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Geological features and prospecting of Ereen gold ore deposit in Mandal Soum, Selenge province, Mongolia

The locales

The Ereen deposit lies within the North Khentei gold belt which is bounded by the north-west by the Bayangol fault system and by the south-east by the Yeroogol (or Sujigtei) fault system. Both fault systems have a similar south-west-north-east trend (generally NE45°). Faults are of east-west, north-south and north-western direction. Regional scale is north-easterly trending. Sujigtei fault controls position of the large-scale Gatsuurt gold deposit. Ereen occurs inside regional magnetic anomaly. The average size of visible Au is reported to be 1mm. Results of combined IP (induced polarization), magnetic surveys and gold in soil anomalies and l48 diamond drillholes in the Ereen area show an anomaly to the south-east of the drilled area and remains to be tested as it did a similar anomaly on the Baavgait license. Ereen gold deposit shows the potential at depth of mineralization using the elevation of Gatsuurt as a guide to possible depth extent of mineralization.

Keywords: *Ereen deposit, induced polarization, gold, prospecting.*

1. Introduction

The North Khentei gold belt has a long history of placer mining and includes gold reserves in both placer and bedrock deposits. Gold placer deposits form a series of geographically distinct placer districts preferentially located in the vicinity of the bounding faults of the North Khentei trend. Zamar, Bumbat and Sharingol placer districts are roughly parallel to the Bayangol fault system; Huder, Tolgoit, Ikh Alt, Yalbag and Gatsuurt placer districts are located in the vicinity of the Yeroogol fault. Reserves of the Zamar and Sharingol gold placer districts totalling approximately 3.0 M oz. The Bumbat deposit (0.6 M oz Au), the Gatsuurt, and Boroo deposits (1.2 M oz Au) are bedrock gold deposits within the belt.

The Ereen property is located in north-central Mongolia approximately 42 km to SW from the centre of Mandal Soum, Selenge province and 140 km to NNW of Ulaanbaatar, capital of Mongolia. The Dzüünharaa, one of the largest stations on the Trans-Mongolian Railway is located 35km to the north. The main towns in the area are served by good infrastructure including power, water and communications. It is the detailed location in north-central Mongolia. There are two main access routes to the Ereen site; by paved road from Ulaanbaatar to Bornüür (110km) and then approximately 50km on dirt road to the site, or 136 km to the north of Ulaanbaatar to Boroo gold mine's improved earth road, and then approximately 30km by unpaved road to the site.

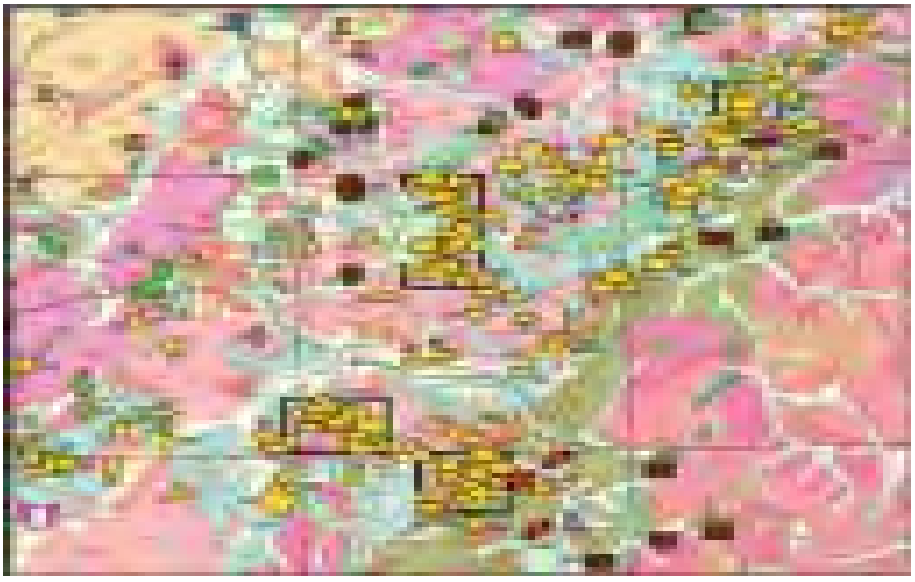

Fig.1 Distribution of lode and placer gold deposits in North Khentii terrain (442 is Ereen deposit)

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Fig.2 Regional geology of Bayangol terrain

Fig.3 Geological map of Ereen-Baavgait area

2. Geology of the region and deposit

Ereen deposit is located near to the principal gold deposit in the district, Gatsuurt mine, developed by Centerra Gold Corporation. The Sujigtei fault separates Devonian rhyolites (which host Ereen) in the west from palaeozoic granites in the east. Therefore, certain Gatsuurt ore controlling features could be similar to Ereen ore-controlling factors. Stratigraphic section of the Ereen area is consecutively represented by Cambrian-Ordovician Kharaa group formation, Ordovician-Silurian Undur formation, Silurian Mandal group formation, Devonian Uaan Undur formation, Jurassic-Cretacious Ajnai white fracture formation, lower Cretacious Shariin Gol formation, quaternary holocene sedimentary formation. Plutonic rocks are spread moderately in the project area. From the previous research the following groups of plutonic rocks were identified on the basis of the geologic-structural location, stratigraphy deposition and border relation towards each other, petrography, and petrochemical characteristics.

1. Medium late Ordovician Boroo river formation
2. Late Ordovician Ikh Tashir formation
3. Medium Devonian rock formation
4. Permian Guadeloupian small Khentii formation
5. Early Triassic Tukhum formation

3. Mine geology

Gold grades vary from trace to 409g/t along the strike and depth extension of the vein. Better grades (from 14g/t to 363.4g/t) of Au are distributed in the middle and deeper parts of the vein, in near-surface grades (down to 40m) considered uneconomic. The average gold grades are 18-23g/t in different blocks.

Ore minerals are pyrite, arsenopyrite, tetrahedrite, chalcopyrite, sphalerite, galena, scheelite, malachite, azurite, limonite and free gold. Free native gold is associated with quartz, galena and arsenopyrite. The average size of visible Au is reported of 1mm.

Vein 2 is located in the north-east part of the deposit, strikes north-east and dips gently (12º) to the north-west. It has a strike length of 200m and an average thickness of 0.4m. Trenching undertaken between 1959 and 1960 showed the average thickness of the vein to be of 1m on surface and is surrounded by a 7m wide silicified halo. Gold grade varied from 0.5g/t to 2.7g/t on the surface.

4. Alteration

The gold mineralization in Ereen deposit is confined spatially with hydrothermal alteration of rhyolites therefore were a

subject of special attention during drill core logging. Rhyolites cover a wide area within the Dzun-Modo ore region in the south part of Hentey ridge and are traced along east-west direction for 15-20 km and along north-north-western direction for 25-30 km. The host rocks for rhyolites are represented by Ordovician chlorite, chlorite-actinolite, and calcian metamorphosed schists of Kharinsky suit and by Palaeozoic granites and granodiorites. The geological section of Ereen gold deposit is represented by rhyolites down the depth of at least 300-350 meters.

During logging the variety of textures and colours were observed and described. These varieties were generated by repeated stages of regional tectonic activity and associated processes of hydrothermal-metasomatic alteration (Fig.4). Hydrothermally altered, bleached volumetric blocks of rhyolites are spatially connected with intensive fractures and vein lets systems (Fig.5). The hydrothermal alteration is resulted in re-crystallization of fine grained matrix and release of silica during feldspar kaolinization and saussuritization. As a result, rhyolite acquires light colours that are typical for acid rocks.

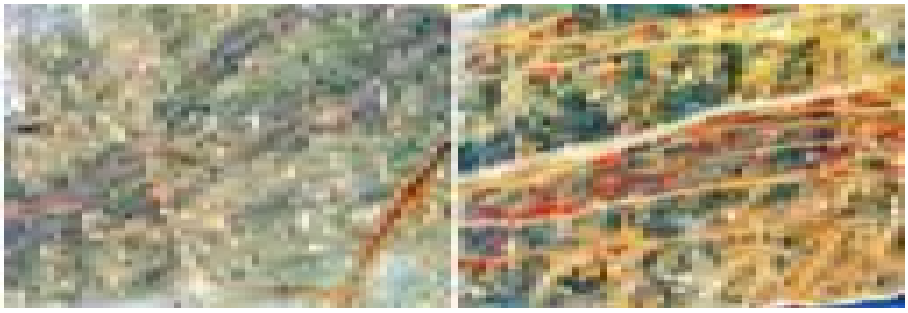

Fig.4 Multi-age vein systems in rhyolites

Fig.5 Successive increase of the veining and volumetric hydrothermal alteration in rhyolites

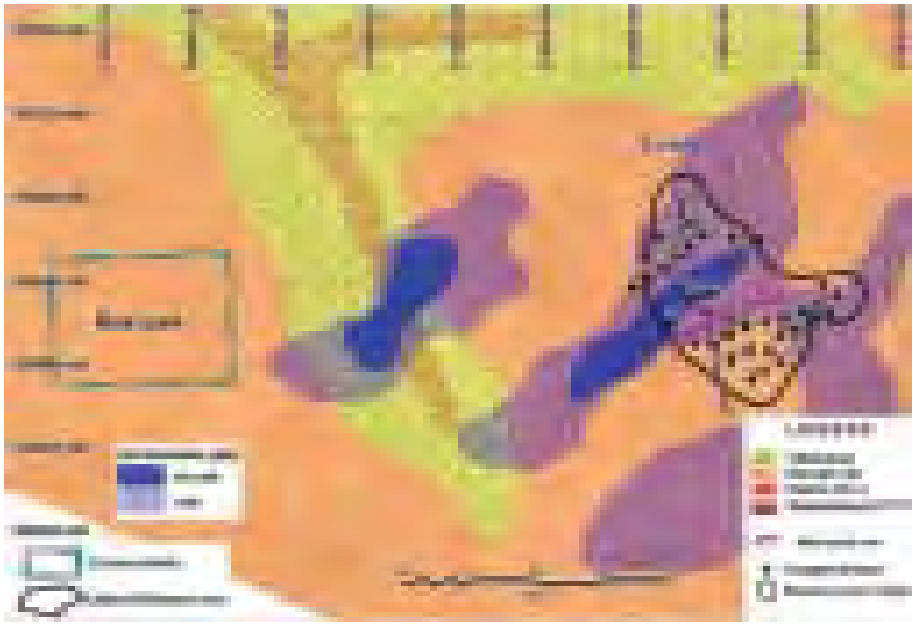

Fig.6 Gold in soil anomaly on geology map

5. Physical and chemical conditions

5.1 Geochemistry

A geochemical survey was conducted with 365 stream and soil samples collected in and around the Ereen-Baavgait area. The soil sample results are shown in Fig.6. Five geochemical associations are identified: Au-As, Pb-Zn-Cu, Ba-Sr-Be, Mn-K-V-Cr, and Ti-Na. A multi-stage gold deposition is reflected in this complex correlation pattern with low Au grades (≤ 20ppb) correlating with Ba, K, Mn; medium level grades - with Cu, Cr; and high grades mostly with As and locally with Pb-Zn. The Baavgait geochemical anomaly is hosted by intensely altered rhyolites traced for nearly 1000min an east-west direction with approximately 100m thickness, though the anomaly remains open to the west and east.

The Ereen deposit geochemical anomaly, which has a north-eastern strike, has Au-Pb-Zn-Cu signature and occurs inside the zone of north-easterly striking regional fault. Gold-in-soil anomalies occur in the northern part of the Ereen area and coincide with intense mineralization as defined by drilling and with a deep-seated IP anomaly. Thus, the geochemical anomalies of the Ereen area are considered to be highly indicative of mineralization and are open for further exploration to the north-east and south-west.

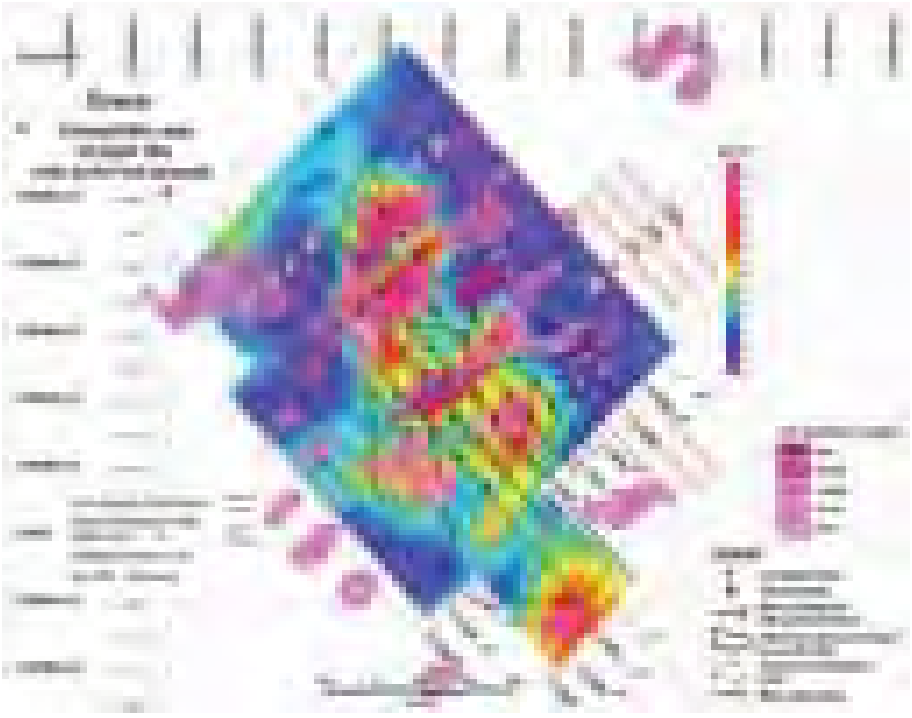

Fig.7 Ereen chargeability and gold in soil map

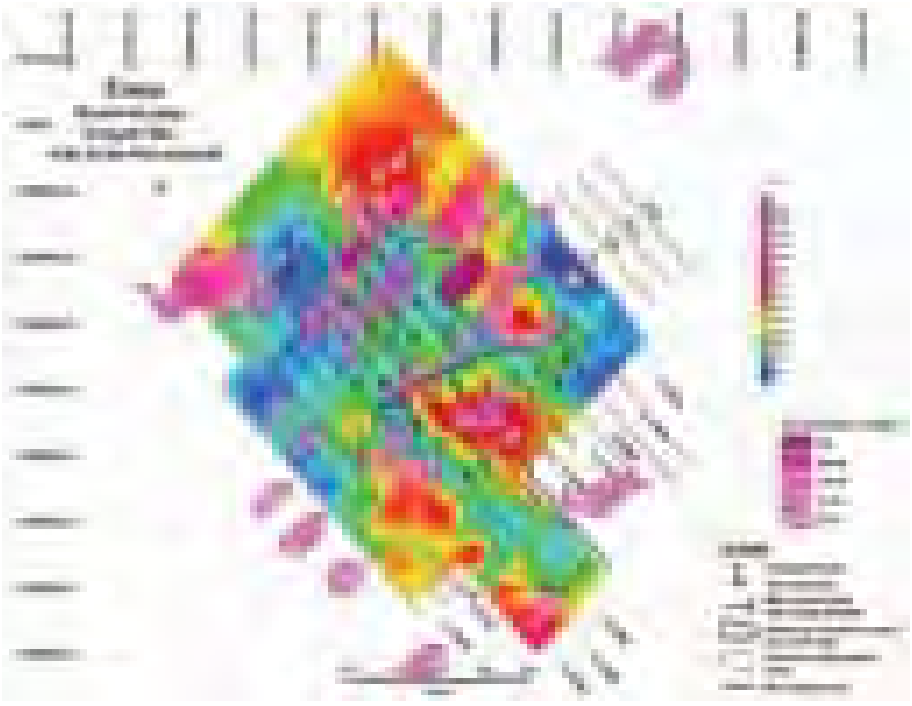

Fig.8 Ereen resistivity and gold in soil map

5.2 Geophysics

The induced polarization (IP) method was used to determine the boundaries of the sulphide mineralization (Fig.7). A grid spacing of 200 x 50m was established with a line length of between 1500-3000m. Measurements were made using Elrec-6 and Elrec-10 instruments. The apparent resistivity and coordinates for each value of resistivity and IP were calculated by appropriate computer programme (Fig.8). The ground magnetic survey, which was conducted by GEOSAN LLC, used a grid spacing of 100 × 50m and was performed using proton survey equipment GSM-19T manufactured by "Scintrex" in Canada (Fig.9). The full-scale data processing included a conversion from the accepted coordinate system (line/station) into the UTM system and preparation of the magnetic field maps. Finally, a magnetic graph correlation of the measurements collected along survey lines was created for all surveyed areas.

5.3 Analysis conclusion

The results of the IP survey have shown a north-north-westerly striking anomaly, which has been subsequently proved by drilling to coincide with the Ereen gold mineralization. The north-westerly striking blue zone, which occurs further to the west, indicates a regional fault that can be followed further to the west by a marginal zone of the Baavgait IP anomaly. The Ereen IP anomaly outlines a mineralized area and reflects a considerable sulphide presence. The anomaly is characterized by NNW strike and inclines towards the same direction. IP profiles demonstrate that IP gradient, rather than the anomaly itself, controls mineralized intervals as seen in exploration drillholes. The southern, western and north-eastern extensions of the anomaly were the targets detailed IP survey. Resistivity zones most probably reflect east-west striking deep-seated intensive silicification; which follows the south-east dip direction of the main gold-bearing quartz vein system. The resistivity pattern also demonstrates a necessity to continue an IP-resistivity survey in a southerly direction.

6. Wireframe modelling

Digital modelling database for Ereen deposit area was established by Kazakhstan Mineral Company using drilling review results. Based on the available materials, as of the transfer of the database 44 boreholes were drilled in the area amounting to 1093.45 m of drilling and 6146 m of intervals, sampled for gold. No other data on drilling were submitted. Interpreted strings were used to design a 3D closed wireframe model for gold mineralized bodies. Wireframe models with a gold grade of 0.3 g/t were designed for the mineralized zone. A digital topographic model (DTM) was designed using topographic survey data (Fig.10).

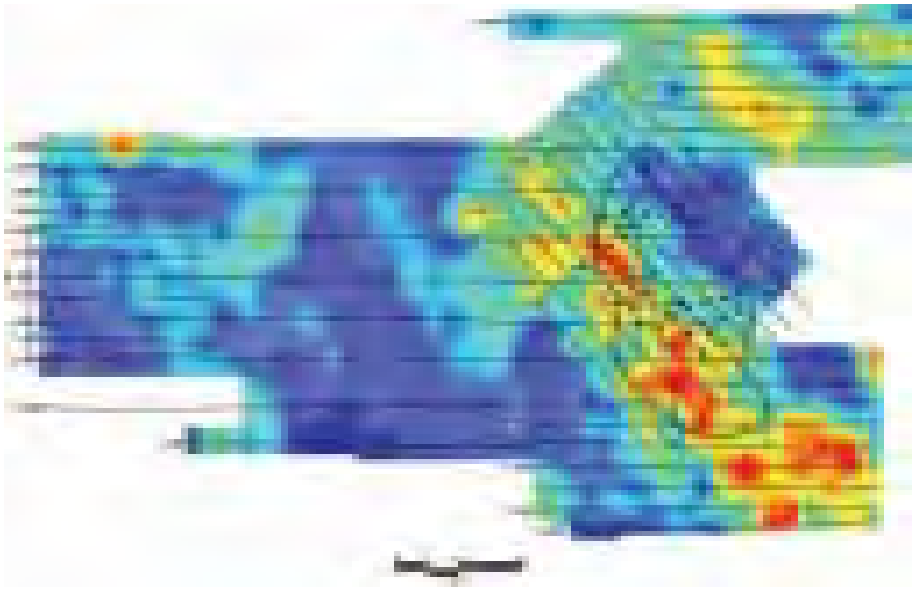

Fig.9 Ereen-Baavgait magnetic map

7. Conclusion and suggestions

Only fifteen per cent of the five licenses comprising the Ereen-Baavgait deposit area has been explored with modern techniques of geophysics, soil sampling or drilling, no detailed prospecting and geologic mapping have been carried out. The majority of work has been concentrated in the vicinity of the Ereen and Baavgait mining licenses. Combined IP (induced polarization), magnetic and gold in soil anomalies allowed CAML to drill 48 diamond drillholes in the Ereen area. An anomaly to the south-east of the drilled area remains to be tested as it does a similar anomaly on the Baavgait license. This south-east extension area of Ereen as stated by Wardell-Armstrong in 2008 has the potential to host at least 250,000 ounces of gold resource. No estimate of potential was made for the Baavgait license. Also, based on the limited drilling adjacent to Baavgait additional resources remain to be defined there. Drillings and a limited resource estimate completed in this area support argument of its potential. Longitudinal section of the Zuun Mod district (Fig.11) strongly support panning follow up exploration work to be made for additional potential mineralization at depth. While viewing the geophysical chargeability cross-sections, with drillholes superimposed upon them, it is clear that the 'shoulders' of the chargeability anomalies, where the best gold values to date are located,

Fig.10 3D ore deposit wireframe model

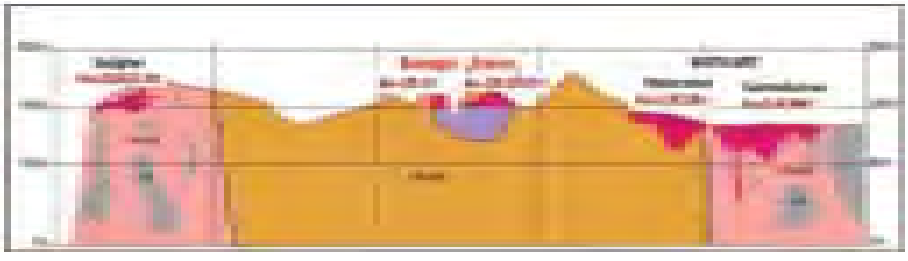

Fig.11 Ereen-Baavgait gold deposit in Zuun Mod district

have not been fully drilled. Nor have these been drilled to depth.

Ereen-Baavgait gold deposits show the potential at depth of mineralization of gold using the elevation of Gatsuurt as a guide to possible depth extent of mineralization (red indicates where mineralization has been defined by drilling). The two high grade veins on Ereen were not the focus of additional drilling, rather the purpose of the drilling was to determine if the potential of the existence stock work gold mineralization. This style of mineralization was verified, but at some point in the future more detailed drilling is required to define this potential high grade core to the overall resource.

It is not the purpose of this report to state the potential extent of additional mineralization, but it is reasonable to assume based on the limited amount of work to date, and the arguments above that the full extent of the resource of the overall five licenses comprising this property has yet to be fully defined.

The preliminary exploration has just been conducted at the deposit, where the resource estimation achieved indicates a possible medium scale mine. However, exploration only covered a small area of the licensed area; therefore, there are potentials on the escalation of the resource estimation. The following items need to be noted:

1. The project feasibility study has not been submitted; therefore a thorough review on the mining and economic details cannot be achieved at this stage.
2. The cut-off grade has not been finalized, and therefore the mining boundary cannot be defined. The cut-off grade will be achieved by thorough economic and technical study.
3. The findings from the site visit and the current exploration are favourable for open pit mining; however, the parameters for the pit development will need to be included in the project feasibility study and mine design in the future.
4. The current engineering geology and hydrogeology study are still very basic and cannot satisfy the mine design requirements in the future.

For the future mining operation, the company needs to engage in a contract with the local electricity supply. The site visit found that water supply seems sufficient.

We made the following suggestions:

1. Work out detailed and systematic exploration plan; start the hydrogeology and engineering geology exploration to provide sound inputs for the feasibility study and mine design in the next stage.
2. The determination of the cut-off grade is up to gold price fluctuation and the mining conditions. Considering the long winter and the backward infrastructures a relative higher gold cut-off grade is favourable for investors.
3. The topography is also appropriate for underground mining which will be less impacted by weather and can assure a long yearly operation time. The feasibility study in the next stage should conduct comparison of both underground and open pit mining to determine a more economical way of mining.
4. A professional mine designing organization should be commissioned on the mine plan and mine design.

The mine needs to sort out an electricity supply contract with the local supplier.

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