Overview of Geology of Iran

Mark Kenwright:
Associate Director Geology & Resources
Wardell Armstrong International Ltd.
HEAD OF EXPLORATION for Wardell Armstrong International:

> 20 years’ experience as a geology and exploration manager in production, exploration, and consulting.

Exploration in Africa and worldwide, including Iran, Mozambique, Burkina Faso, Mali, Ghana, South Africa, Zambia, Niger, Russia, Chad, Madagascar, UK, Portugal, Chile, Spain, Senegal, USA, Kazakhstan and DRC.

Experience covers greenfield and brownfield exploration through to feasibility studies. Completed large scale exploration programmes.

On one project planned and implemented >250,000m of RC and >25,000m DD drilling, as well as large geophysical programmes, including IP, Gravity, VTEM, and on a separate project a >US$1.4M FTG survey.

Led teams of over 300 staff with >US$30M budgets on time, and under budget. Mostly been involved in gold, Copper/Cobalt (and REE & uranium exploration) projects.

Authored articles on uranium exploration, presented from an exploration perspective on the use of large scale data sets, such as the Tellus SW project in SW England, and completed NI-43-101 reports and Competent Person Reports (CPR) for stock exchanges.
Basic overview: not an Iran expert, though have recently visited and WAI are currently advising clients on the following projects in Iran.

- Fe
- Au-Cu
- Cu-Au-Ag
- Barite
- Mn
- Porphyry projects

Info on slides provided by

- WAI Knowledge
- Conference Paper: Mineral Resources of Iran; an overview
- Samaneh Kansar Zamin Co. (SKZ) (WAI are working closely with)
- Tunnel Falat Pars Ltd (WAI are working closely with)
- Most photos from recent site visit
Samaneh Kansar Zamin Company (S.K.Z. Co.) was founded in 2012, in Tehran- Iran as the mineral exploration subsidiary of Samaneh Negar Zamin Company (S.N.Z. Co.).

http://www.samanehkansar.com

LinkedIn: Samanehkansar
Geotourism

Mineral Exploration

Mining

S.K.Z. Activities

Geology

Geotourism

Mining Projects Advisors

Samaneh Kansar Zamin (www.samanehkansar.com)
Geology of Iran

Part of Alpine-Himalayan or Tethys belt
Global Distribution of Tethyan Arcs

1700km * 100 km

- Extensional arcs
- Neutral arcs
- Compressional arcs
Summary

11 defined Geological zones in Iran.

The Urumieh-Doktar, Sanandaj-Sirjan, Central, and Lut Zones along with Proterozoic terranes are all the richest Metallogenic provinces in Iran.

These Host different types of deposits including:
- Porphyry (Cu±Mo±Au);
- Manto (Cu);
- VMS (Pb-Zn±Cu);
- Sedex (Pb-Zn+Ag+Cu);
- MVT (Pb-Zn±Ag±Cu);
- IOCG (Fe±P±REE±Au);
- Epithermal (Au);
- Carlin (Au);
- Orogenic and intrusion related (Au);
- Hydrothermal (polymetallic); and
- Sedimentary (Cu).
Summary

Samaneh Kansar Zamin Co.

- The Major epochs:
  1. Proterozoic – (Cambrian);
  2. Early – Middle Paleozoic;
  3. Permo-Triassic;
  4. Middle-Mesozoic;
  5. Late Mesozoic; and
  6. Cenozoic.

Most important for metals
- Proterozoic – (Cambrian); and
- Cenozoic.

Most important for industrial minerals
- Permo-Triassic
  - Refractories, phosphate, barite, fluorite, silica
Resources:

- Oil
Zagros Fold Belt

Conference Paper: Mineral Resources of Iran; an overview

Some Resources:
- Chromite
- Pb, Fe, Cu
Zagros Thrust

Conference Paper: Mineral Resources of Iran; an overview

Resources:
- Chromite
Sanandaj-Sirjan Zone

Conference Paper: Mineral Resources of Iran; an overview

Resources:
- Fe;
- Fe-Mn;
- Pb-Zn (±Ag);
- Au (±Tungsten±Tin±Cu);
- Cr; and
- Barite, Graphite etc.

One of the most productive metallogenic provinces of Iran.
Urumieh-Dokhtar Magmatic Belt
Conference Paper: Mineral Resources of Iran; an overview

Resources:
- Various
- Cu (-Mo-Au)
- Fe, Au, Pb-Zn, Mn etc
- Porphyry
- VMS
- Skarn
- Hydro & Epithermal
Resources:

- Cu (±Ni±Co)
- Pb-Zn,
- Fe (±Mn)
- Au
- W (Tungsten)-Cu (±Sn) - Au
- Mn
- Sb (antimony)
Alborz-Azarbaijan

Conference Paper: Mineral Resources of Iran; an overview

Resources:
- Pb-Zn,
- Cu (±Mo±Au)
- Fe
- Phosphate, Barite, Fluorite, Bauxite-Laterite, Coal
Kopet Dagh
Conference Paper: Mineral Resources of Iran; an overview

Resources:
- Few metal Resources
- Gas & Oil
Resources:

- Fe (±Mn, ±P, ±REE),
- Cu (±Mo±Au)
- Pb-Zn (±Cu-Sb)
- W-(±Sn)-Cu
Eastern Iran

Conference Paper: Mineral Resources of Iran; an overview

Resources:

- W - Au
- Cu – Au
- Cu (+ Pb-Zn)
- Cr
- Mn
Makran

Conference Paper: Mineral Resources of Iran; an overview

Resources:

- Cr
- Mn
- Cu – Zn
- Cu – Au
- Ti (also placer)
Cu Metallogenic Belts in Iran

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Pictures from National Iranian Copper Industries
Distribution of Gold indices in Iran

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Distribution Map of Gold Indices in IRAN

Legend:
- Gold Indices
- Structural Zone
- Study Area

Persian Gulf
Caspian Sea

Locations:
- Masjid Daghi
- Zarshuran
- Agdarreh
- Sari
- Sungun
- Dalli
- Kahang
- Meiduk
- Sarcheshmeh
- Bazman
- Maher-Abad

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Distribution of Hydrothermal Cu in Iran
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World class deposits
Samaneh Kansar Zamin Co.

Zinc and Lead:
- Anguran
- Mehdi Abad,

Iron:
- Chadormalu
- Gole Gohar,
## Important Cu Mines

### Samaneh Kansar Zamin Co.

<table>
<thead>
<tr>
<th>Name</th>
<th>Reserves Mt</th>
<th>Average Grade Cu (%)</th>
<th>Cut Off Grade Cu (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sarcheshmeh</td>
<td>1,538</td>
<td>0.58</td>
<td>0.15</td>
</tr>
<tr>
<td>Miduk</td>
<td>176</td>
<td>0.61</td>
<td>0.15</td>
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<tr>
<td>Sungun</td>
<td>846</td>
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<tr>
<td>DarAlu</td>
<td>186</td>
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<tr>
<td>Chah Firuzeh</td>
<td>149</td>
<td>0.41</td>
<td>0.15</td>
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<tr>
<td>Eju</td>
<td>74</td>
<td>0.30</td>
<td>0.15</td>
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<tr>
<td>Darehzar</td>
<td>134</td>
<td>0.42</td>
<td>0.2</td>
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<tr>
<td>Darehzar Zereshk</td>
<td>130</td>
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<td>Nowchun</td>
<td>527</td>
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<tr>
<td>Masjed Daghi</td>
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<tr>
<td>Kahang</td>
<td>39</td>
<td>0.59</td>
<td>-</td>
</tr>
<tr>
<td>Haft Cheshmeh</td>
<td>155</td>
<td>0.23</td>
<td>0.25</td>
</tr>
</tbody>
</table>
Photos from recent site visit

Good exposure
Photos from Recent Site Visit

Thrust Plane
“Potential” Common Issues

- QA/QC
  - CRM : BLANKS: Pulps
- No Orientated Core
- Lack of Systematic Sampling of core (cost)
- Lack of Systematic Sampling of trenches (cost)
- Lack of Systematic Soil Sampling (cost)
- Good Assay values/Potential
- Limited drilling
No Fatal Flaws / Issues can be Corrected

• Step by step approach:
• Mineral Resource Estimate & Report
  • **Milestone**
• Scoping Study/PEA
  • **Milestone**
• Pre-Feasibility Study
  • **Milestone**
• Feasibility Study (remember not all FS are positive!)
• Funding
Projects Recently Visited

• Iron Ore (>60% Fe)  “Potential” for 500Mt – 1Bt  (5Km * 1Km)
• Cu - Au projects: ± 2km strike length
• Cu - Au –Ag projects: ± 2km strike length
• Manganese & Zinc
• Barite: ± 2km strike length
• Zinc potential
• Copper Porphyry

As an experienced exploration manager I would be happy to have these projects.
Questions

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