstone samples have been analysed by X-ray diffraction and by short-wave infra-red spectroscopy. Both techniques confirm smectite as the dominant clay constituent together with minor kaolinite and white mica. Dominant kaolinite is found in surface and near-surface samples and thus probably relates to relatively recent weathering. Little difference in mineralogy was noted between oxidised (red-brown) and reduced (gray) mudstones.

Normal and thrust faulting, active at various times during and after sedimentation, is observed to offset defined stratigraphic units and particular faults are spatially related to uranium grade distribution.



## Uranium Mineralisation

Ore at Kayelekera is hosted in several arkose units where they are adjacent to the Eastern Boundary Fault zone. The ore forms more or less tabular bodies restricted to the arkoses, except adjacent to the NS strand of the Eastern Boundary fault at the eastern extremity of the pit. Here, ore also occurs in mudstones in the immediate vicinity of the fault. It can be seen that the highest grades correspond to the intersection of the eastern and Champanji faults. Ore grade and tonnage declines with lateral distance from these faults.

Oxidised ore tends to be concentrated in vertical fractures and along the contacts between mudstone and arkose and is restricted to the upper parts of the ore-body.

### Mineral Resources and Reserves

The JORC (2004) Code and NI 43-101 compliant Mineral Resource, is summarised to the right, depleted for mining to June 30, 2014.

Cut-off	Measured			Indicated			Inferred		
	Tonnes	U <sub>3</sub> O <sub>8</sub>	Metal	Tonnes	U <sub>3</sub> O <sub>8</sub>	Metal	Tonnes	U <sub>3</sub> O <sub>8</sub>	Metal
ppm	Mt	ppm	Mlb	Mt	ppm	Mlb	Mt	ppm	Mlb
300	0.74	1,010	1.66	12.71	700	19.62	5.35	620	7.35

Mineral Resources

In addition the site held 1.59Mt @ 755ppm U<sub>3</sub>O<sub>8</sub> for 2.64Mlb U<sub>3</sub>O<sub>8</sub> in ROM stockpiles.

Cut-off	Proven			Probable			Total		
	Tonnes	U <sub>3</sub> O <sub>8</sub>	Metal	Tonnes	U <sub>3</sub> O <sub>8</sub>	Metal	Tonnes	U <sub>3</sub> O <sub>8</sub>	Metal
ppm	Mt	ppm	Mlb	Mt	ppm	Mlb	Mt	ppm	Mlb
400	0.39	1,170	1.0	5.34	880	10.38	5.73	900	11.4

Ore Reserves

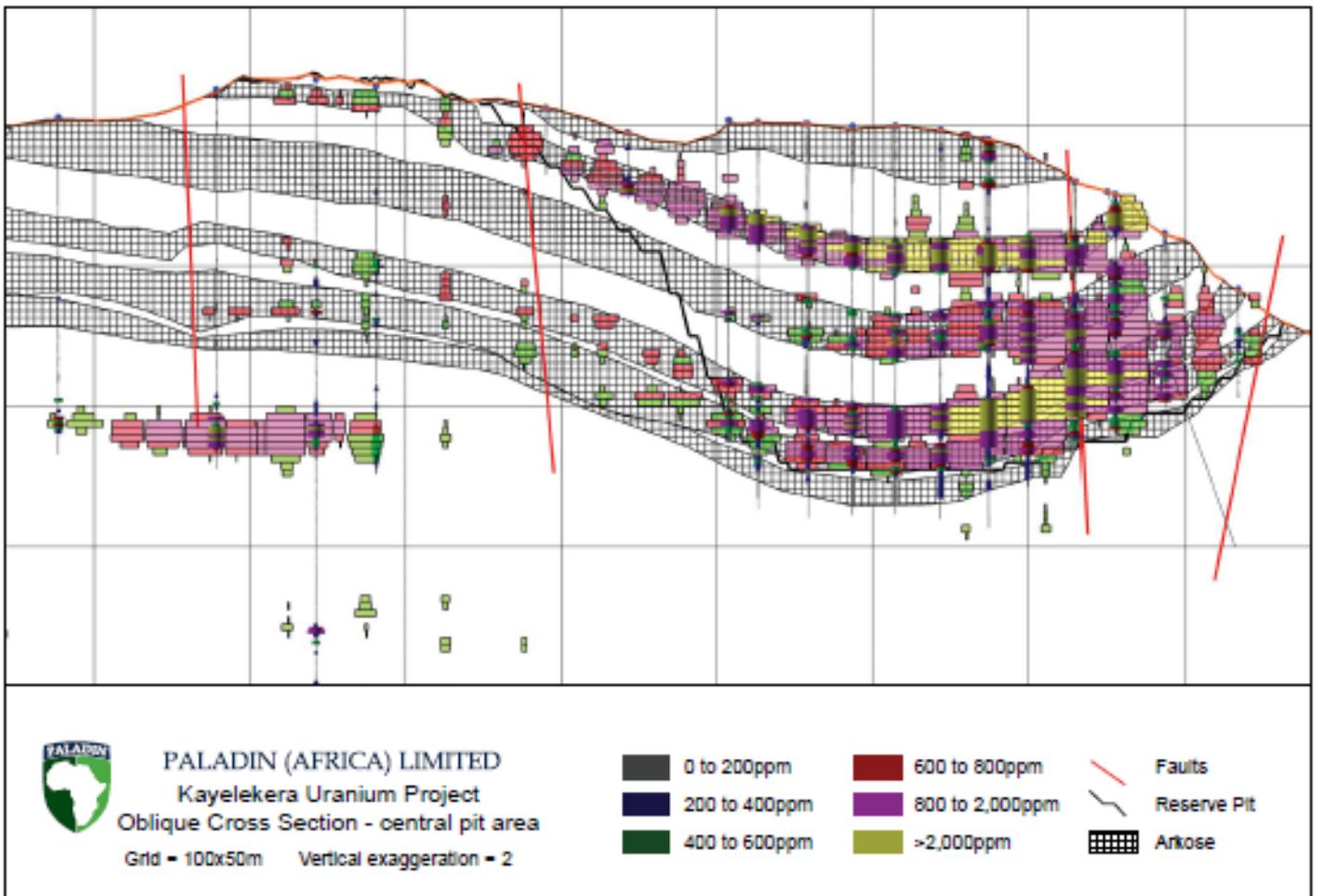
Economic analysis on the 2008 Mineral Reserve indicated a break-even cut-off grade of 400ppm U<sub>3</sub>O<sub>8</sub>. The economic parameters that indicated this cut-off grade were used in pit optimisation studies and resulted in an updated in situ Ore Reserve as shown in the following table, depleted for mining to June 30, 2014. Again, in addition to the in situ Ore Reserve, there are 2.64Mlb U<sub>3</sub>O<sub>8</sub> in ROM of stockpiles at KM.

Currently these licences are maintained on a basis intended to keep them in good standing. Significant target refinement work has been completed across the EPLs and innovative drilling programmes have been designed to test the generated targets.

### Exploration

In addition to the KM Mining Lease, Paladin Africa holds five Exclusive Prospecting Licences (EPLs) that are coincident with Karoo sediment basins that are similar to those that host the Kayelekera deposit.

The drill targets have been ranked and it is intended that the targets will be tested in accordance with their ranking. Importantly the ranking takes into account the proximity of each drill target to KM.

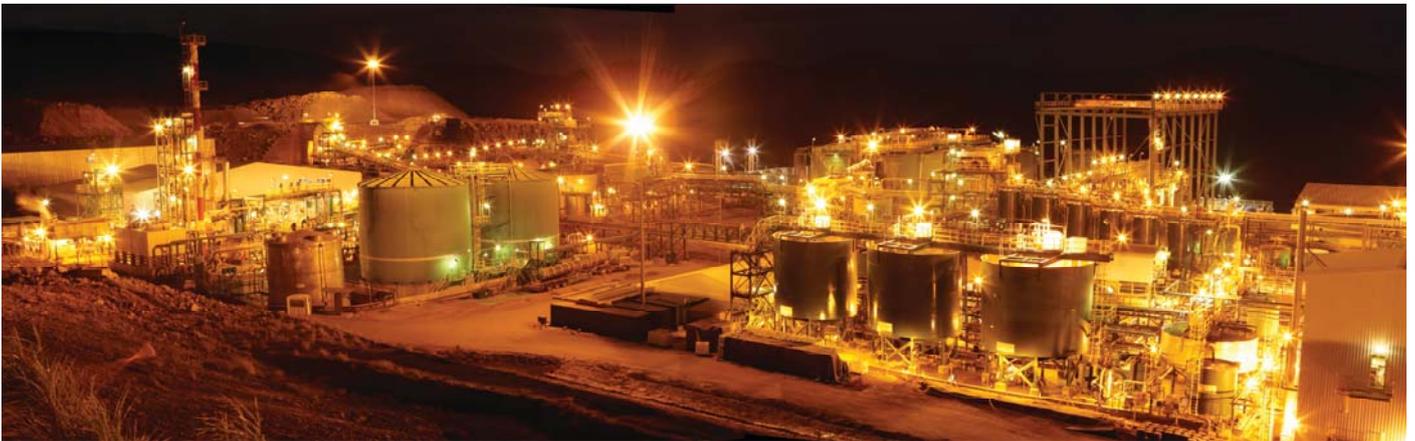


## Current Status

Focus during the current care and maintenance phase of the Project has been on the safety of personnel and the security of the projects assets, maintaining idled plant and equipment, maintaining stakeholder relationships, environmental monitoring and treating and discharging surplus water stocks to reduce water balance prior to the onset of each rainy season. Treatment and discharge of water is conducted under licences granted by the GoM.

## The Way Forward

KM remains on care and maintenance until there is a noticeable and sustainable correction in uranium pricing.



**PALADIN ENERGY LTD**



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*The mineral resource information in this document is extracted from the report entitled Paladin Energy Ltd 2018 Annual Report created on 28th August 2018 and is available to view on [www.paladinenergy.com.au](http://www.paladinenergy.com.au). The company confirms that it is not aware of any new information or data that materially affect the information included in the original announcement and, in the case of Mineral Resources, that all material assumptions and technical parameters underpinning the estimates in the relevant market announcement continue to apply and have not materially changed. The company confirms that the form and context in which the Competent Person's findings are presented have not materially modified from the original market announcement.*