Exploration for Ophiolitic Besshi-type VMS deposits in Turkey

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Western Tethyan Orogeny - Regional Metallogeny 2011

Major Deposits
- Carlin style gold
- Epithermal gold
- Mesothermal gold
- Porphyry
- Shear hosted copper
- Replacement (skarn) Cu Au
- VMS copper zinc (felsic hosted)
- VMS Cyprus type
- VMS Island arc type

Neogene Arc
Eocene - Oligocene Arc
Cretaceous Arc
Ophiolites
Pre-Cambrian Shield

(Cyprus-Oman-Turkey VMS)
Gentor’s 2012 Turkey Strategy

• Gentor had global VMS expertise and recognised major exploration potential in Turkey for Cyprus, Besshi and Kuroko-type VMS deposits.

• Mesozoic to Tertiary Ophiolitic and Island arc settings are widely distributed in Turkey and most have not received intensive modern exploration.

• Turkey hosts at least six +20Mt world class VMS Cu deposits within five prospective volcanic terrains that Gentor initially selected for review.

• Most of these Ophiolitic terrains had not been a prime target for international or local VMS investment due to perceived low potential for major Cu deposits.

• Gentor’s focus was the Central Pontide Region due to large new discoveries of both Cyprus & Besshi type deposits, and potential license area availability.

• Gentor intended to acquire key tenement coverage within several priority target areas by the end of 2012 and develop strategic relationships with Turkish partners to accelerate their exposure to significant new deposits.

• Proceed to explore and delineated sufficient resources to establish feasibility for mining development by 2015.
VMS Copper Targets in Turkey
- Gentor Resources 2011
Central & Eastern Pontides VMS Deposits

From Yigit, O. 2009. Economic Geology
Western Tethyan Orogeny – Structural Blocks

From Aral Okay - Orogenic Episodes in the Pontides. AAPG European Region Annual Conference October 17-19, 2010, Kiev, Ukraine
Tethyan Pre-Tertiary Ophiolites and Accretionary complexes in the Sakarya Zone

Okay, A. 2010. Orogenic Episodes in the Pontides. AAPG European Region Annual Conference,
Pontide Tectonics – multiple accreted Island Arcs and Ophiolitic Mélanges
Central Pontides Cretaceous Tectonic model – VMS Deposit Locations

From Robertson A, 2002
Late Neogene Tectonic map - Western Tethyan region.

Note active orogenic uplift in the Central Pontides associated with the North Anatolian Fault.

From Yildirim et al 2011 TECTONICS, VOL. 30, TC5005
Relevance of the Central Pontides?

The Central Pontides represent a prime relatively under explored target for Ophiolitic Cyprus-Besshi type VMS deposits with several large Jurassic copper deposits known in the north:

• Küre Mine *(Eti Bakir)* – 40Mt @ 2.0% Cu – *in UG production*
• Hanönü *(Asya Maden)* – 30Mt @ 1.56% Cu – *in UG development*

• Large areas of undifferentiated Mesozoic supra subduction zone ophiolitic melanges to the south are considered to be VMS prospective.

• Gentor reconnaissance has identified several “new” gossan discoveries in these terrains near Hanönü, so the potential for further large deposits in the region is high.

• Excellent regional infrastructure *(highway access, power, manpower, communication, water, town and village accommodation)*

• Asya Mining copper concentrator nearby at Hanönü and the Eti Bakir Copper Smelter & Refinery 150km away at Samsun on Black Sea coast.
Simplified Regional Geology of the Central Pontides

From Yildirim et al 2011, TECTONICS, VOL. 30, TC5005
Central Pontides – Prospective VMS Stratigraphy

From Robertson A, 2002
Central Pontide VMS Deposit Models

The Central Pontide region lies within the Intra-Pontide Sakarya Suture Zone of northern Turkey. The prime VMS terrain in this region comprises early Tethyan Triassic-Jurassic volcanic arcs and Ophiolites with associated mélanges, and an accretionary complex consisting of a thick extensive metamorphosed mafic volcanic and schistose sedimentary sequence.

The main prospective sequence is the 2,000m thick Bekirli Formation, part of the Domuzdag Melange and equated with similar sequences in the Çangaldag volcanic arc to the north.

Two Cu-rich VMS deposit models are prospective in this region:

• Ophiolitic mafic volcanic dominated proximal Cyprus-type setting (e.g., Küre Complex)

• Sediment dominated distal mafic volcanic Besshi/Kieslager-type setting (e.g., Hanönü Çangaldag volcanic arc).
Central Pontides – VMS Deposits & Key Tenements

Black Sea

- Copper Deposit
- Asya Gold Former JV
- Gentor Tender
- Gentor JV

Key Locations:
- Küre
- Cozoğlu
- Hanönü
- Asia Mining
- Karaburun VMS
Küre town and copper mine 2012
Hanönü Deposit - Roman workings in footwall MS lodes at Üvezlidere
Hanönu Deposit Resource drill sites on topographic base (2013)
Hanönü Deposit Resource Model

3D view onto the mineralized bodies of copper project; 83 separate mineralized bodies have been modeled. DMT Presentation Oct 2013
Gentor’s Progress in Turkey 2011-2012

• October 2011 – Mar 2012 Establishment in Turkey

  Initial Central Pontide field visit by Gentor staff – Bob Close and Andrew McCarthy
  Set up of local Turkish company & opened Ankara Office – headed by Country Manager Dr Omer Celenk
  - Purchased Regional Turkish Database – topography, geology & tenements
  - Utilised Consultants (ex-MTA) for field and data input on Turkish VMS potential
  - Selected 5 regions with potential for VMS discovery
  - Initial focus on Central Pontides – Jurassic Ophiolite Sequence, mine visits confirm potential
  - Gentor was offered 50% equity in the Hanonu deposit for $5m but could not secure the required finance
  - Reconnaissance geological mapping & geochemical sampling by Gentor personnel commenced in Kastamonu- Sinop region (March-June 2012)

• June-August 2012 – Karaburun VMS discovery

  - Followed focus on volcaniclastic sequences between Hanonu and Boyabat in Domuzdag Melange
  - Resulted from field mapping of selected Tender ground in Hanonu district due for release on Dec 2012
  - Tenders withdrawn by Government in Oct 2012, so Gentor negotiated an easy JV with adjacent tenement holder Dincer to secure the down dip and strike extensions of this large VMS system
Hanönü Region license targets - late 2012
Hanönü- Boyabat Region 2013
Interpretive Geology

Figure - Major lithologies

Geology Map
Taşköprü - Hanönü - Boyabat Regional Geological Interpretation Around the Karaburun Project Area

FEB 2015
Karaburun Project area 2012-13
Prospective sequence and gossans
Karaburun District – Summary Geology & Tenements 2012
Gentor Progress in Turkey 2013-2014

• April – Aug 2013 Regional Kastamonu evaluation
  Regional mapping conducted to assess the broader Kastamonu region for more copper deposits. **Priority target areas established in the Hanonu-Boyabat districts**

• May 2013 – Asya Gold JV signed over Hanonu East area
  Gained JV title to prospective Bekirli Formation sequence directly north of Karaburun and along strike east of the Hanonu deposit
  - Discovery of minor gossans at similar stratigraphic level to Karaburun

• June 2013 - JV signed with Dincer over south Karaburun
  **Surveys commenced to better define the gossan system and host stratigraphy**
  **Reconnaissance mapping and grid XRF soil/rock geochemistry defined the size and quality of this VMS system within the JV and to the north in prime tender ground**
  - Grid surveys conducted over and around known copper mineralisation (June-Aug)
  Planning for drilling assessment of main resource targets (July) with Stage 1 program - Diamond drilling of 1200m in 12 holes targeting the shallow MS portion of four gossan zones
  Permitting for drill site access in forestry delayed by Government
Karaburun Project – initial view in forestry setting
Karaburun Project - Gossans & Licenses
2013 Rock Geochemistry

- Sample Point - ALS Laboratory (ppm)
- Sample Point - Portable XRF Insitu (ppm)

XRF shows only presence of gold
Karaburun Main Zone MS & Pelitic Schist

Gossan
Adit
SMS Gossan
Crenulated Black Schist
Silica- Pyrite Alt
Karaburun Main Zone VMS in Adit

“showing secondary copper- chalcanthite in folded MS”
Karaburun Main Zone Gossan

Dip Slope Gossan

Lower Bedded MS Zone

Dip

Upper SMS Zone Gossan wall
Karaburun Project - Discovery Summary

In August 2012 Gentor found a significant metasediment-hosted VMS gossan system in forest terrain at Karaburun about 20km SE of Hanonu during its regional reconnaissance mapping program. This project lies in Bekirli Formation greenschist facies schistose pelites and mafic volcaniclastics similar to the nearby Besshi style Hanonu deposit.

The stratabound gossans extend E-W along strike for 2.5km and are stacked over an estimated 400m thick shallow dipping mixed metasedimentary package with northern stockwork footwall zones.

Initial XRF rock and soil results defined coincident Cu-Zn-Au-Ag and local Co anomaly associated directly with the gossans with peak values of 0.5% Cu and 1.6g/t Au in the No 1 Zone at the inferred top of the sequence. Minor Cu workings within barren pyritic MS occur in the Main Zone, and drainage geochemistry defines the gossan package.

Given the impressive length, stacked nature and thickness of these gossans (the Main Zone in the east being about 75m in a cliff face with pyritic MS in creek exposures over 300m near its base), Gentor considered this project has major resource potential similar to Hanonu, but shallower with less environmental impact due to its more remote position.

Several JV Agreements were signed by Gentor in 2013 with local explorers holding licences adjacent to the project. In particular the Dincer JV over the western and southern dip extensions of the VMS system, were evaluated by grid mapping and soil surveys which led to stage 1 diamond drilling following permitting in 2015. Gentor won a Government tender area covering the bulk of the gossan outcrop in 2014.
Karaburun Project
Stratigraphy & Exploration criteria

**Besshi-Type VMS Cu Target**

*Distal volcanic-sedimentary environment*

*Triassic-Jurassic volcanic-arcs & ophiolite melanges*

*Prime stratigraphy - Bekirli Formation greenschist facies & amphibolitic equivalent Domuzdag Formation*

- **Geology** – mixed schistose carbonaceous metapelites with bedded volcaniclastics, minor mafic volcanics; overlying thrusted ultramafics. Possible structural stacking of mineralised zones.

- **Geochemistry** – anomalous Cu, Au, Zn, Ag, Co, Fe, Mn

- **Alteration** – silica-pyrite-sericite in deformed pelites + chlorite-epidote in the host and footwall volcaniclastics

- **Geophysics** – No data but likely chargeable footwall stringer zones & SMS with conductive stacked MS zones

- **Access** – Reasonable forestry tracks in steep terrain
Using Portable XRF - 1034 XRF Insitu Test

Soil geochemistry was conducted with sample readings taken at 25m along 26 N-S lines spaced at 100m.
Karaburun Project comparative soil analysis

Soil Results

Cu & Zn

XRF comparison with ALS Laboratory

for more information
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Karaburun Main Zone Drill Plan
Karaburun Main Zone Drill Summary

- Shallow Northerly dips
- HW VC
- FW Volcs
- Upper Main SMS
- Lower Main SMS
- FW Volcs
- Gos 8?
Drillhole J21 core from 247.7-252.6m top of MS

Drillhole J21 core from 270.9-275.8m base of MS
Conclusions

- Turkey is a superior destination for VMS exploration due to its multiple well exposed Mesozoic-Tertiary Tethyan Ophiolitic and Island arc settings.

- Gentor Resource’s small experienced VMS team selected the Central Pontides as the prime target area in late 2011 because it contained two recently discovered large (+25Mt) copper deposits and was relatively underexplored.

- The main target was Besshi-type deposits i.e. the 30Mt Hanönü deposit within Jurassic distal mafic volcaniclastics and terriginous black schists melanges.

- Within 6 months regional reconnaissance road/track mapping and gossan search of prospective sequences utilising portable XRF technology, led to the 2.5Km long Karaburun VMS deposit discovery 20km south of Hanönü.

- Mapping and grid soil/rock geochemistry defined the stacked stratabound nature and strong Cu-Au geochemical zonation of this Besshi type gossan/MS system.

- Title acquisition through tender and JV licenses with local miners took two years to complete, then subsequent permissions delayed drilling until May 2015.

- Drilling of the 75m thick Main Gossan provided mostly low grade SMS intersections so further drilling and geophysical surveys are required to test the more anomalous zones higher in the system to define economic resources.

- Recent exploration by other groups has defined several new Cu prospects, thus confirming Gentor’s original strategy of this regions VMS resource potential.