Advances in Mineral Exploration

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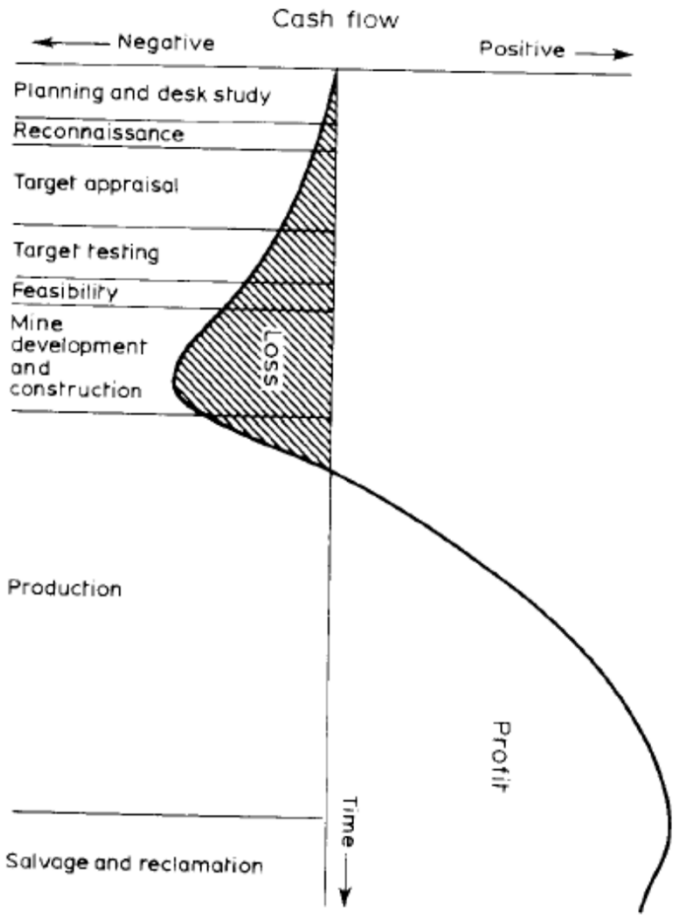
2nd Iran Mines and Mining Industries Summit Dec. 2016 Tehran

Facts

- **Exploration is the foundation of all mining.**
- **Exploration investment determines the rate of discovery of future mineral deposits and mines.**
- **There is a lack of investment in mineral exploration and more support is needed.**
- **The minerals resources industry creates a lots of jobs in rural and regional communities.**

Facts



- Mining Industry
- Exploration-Exploitation-Mineral processing-Metallurgy-Trade
- Our Definition
- Exploration-Exploitation-Mineral processing

Exploration Challenges

- Discovery costs have risen dramatically over the last three decades
- Size of discoveries declines with terrain maturity
- A need to balance Risk Vs. Opportunity
- Inability to detect mineral deposits beneath cover is considered as major impediment to success
- Relations between mining and new discoveries

The key reasons for a gradual increase in exploration expenditures are:

- 1. Ore bodies close to the surface have mostly been localised. New deposits need to be located at greater depths / increased coverage.
- 2. Deposits are increasingly found in area that are less accessible and more distant from facilities and markets.
- 3. Deposits are found in areas that are more inhospitable and exposed to more extreme conditions (altitudes, weather, seasonality etc.)
- 4. Easily accessible ore bodies of high grade have already been found. Ore bodies of lower grade are progressively being considered but (generally) the discovery / delineation of these bodies is increasingly complicated due to geoscience complexity.

21st Century Successes and Challenges

- (1) Rising costs of exploration,
- (2) Technical surveys that are easy to do, but insufficient constraint with geological data,
- (3) Decline of experienced exploration teams and strategies, and
- (4) Brief time to assess new targets
- (5) Complicated legal and environmental regulation and socioeconomic demands

Way Forward

- Go deeper
- Go to remote inhospitable area
- Look for low grade deposits

Needs

- Robust new technologies
- Techniques with minimum maintenance time and cost
- Fast data acquisition and processing
- Using 3D and 4D systems

Major Exploration Criteria

- Geology
- Geochemistry
- Geophysics
- Geomatics
- Drilling
- Analyses
- Data Processing

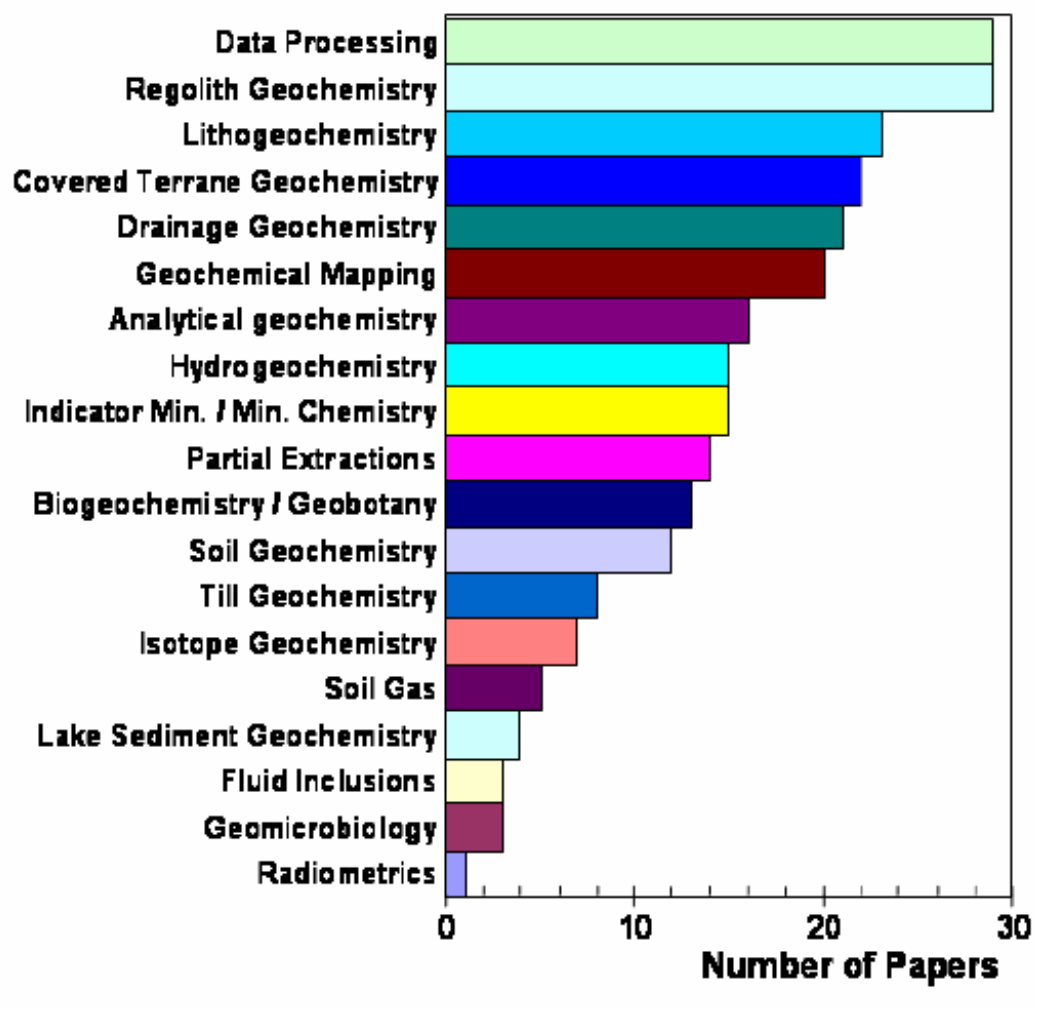
Geosciences Engineering/Geology

- Geology is base of all mineral exploration.
- Classic regional mapping using geochemical and isotopic data
- Quantitative metallogenic mapping
- District and mine based mapping (2D and 3D)
- Using basin analyses, magmatism-metamorphism and structural geology by experts for mineral exploration
- Digital 2D and 3D mapping

Geochemistry

- Exploration geochemistry continues to be a major contributor to mineral exploration programs at scales ranging from regional reconnaissance down to mining leases.
- New models for geochemical dispersion from deeply buried mineralisation have been proposed and new sampling and analytical techniques tested in a large number of orientation surveys, but with varying degrees of success
- One fundamental geochemical question has survived six decades of debate: What constitutes a geochemical anomaly and how can this be enhanced (by suitable combinations of sampling processing and analytical methods) and detected (by use of various univariate and multivariate mathematical techniques)?

Distribution of Geochemical Paper Subjects in EG and AG journals



Geophysics

- Air borne geophysics
- Air borne gravity
- Air borne radiometrics
- Air borne magnetics

And

- Revolution in Time Domain techniques
- GPS changes the methods heavily
- Bore hole exploration

Fix Wing, Helicopter and Unmanned based

Time-Domain Electromagnetic (TDEM), magnetic and radiometric data up to 500 m depth

GyroLAG (Gyrocopter Light Airborne Geophysics). GyroLAG is a single pilot operated, smart tailored, ultra-high resolution airborne geophysical platform

GyroLAG will accommodate up to 7 distinct remote sensing technologies including a range of digital cameras covering the entire IR to UV spectrum, lightweight magnetic, radiometric and gravity sensors.

Remote Sensing

- Aerial LiDAR (Light Detection and Ranging), digital image and hyperspectral surveys support mineral exploration project phases

Drilling

Robust instrument with minimum maintenance
Versatile drilling rig for shallow and deep drilling (Min. 1200 m)
On-line geochemical analyses

(Atlas Copco D65 Smart Rig)