

# Klen Gold Deposit, Chukotka, Russia

Excerpt from report “*Audit review of the Klen Gold Deposit, Chukotka Autonomous Region, Russia*” dated 18 April, 2012, and issued by Micon International Co Ltd. to the address of Highland Gold and Numis Securities Ltd.

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## 1.0 EXECUTIVE SUMMARY

### 1.1 INTRODUCTION

Micon International Co Limited (“Micon”) has been retained by Highland Gold Mining Limited (“Highland Gold”) to conduct a review of the resources and reserves of the Klen deposit and the Verkhne-Krichalskaya licence area, Chukotka Autonomous Region, Russia.

Micon has prepared an estimate of the mineral resources and conducted a preliminary economic analysis of the Klen deposit based on a preliminary production schedule from an open-pit mine and ore treatment using gravity and conventional carbon-in-leach (CIL) methods. In addition, Micon has reviewed the exploration data on the Verkhne-Krichalskaya area with the objective of assisting Highland Gold to make decisions regarding the future development of the project. In 2012 the resources were re-calculated using new exploration data derived from the 2011 exploration programme.

The Klen deposit is located within the Verkhne-Krichalskaya licence area as shown in Figure 1.1. The licence area is located in the Bilibinsky area of the Chukotka Autonomous Region, 250 km to the southwest of Bilibino.

In the second half of June, 2011, a visit was made to the office of the licence-holder, Klen LLC, in Bilibino and to the property. During the visit, an inspection of exploration trenches, drill core and the field laboratory was conducted.

It is emphasised that the reviews of the resources and reserves of the Klen property and the Verkhne-Krichalskaya area are principally derived from the examination and interpretation of historical exploration work conducted by various organisations (both state, and private). No independent confirmatory sampling has been performed by Micon as part of the current study to confirm or otherwise qualify the conclusions presented in this report.

### 1.2 LICENCES AND PERMITS

Micon has not undertaken legal due diligence of the asset portfolio associated with the Klen deposit and the Verkhne-Krichalskaya licence area and provides no legal opinion upon ownership or rights to operate. Nevertheless, Micon has inspected documentation concerning the title to assets and permits to operate. At present, the licence for geological surveying and production of gold and silver at the deposit belongs to Klen LLC. The licence is valid until 16th March, 2014. Klen also owns the licence for geological surveying, exploration and production of hardrock gold and silver within the Verkhne-Krichalskaya area, and which expires on 11th January, 2036.

### 1.3 ACCESS AND INFRASTRUCTURE

The region around the Klen deposit is poorly developed. The nearest settlements, Mandrikovo and Dalny, 86 km and 50 km respectively from the Klen licence area, are deserted. In summer, freight may be delivered from Bilibino to the property by air or using caterpillar-tracked vehicles. In winter,

transportation is possible along the Bilibino-Angarka-Klen ice road (397 km). Freight from the central regions of the country may be delivered by barges to the river port of Zeleny Mis and to Mandrikovo (360 km) and further along the Mandrikovo-Shirotny-Klen ice road (125 km).

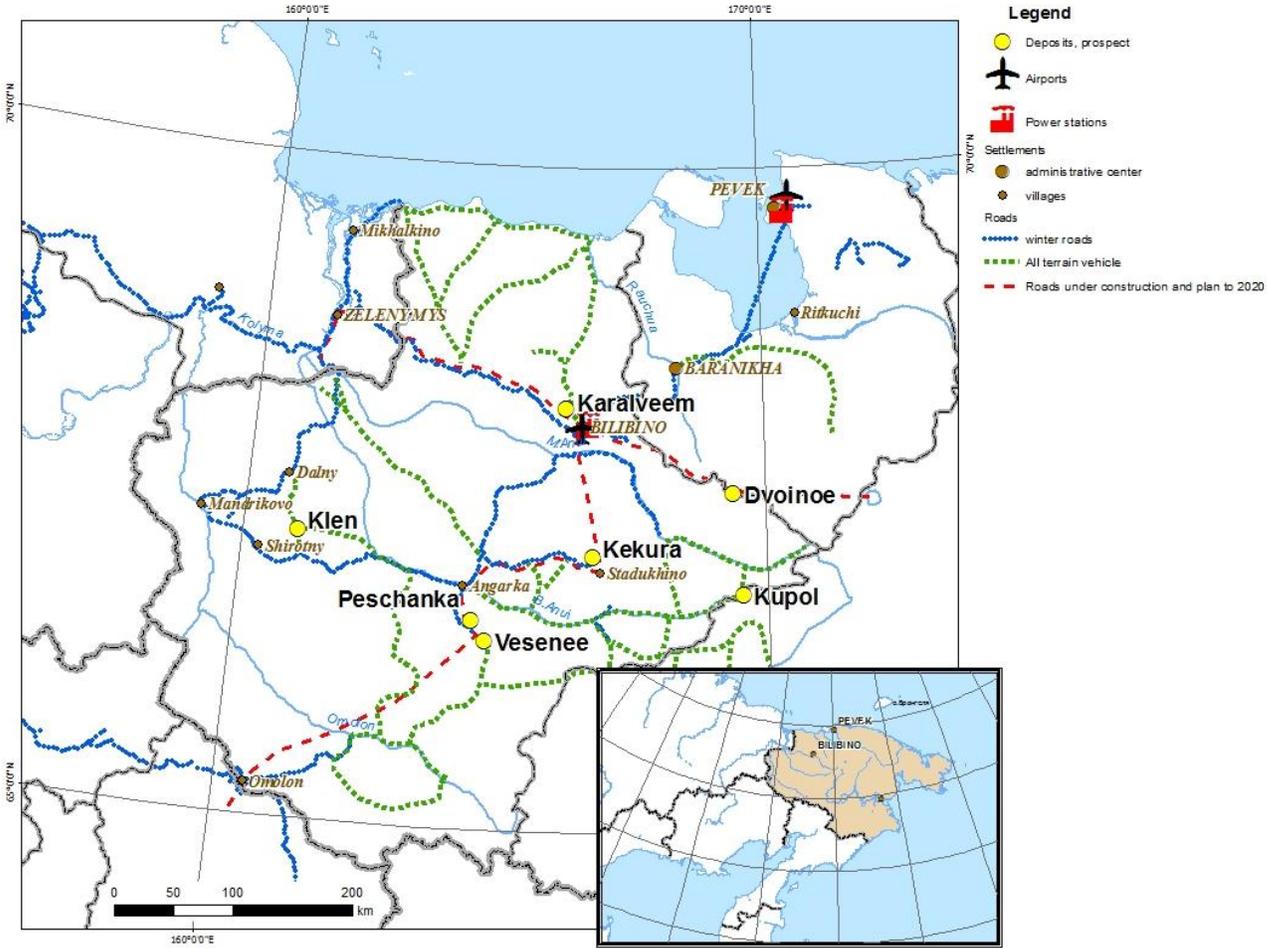
Since there is no settled population in the area, recruitment of the labour force is possible only in the regional centre of Bilibino.

The area around the property does not have any agricultural value.

A permanent power supply may be arranged either through construction of a power line from the nuclear power station at Bilibino or through installation of diesel powered generation at the project site. On-site generation is the preferred option. In summer, drinking and process water supply may be taken from the Klen and Alisa rivers. In winter, water is available from the thermokarst lakes of the Rakovsky and Krichalskaya valleys.

The nearest gold-bearing properties in production are at Dvoinoe (360 km away in the Chaunsky area) and Kupol (375 km away in the Anadyrsky area). The Kekura deposit (240 km, Bilibinsky area) has been explored. The Peschanka copper porphyry deposit is under exploration and is situated 170 km to the east-southeast.

**Figure 1.1: Location of the Klen Deposit and Verkhne-Krichalskaya Licence Area**



## **1.4 GEOLOGY AND MINERALISATION**

Gold-silver mineralisation of the Klen deposit is confined to the quartz and quartz-carbonate, low-sulphide veins and, to a significantly lesser extent, to the veinlet zones and the mineralised fracture zones. Mineralised bodies are thick, extensive and non-uniform both along strike and down dip. Host rocks are represented by andesite of lower Cretaceous age, pierced by andesite-dacite and dacite dykes. The structure of mineralised bodies is complicated by post-mineralisation basalt dykes.

Potentially commercial concentrations of gold and silver are confined to two vein systems (veined zones) of the six discovered in the area. These are known as Vein Zone 1 with its apophyses, and Vein Zone 2.

Vein Zone 1 has a complex structure, quartz-carbonate composition and includes lenses of host rocks. It can be traced for 1,700 m along strike and to a depth of 220 m from surface down dip. The zone has a sub vertical dip ( $85^{\circ}$  to  $90^{\circ}$ ). Its thickness varies from 0.1 m to 10.1 m. The distribution of gold and silver is extremely erratic with grades varying within a wide range: from trace to 214 g/t gold and from trace to 1,067 g/t silver.

Vein Zone 2 can be traced for 1,250 m along strike, and to a depth of 68 m from surface down dip. The zone dips to the northeast at an angle of  $60^{\circ}$ ; at depth the dip flattens to  $45^{\circ}$ . Thickness of the zone varies from 0.4 m to 5.9 m. In accordance with the core sampling data, the grade of gold varies from trace to 17.1 g/t, and silver from trace to 40.4 g/t.

Native gold, generally associated with the quartz-carbonate groundmass is the primary ore mineral within the deposit. The prevailing size of gold grains is 1  $\mu\text{m}$ -10  $\mu\text{m}$ .

Silver minerals are represented by sulphides and sulphosalts. The mineral grains have a prevailing size of 0.003 mm to 0.5 mm.

## **1.5 EXPLORATION AND SAMPLING**

Gold-silver mineralisation at the Klen deposit was first discovered and explored at the surface in 1982 to 1984.

In 1985, prospecting operations included trenching, core drilling, prospecting traverses and lithogeochemical sampling on grids of 500 m by 50 m and 100 m by 20 m. Ground geophysical surveys were carried over the Klen site and on its flanks. The trenches (spaced at 115 m on average) allowed the study of Veins 1 and 2 in detail.

From 1993 to 1998, exploration was conducted on the Klen deposit and at the nearby sites of Alisa, Kharkov and Yasen. As a result Vein 1 was traced for 1,700 m along strike with the mine workings developed every 40 m to 60 m. Vein 2 was traced 1,250 m along strike.

On the basis of the exploration conducted, C2 category reserves and P1 category prognostic resources were calculated for the Klen deposit and P3 category prognostic resources were calculated for the Alisa, Kharkov and Yasen deposits. The Alisa and Kharkov deposits were determined to be insufficiently prospective for discovery of potentially economic mineralisation. The Yasen site was recognised as the asset with unascertained prospects, requiring additional confirmation with mine development. The Territorial Committee on Reserves (TKZ) (Protocol No. 254, dated 21.10.98) adopted the C2 category reserves, calculated in accordance with the ore quality requirements of the Dvoynoye deposit. During the period 1999 to 2003, the Anyuiskaya

Mining and Geological Party carried out a detailed exploration of the central part of the Klen deposit.

In 2011 Klen conducted detailed exploration of the central part of the Klen deposit with the objective of reducing the spacing of the exploratory grid and, as the result of this work, a feasibility study was prepared and C1 and C2 category reserves were approved by the GKZ in early 2012.

## **1.6 MINERAL PROCESSING AND METALLURGICAL TEST WORK**

Micon requested Metallurg Pty Ltd (Metallurg) to prepare a summary of the metallurgical testwork, flowsheet development and process operating cost estimate for the Klen gold deposit.

Metallurgical testwork has been completed by the following organisations:

- Central Laboratory of the North-Eastern Geological Association (TsL SVPGO), Magadan, 1985;
- Siberian Research and Development Institute of Non-ferrous Metals (SIBTSVETNIIPROJECT), Krasnoyarsk, 1986;
- OJSC All-Russian Research and Development Institute-1, Magadan, 1995;
- OSJC Irgiredmet, Irkutsk, 2002; and,
- FGUP TsNIGRI, Moscow, 2011.

Metallurg has undertaken the following:

1. Review the metallurgy and define an achievable metallurgical recovery for use in the mineral resource block model;
2. Review the metallurgical testwork and agree on the principles of the process flowsheet developed for the Klen vein mineralisation types; and,
3. Review the process plant operating cost estimates.

The metallurgical testwork programmes confirmed that the mineralisation of the Klen deposit is of the low-sulphide gold-quartz argentiferous type where gold is the principal metal of value and silver may be recovered as a by-product.

The majority of the gold is fine and finely dispersed. The percentage of fine gravity gold is 8.1% of the total, of which 50% is +0.25 mm. The mineralisation is readily-cyanideable. Amalgamation testwork showed recoveries of 38.3% gold and 21.55% silver. The combined cyanideable gold and silver is 95.8% and 70.0% respectively for the head grade tested. The preferred process route is conventional CIL.

In 2011 TsNIGRI conducted metallurgical testwork on two 50 kg samples referred to as high-grade and low-grade mineralisation. Gold recovery from cyanidation ranged from 94.0% for high-grade mineralisation to 91.37% for low-grade mineralisation. Silver recovery ranged from 65% to 88% and averaged 76%.

Making adjustments for head grade, the projected recoveries for gold and silver are 92% and 75%, respectively. When losses in refining are taken into account, overall gold recovery is estimated at 91% and silver recovery is estimated at 74%.

As a result of its review, Micon recommends that:

- A gravity circuit is included in the process flowsheet to recover fine free gold;
- The unit assumptions for the neutralisation process stage are reviewed;

- The design production rate is increased to a minimum of 300,000 t/a; and,
- Assume processing and general and administration costs of US\$25/t and US\$15.00/t, respectively for the Whittle pit optimisation.

These recommendations are reflected in the preliminary production schedule and Whittle optimisation conducted by Micon.

## 1.7 MINERAL RESOURCES AND MINERAL RESERVES

The Klen deposit mineral reserves were calculated in accordance with results of the prospecting-estimation operations of 1993 to 1997 and approved by the Territorial Committee on Reserves (TKZ) of the Chukotka Autonomous Region Committee on Natural Resources with Protocol No. 254 dated 21<sup>st</sup> October 1998.

In 1998, P3 category resources in the amount of 25 t of gold and 2,656 t of silver were calculated for the Alisa, Kharkov and Yasen sites. The resource calculation was based on the geochemical and geophysical surveying data.

Klen mineral reserves were again calculated during 2011 and were approved by GKZ Protocol 2689 dated 29<sup>th</sup> February 2012. GKZ-approved mineral reserves for the Klen deposit are summarised in Table 1.1.

**Table 1.1: Klen Mineral Reserves as at 01.01.2012  
Cut-Off Grade 0.7 g/t Au**

Category	Tonnage (kt)	Grade (g/t)		Contained Metal (t)	
		Au	Ag	Au	Ag
<b>Balance within Pit Limit</b>					
C <sub>1</sub>	1,210.2	9.09	22.15	11.002	26.80
C <sub>2</sub>	1,741.1	4.40	9.76	7.6558	17.00
<b>C<sub>1</sub> + C<sub>2</sub></b>	<b>2,951.3</b>	<b>6.32</b>	<b>14.84</b>	<b>18.6578</b>	<b>43.80</b>
<b>Off-Balance beyond Pit Limit</b>					
C <sub>2</sub>	528.0	1.59	3.92	840.3	2.07

In 2011, Micon produced a block model and calculated mineral resources in accordance with the guidelines of the JORC Code. In 2012 Klen mineral resources were re-calculated using new exploration data received in 2011, as shown in Table 1.2.

**Table 1.2: Klen Deposit Mineral Resources at Cut-Off Grade 1.0 g/t Au**

Category	Million tonnes	Grade (g/t Au)	Contained Gold (t)	Contained Gold (Moz)	Grade (g/t Ag)	Contained Silver (t)	Contained Silver (Moz)
Indicated	2.85	5.79	16.51	0.53	14.40	41.08	1.32
Inferred	1.02	2.93	3.00	0.10	5.74	5.86	0.19

## 1.8 MINING

The Klen mineralisation is referred to as a low-sulphide gold-quartz argentiferous type. The main valuable component is gold with silver as a by-product. The pit optimisation analysis demonstrated that a significant proportion of the currently defined mineralisation within the deposit could be mined economically from an open pit. Pit shells can be derived using low metal prices or high operating costs, and the high-grade mineralisation is profitable enough to carry a high strip ratio. The optimised pit shells derived using the Micon parameters are relatively robust and are relatively insensitivity to a drop in the gold price.

An open-pit design was created based on a pit shell derived using a metal price of US\$1,300 per ounce gold and US\$30 per ounce silver. A conceptual production schedule was also created for the cash flow modelling. The mineable resources within the pit shells are presented in Table 1.3. The pit has contains a total of 48.2 Mt of waste resulting in a strip ratio of 15 to 1.

**Table 1.3: Potentially Mineable Resources**

Category	Mill Feed (t)	Au (g/t)	Gold (oz)	Ag (g/t)	Silver (oz)
Indicated	3,004,378	5.28	510,068	13.23	1,278,068
Inferred	311,983	3.79	38,020	6.69	67,111

## 1.9 ECONOMIC ANALYSIS

Micon has carried out a preliminary economic analysis of the Klen deposit using a discounted cash flow model to determine the net present value (NPV) and internal rate of return (IRR) after profit tax and on a 100% equity basis. The cash flow is in constant US\$ (i.e. not inflated), with costs and exchange rates as at first quarter 2012 and discounted at a real rate of 10%/y. Metal prices used for the base case are US\$1,300/oz gold and US\$30/oz silver.

The base case life-of mine (LOM) project production highlights are summarised in Table 1.4.

**Table 1.4: Base Case Production Highlights**

Criteria	Unit	Value
Production Life	years	11.05
Waste Mined	Mt	48.18
Mill Feed Mined and Processed	Mt	3.32
Strip Ratio (Including pre-strip)		14.5
Strip Ratio (excluding pre-strip)		14.5
Mill Feed Gold Grade	(g/t)	5.14
Mill Feed Silver Grade	(g/t)	12.61
Gold Recovery	%	91.7
Silver Recovery	%	72.3
Gold Produced in Doré	kg	15,618
Silver Produced in Doré	kg	30,227

## 1.10 VERKHNE-KRICHALSKAYA AREA

The location of the Verkhne-Krichalskaya area is shown in Figure 1.1 on page 1.

The total area of the Verkhne-Krichalskaya licences is 995.76 km<sup>2</sup>. Licence AND 01187 BR for geological surveying, exploration and production of hardrock gold and silver within the Verkhne-Krichalskaya area is held by Klen LLC and expires on 11th January 2036.

Klen LLC holds licence AND 01191 BE, which confers the right to use the subsurface of the Klen deposit for geological surveying and production of gold and silver.

The right to use the subsurface of the Dedal stream deposit for placer gold production and is held by the CJSC Prospectors Team Polar Star (AND 00987 BE).

Within the boundaries of the Verkhne-Krichalskaya area there are several licences covering subsurface minerals and placer gold deposits in the Ikar, Leda and Lovky rivers, for a total area of 0.84 km<sup>2</sup>.

The area is covered by a geological survey at a scale of 1:200,000 scale and partially, at a scale of 1:50,000. Geochemical prospecting has been conducted along the dispersion streams at a scale of 1:200,000 and the southern and the eastern parts of the area at a scale of 1:50,000.

Sedimentary-volcanogenic and intrusive formations of Upper Jurassic-Lower Cretaceous age comprise the principal geological units. The area is cut by the deep Yarovoy, Anyuysky and Eolian faults. Intrusive rocks are subdivided into three complexes, of which the dacite of the third complex host mineralisation. It is assumed that the gold-silver mineralisation has a paragenetic association with sub volcanic formations of the third group. There is evidence of extensive metasomatism with the presence of propylite, beresite and, to a lesser extent, argillic alteration. Linear zones of silicification, carbonatisation and sulphidation have also been determined.

Gold, silver, copper, molybdenum, lead, zinc and antimony have all been identified within the Verkhne-Krichalskaya area. Several sites have been assessed as prospective for the discovery of hardrock gold and silver. These are the Yunost, Ikar, Northern and Eol deposits in the Klenovskoye area for which summary resources in the P3 category have been estimated at 57 t of gold and 2,725 t of silver. Geological evidence, both indirect (structural position, presence of quartz-veined formations, relatively extensive development of hydrothermal alteration) and direct (identification of the medium-sized Klen hardrock gold-silver deposit, small gold placers, geochemical anomalies within the secondary dispersion halos and gold and silver grades within some grab samples) are strongly indicative of the mineral potential of the Verkhne-Krichalskaya area. Implementation of a significant amount of prospecting and exploration will be required in order to confirm this.