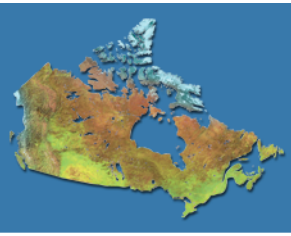
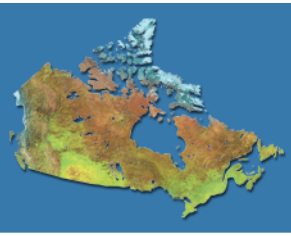


Deep Mining Technologies

Mines Ministers' Conference:
St. Andrews, New Brunswick,
September 19, 2005

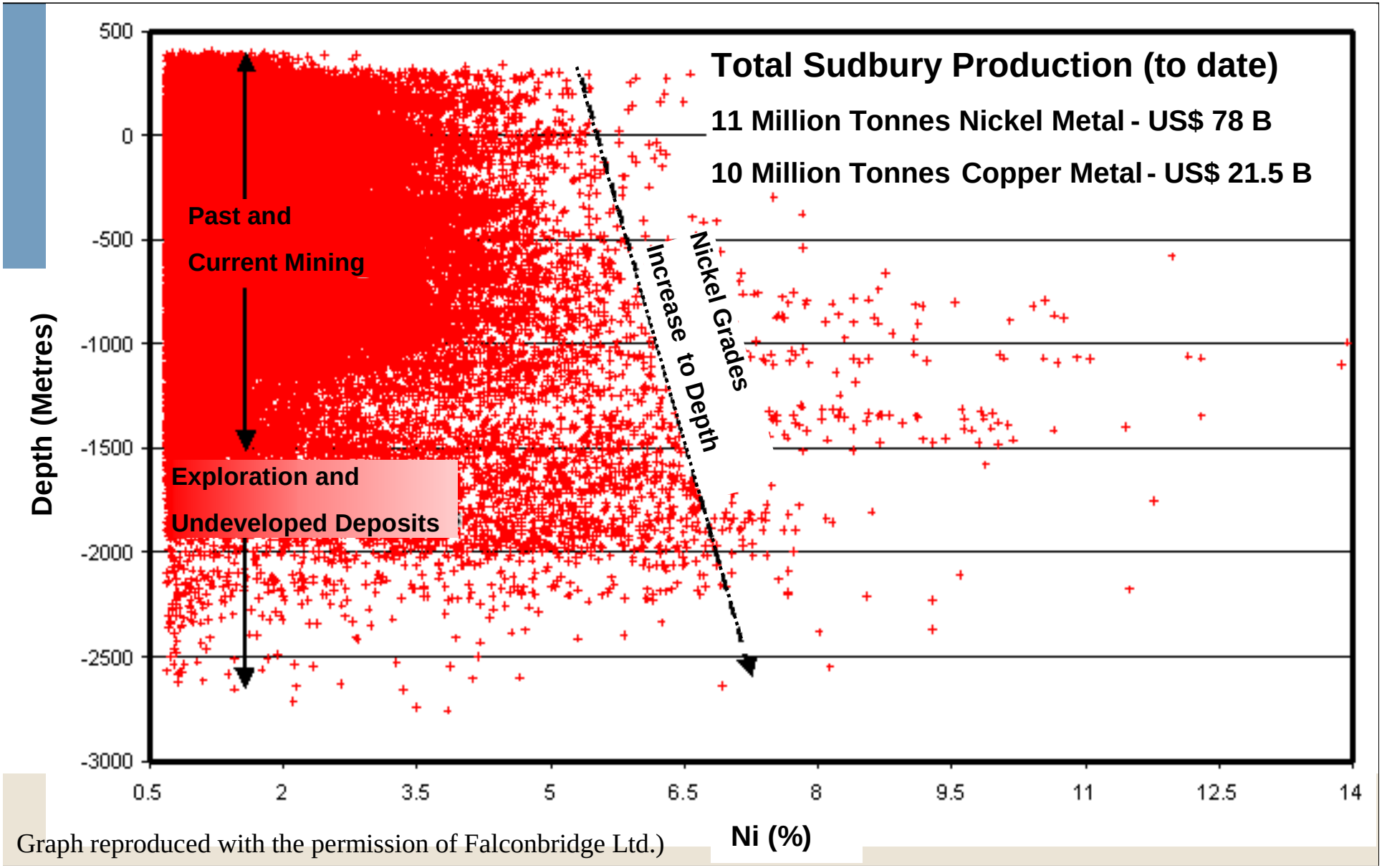
Louise Laverdure
Deputy Director
Mining and Mineral Sciences Laboratories - CANMET

A critical issue for Ontario and Quebec regional communities



- 12 000 direct jobs; 30 manufacturers, over 320 suppliers of mining goods and services in northeastern Ontario
- 7200 direct jobs in Abitibi-Témiscamingue and northern Quebec
- Considering that the average mining wage is over $60 000, **mining is critical to the well-being of the northern economy and is a significant fiscal contributor**

The future prosperity of these communities depends on access to rich, deep orebodies



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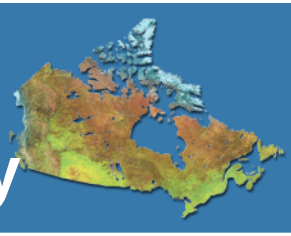
Accessing reserves at depth raises new technical challenges

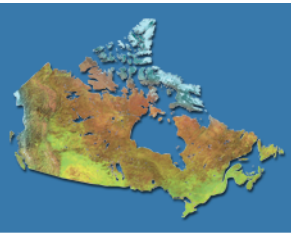
- **Ground control issues: dealing with high stress**
  - Stability of permanent infrastructures such as shafts and ore/waste passes
  - New engineering tools to better understand rock mass behaviour and response in highly stressed ground
  - Mining methods to deal with high stresses and avoid/minimize rock burst occurrence
  - Better engineered backfill to withstand the pressure from the convergence of mine openings

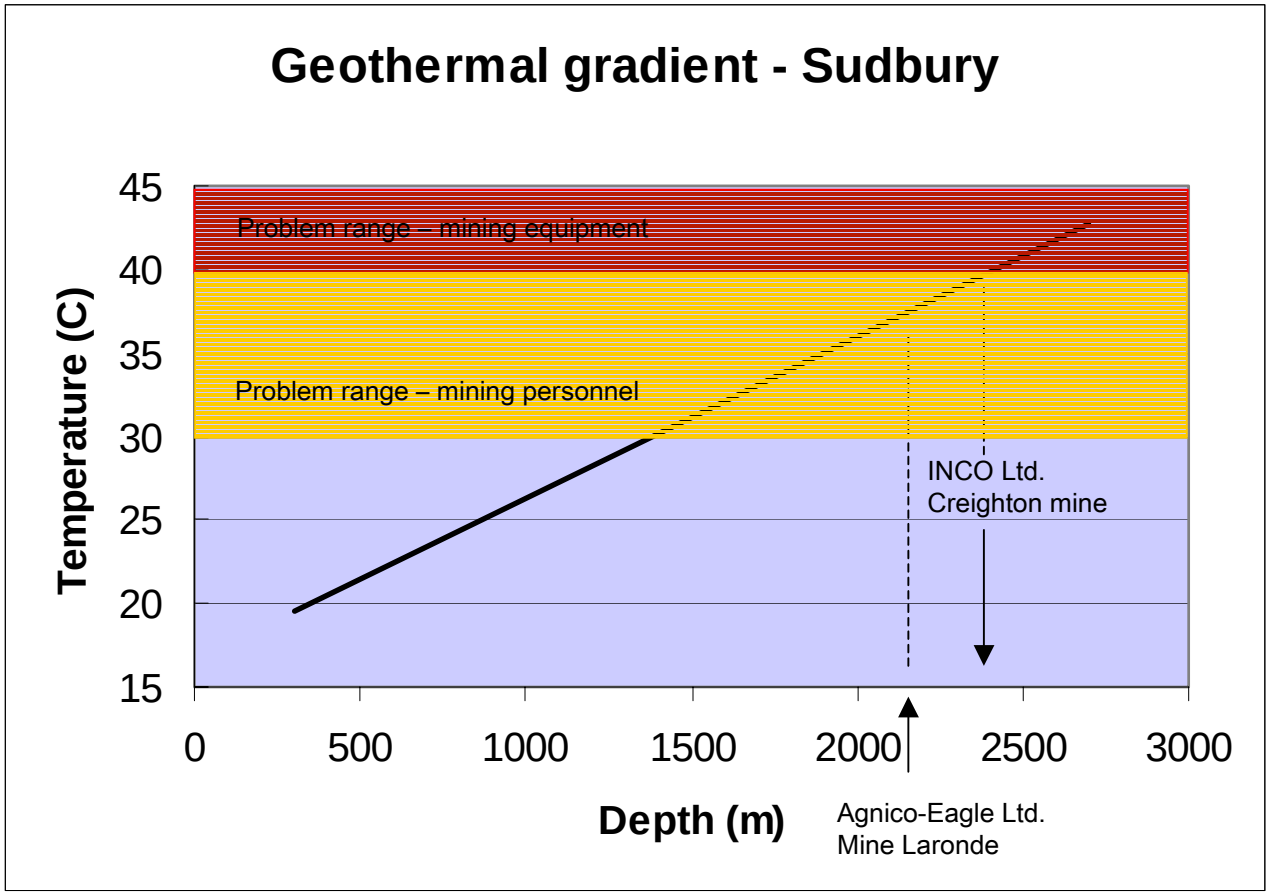
Accessing reserves at depth creates significant challenges for the industry



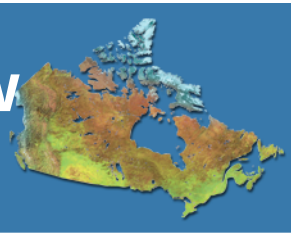
- **Underground environment: dealing with heat from strata and equipment**
  - Expensive air-cooling capacity may be required
  - Ventilation costs increase exponentially with demand (e.g., 10% increase in flow implies 33% increase in energy consumption)
  - Ventilation and air conditioning (refrigeration/heating) represents 50% of the energy required in the mineral extraction process
  - Low emission and low heat generation equipment
  - **Energy cost will increase steadily for the foreseeable future**

Temperature and heat stress issues at depth



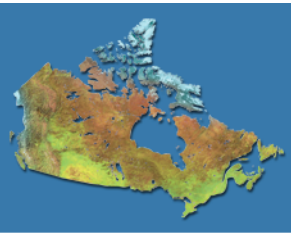


Accessing deep reserves creates new and specific technical challenges



- **Other issues**
  - Logistics: increase in transportation and communication needs results in high cost, loss of effective working time and difficult inventory control
  - Rock and material handling: vertical transportation of ore and waste over 3000 m
  - Development of regulation and policy geared to deep mining operations (ground control, heat stress, hoisting, etc.)

Specific R&D streams aimed at deep mining challenges



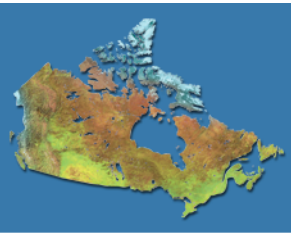
- Based on extensive NRCan consultation with industry, universities, manufacturers, SMEs, mining associations and provincial governments, deep mining R&D must be focused on the following areas:

  - Drilling and blasting
  - Underground environment technologies (i.e., ventilation, low-emission vehicles)
  - Mining methods for extreme environments
  - Backfilling material for underground

Mining research must be country-wide, coordinated and funded

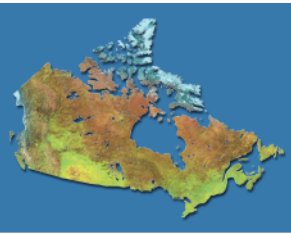
- There is a strong **need** for collaborative mining research; this need is acknowledged and must be addressed by the mining industry, research organisations and by government
- Federal and provincial governments must reinvest funds from mining fiscal revenues into mining research – estimates are that $50M/yr would be required for the next 10 years to provide **stable** funding
- Promote mechanisms for co-coordinating research at a national level

Promote the wise use of research resources and funds



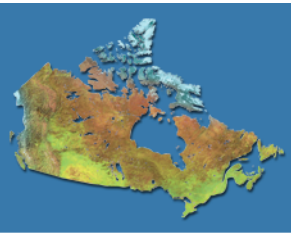
- Orient funds and maintain focus on highest priorities supported and led by industry champions and stakeholders in order to have impact on mining
- Establish a fund allocation mechanism that minimizes time spent on fund raising that will lead to concrete solutions within a reasonable time frame
- Select the appropriate industrial partners to successfully introduce and apply new technologies

Outcome and benefits



- Long-term viability of Canadian mining communities
- Safe and economical development of new, deep orebodies in existing mines and possible opening of new mines
- Long-term industry stability and positive impact on secondary industries
- Development of new expertise and technologically advanced mining equipment for SMEs
- Opportunity to export new technologies and expertise

Outcome and benefits



- Support northern and regional economies and foster First Nations self-reliance
- Maintain high-quality jobs and fiscal revenues for all levels of government
- Reaffirm Canada's global leadership in the development of novel mining techniques and technologies