Elkon – A New World Class Russian Uranium Mine

ARMZ Uranium Holding Co., Russia
Alexander Boytsov, Deputy Director General
Elkon Location

- The closest town is Tommot with a population of 10,000 people. Tommot is connected with the Baikal-Amur Mainline and the Trans-Siberian Mainline by railroad. A road and electrical power line are located 10 km north of the deposit.
- History of the deposit:
  - Date of discovery: 1960
  - Extensive exploration in 1960-1980

1 – Elkon uranium region;
2- 7 deposits:
  2-gold; 3 - phlogopite;
  4 - iron; 5 - apatite;
  6 – quartz; 7- coal
Elkon resources and regional geological setting

In situ known U resources 344 ths.t at 0,158% (recoverable 289 ths.t)
Elkon Mining Company 100% subsidiary of ARMZ

Elkon uranium mining company was established by ARMZ in November 2007.

### Planned production capacity
5000 mtU/year to 2025

<table>
<thead>
<tr>
<th>Zones</th>
<th>Resources (B+C1+C2)</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>U, ths.t</td>
<td>Au, t</td>
</tr>
<tr>
<td>Yuzhnaya</td>
<td>257,8</td>
<td>140,8</td>
</tr>
<tr>
<td>Severnaya</td>
<td>58,6</td>
<td>29,2</td>
</tr>
<tr>
<td>Interesnaya</td>
<td>2,8</td>
<td>-</td>
</tr>
<tr>
<td>Total</td>
<td>319,2</td>
<td>170</td>
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Elkon. Schematic cross cut through Yuzhnaya zone

1- gneiss, 2- granite, 3- orthotectite, 4- metamorphosed ancient diorite dikes (orthogneiss), 5- blastomilonites and cataclasites, 6- faults, 7- metasomatites, 8- ore bodies
About 20 ore bodies located in 3 ore zones within the Yuzhnaya fault zone

- Ore bodies have complex morphological structure with significant variations in thickness over short intervals as ore-bodies bulge and narrow.
- Ore zone includes areas with closely-adjacent and parallel veins, making selective mining difficult. Bulk mining will add more dilution requiring radiometric sorting.
- Length of ore bodies along strike: 50 to 400m, up to 700m;
- Length of ore bodies down dip: 100 to 200m.
- Thickness varies from 0.9 to 4m, average about 1.3m
Elkon Uranium mineralization

At the Elkon deposit uranium mineralization occurs largely as brannerite \((U^{4+},Ca)(Ti,Fe^{3+})_2O_6\).

The mineral is a refractory ore of uranium. In addition other uranium minerals are present in lower amounts such as: coffinite \((U,\text{Th})[(\text{OH})_4x(\text{SiO}_4)^{1-x}]\) and urannite \(\text{UO}_2\).

The uranium minerals occur in breccia fragments in the calcite-fluorite veins.

Gold occurs as sub-micron grains or micron sized inclusions in pyrite and galena. The sulphides occur in quartz and calcite as inclusions and in fractures and on grain surfaces.

Microphoto:
1 - Fragments of rock and pyrite cemented by brannerite (x 400)
2 – Microbreccia with brannerite-coffinite-pyrite cement (x 100)
Elkon 3-D carcass model

Elkon Data base

- Number of exploration holes, trenches – 7 354;
- Number of samples (measurements) – 976 371;
- Uranium grade variation 0.001% to 8.7%

Data base on Au, Ag, Mo
- Number of samples – 17 785
Block model for one of the ore bodies of Kurung deposit
Elkon operations principal structure
Elkon schematic mining and processing flowsheet

Plant recovery:
- Uranium: 89.6%
- Gold: 43.4%
- Silver: 35.8%
- Molybdenum: 38.9% (Druzhnoye)

Hydro metallurgical works:
- U3O8 storage area
- Refining
- Sorption
- Leaching U
- Radiometric sorting

Heap leach:
- Piles
- U, Au

Waste rock:
- Radiometric sorting

Mine:
- Deposits
- Primary radiometric sorting

Waste rock flowsheet:
- Mine
- U, Au
- Radiometric sorting
- Heap leach

Productive solutions:
- Floatation concentrate, Au
- Floatation tailings, U

Secondary flowsheet:
- Crushing
- Radiometric sorting
- Milling
- Flotation (if the gold is processed)
- Thickening
- Autoclave leaching of flotation concentrate and flotation tails
- Adsorption of uranium onto resin
- Stripping of uranium from the resin
- Precipitation and dewatering of the uranium
- Cyanide leaching of gold

Primary recovery:
- Plant recovery: Uranium 89.6%, Gold 43.4%, Silver 35.8%, Molybdenum 38.9% (Druzhnoye)
Elkon Principal Mining Scheme

- Production method: mechanized cut and fill mining using unconsolidated backfill, selectivity allowing for the variability in ore body thickness
- Modifying factors: losses 5% and dilution 34%
- Potential to consider bulk mining method if radiometric sorting is effective
- Initially 2.2 Mtpa, processing ore from Elkon Plateau and Kurung,
- Potential to expand to 4.5 Mtpa to process the ore from all 5 mines
Elkon project Infrastructure

- Elkon is realized in the framework of state-private partnership «Complex development of South Yakutia» to allocate state financing for development of the Elkon infrastructure.

- The following infrastructure construction will be financed by government:
  - Railroad connecting Elkon deposit with Tommot (53 km)
  - Road connecting the deposit with Tommot (10 km)
  - High voltage electric line connecting Elkon with Aldan including substations
Stages of Elkon development

Stage 0. Exploration (1964-1984 гг.). Expenditures - 440 USD.

Stage 1. Prefeasibility Study (2007-2009 гг.)

Stage 2. Feasibility study and infrastructure development (2009 -2011 гг.)


Stage 5. Mine development and achieving full capacity (2016 – 2024 гг.)

Preliminary investment estimation 3,5 bln. USD
Basic principals for Elkon feasibility study

- Technical expertise of international engineering companies
- Resources classification according to JORC
- 3D modeling
- DCF modeling

Setting up favorable conditions to attract investments