Managing Expectations: Lessons from Building CMIC-EIC and the Initial Footprints Project

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CMIC in the early days

• Created in 2007 to generate long-term fundamental research in Canada that will enhance the competitiveness of a responsible Canadian mining industry.

• Objectives:
  – (1) to increase mining research, innovation and commercialization to strengthen Canada’s pre-eminent role as a leader in mineral exploration, mining and knowledge-based services and technologies;

  – (2) to increase the supply of highly qualified graduates from mining and earth science faculties to meet the significant demand today and into the future of industry, governments and academia.

Arrive at clarity  Go from the haze
Comparing biotech and exploration (2001)

**BIOTECHNOLOGY**
- 1400 companies
- Can. $10 billion expenditure
- 5000 new compounds
- 5 Stage 3 tests
- One FDA approved drug
- 20 new products annually
- $250 million per discovery
- Monetize discoveries through sale or licensing to major

**EXPLORATION**
- 1500 companies
- Can $800 million expenditure
- 1000 new projects
- 5 discoveries
- 1 new mine
- One or two new mines annually
- $100-200 million per discovery
- Monetize through sale to major or producing product

Source: Robbins Roth

Source: Discovery data Fenton Scott
Where does exploration fit?

Exploration costs $$$, but **DISCOVERY** of new assets is required for Co. survival

Exploration needs to:
1. discover much more quickly
2. evaluate projects to minimize risk and destruction of shareholder value
Exploration (Technical) Challenges

Need discoveries to sustain healthy mining industry. But...

• Mining camps maturing
• Discoveries getting deeper
• Global discovery rates down
  – <50% become producers
  – >12 years to production!
• Costs increasing

Also need quality discoveries

• 80% metal in top 20% mines
• Need Tier 1 discoveries

Canadian discoveries:
only 3 “Tier 1” / decade

From Schodde (2015)
Challenge and Goal of CMIC EIC

Graph of exploration success
1950 - 2000

How do we improve?

How do we move the curve to the next level?
EIC Development

• 2008: CMIC initial objectives at first conference call
  * Develop new exploration concepts, tools, technology, etc
  * Enhance innovation opportunities
  * Break-down silos

• Industry, government, and academia to arrive at an objective
  * Use NSERC funding to underwrite project meeting (January 2009)

• Challenge with approach:
  * Competing goals, agendas and career needs.
  * Impeded consensus on what is the most important question

• Solution: Let industry develop broad-scale questions
EIC Development

Required:

• Independent consultant to ask industry geologists across Canada and involved in All commodities what they wish they were able to undertake during exploration 5 or 10 years into the future.

• Build support for CMIC

• Meeting facilitator to distill the future exploration needs

• Then engage service providers and research community
## Critical Research Areas for Exploration

<table>
<thead>
<tr>
<th>Themes</th>
<th>Discovery Criteria</th>
<th>Discovery Technology</th>
<th>Data to Knowledge</th>
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</thead>
<tbody>
<tr>
<td><strong>Focus</strong></td>
<td>Knowledge and models</td>
<td>Detection &amp; Delineation</td>
<td>Interpretation</td>
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<tr>
<td><strong>Key Questions</strong></td>
<td>• Where to look?</td>
<td>• How to best detect?</td>
<td>• What do the data mean?</td>
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<tr>
<td></td>
<td>• What to look for?</td>
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<tr>
<td><strong>Exploration Challenges</strong></td>
<td>• Terrane selection</td>
<td>• Mapping and detection tools</td>
<td>• Visualization and integration</td>
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<td></td>
<td>• Area selection</td>
<td>• Cheaper drilling</td>
<td>• Physical property models</td>
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<td></td>
<td>• Vectoring to ore</td>
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**Education & Technology Transfer**
## 10 Year Exploration R&D Program

<table>
<thead>
<tr>
<th>Deep Mature Camps</th>
<th>Remote &amp; Covered Areas</th>
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<tbody>
<tr>
<td><strong>1. Multi-parameter footprints and 3D vectoring</strong></td>
<td></td>
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<tr>
<td>• Detecting edges and vectoring to ore</td>
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<tr>
<td><strong>1. Characteristics of fertile terranes and districts</strong></td>
<td></td>
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<tr>
<td>• How to identify most fertile areas?</td>
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<tr>
<td><strong>2. Techniques to unravel deep 3D geology</strong></td>
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<tr>
<td>• Deep penetrating detection and mapping techniques</td>
<td></td>
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<tr>
<td><strong>2. Techniques to map sub-surface geology</strong></td>
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<tr>
<td>• Drilling, data integration</td>
<td></td>
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<tr>
<td>• Data density for detection</td>
<td></td>
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<tr>
<td><strong>3. Real-time down-hole data collection</strong></td>
<td></td>
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<tr>
<td>• Real-time decision</td>
<td></td>
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<tr>
<td><strong>3. Secondary dispersion</strong></td>
<td></td>
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<tr>
<td>• Understand mechanisms</td>
<td></td>
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<td>• Develop techniques</td>
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Footprint Project Snapshot

- **Objectives**
  - New approach and tools
  - Detect distal footprints & vector to ore

- **Funding**
  - 5-year program, $13M (now in Y5)
  - Largest CRD by NSERC
  - Managed by Laurentian U

- **Collaborators**
  - 28 company sponsors,
  - 45 researchers from 24 Canadian universities
  - Gov’t partners & PDAC

- **Silo-breaking effort**
  - Between Industry, Universities & Service Providers
  - First on this scale in Canada
Footprints Project

Concept

– Better signal : noise response
– Multiple parameters on same sample suites, 3 deposits
– Integration: big data analytics

Key results

– New concepts to minimize exploration time: save $$’s
– New tools to integrate disparate data sets critical to exploration success

Footprint Project

Deposit

Ore system footprint

Phengitic Mica Footprint (SWIR)
Lessons learned since 2009

5 Areas

1. Project development (*covered*)
2. Political timing
3. Funding
4. Staffing
5. Delivery

Key is managing expectations of all stakeholders at all times
Political timing – Governmental impetus

- Natural Sciences and Engineering Council of Canada
  - Change in strategic plan
  - Willingness to work with EIC to support large national-scale project

- Provided climate for first CMIC project at a larger financial level ($13M) than previously possible just prior to Global Financial Meltdown.

- Timing is everything!
Funding

Exploration road map funded jointly by industry, the PDAC, and Natural Resources Canada

Funding structure for national scale Footprint project proved trickier.

NSERC created a category of unofficial “super” Cooperative Research and Development project

• Became a *de facto* Strategic Network complete with complex administrative structure
  1. *Major challenge was to educate the community that data integration was the critical outcome.*
  2. *New data acquisition funded to address linkages across disciplines*
  3. *Not a separate funding source but has a promised outcome*
Staffing the Project

• Senior university faculty

• Full-time EIC coordinator

• Experienced leaders and staff for modules

➤ Willingness to remove non-performing research staff or research directions

➤ Keep focus on project goal
Staffing the Project

• Largely moved the industry sponsors out of the staffing and initial research decisions (reality of NSERC-funded project)
  • Science Advisory Board and Subject Matter Experts began to influence science direction
  • Created funding challenges

• Qualified senior staff to reside in host university

• Sufficient unaffiliated geoscientists for Science Advisory Board

• Balancing culture

• Requirement of a significant number of graduate students

• Inability to tap into service industry
Delivery of Outcomes

- Project site meetings
- White papers outlining techniques
- Quarterly reports
- Annual report
- Annual General Meeting
- NSERC report
- Public dissemination after confidentiality expires
Major lessons

1. Expectation MUST be managed at all times
2. Outcomes can NOT be over promised
3. Challenge finding qualified staff
4. Insufficient flexibility to address issues and questions in a timely manner
5. Reporting protocol became too cumbersome
6. Involvement of service companies within project.
Keys to future success

• Focus on relevant problems
• Industry-driven focus, research-driven delivery
• 3 year projects better
• Need strong champions – From Industry & Research
• Proactive communication

• Catalyzing Vehicle - CMIC
• Vision & unifying initiative
• Support from Senior Industry Leaders
• Adequate funding
• Appropriate funding structure

Timing!!!!
Innovation Contributions

Linked disparate research groups (university and industry)

First Exploration program with truly National scope

Non-standard approach to Footprint studies

Knowledge linkages previously unavailable

Imported machine learning into the exploration process

Sociological as well as scientific “experiment”

*Grass always appears greener on the other side!*