The Lowell Institute for Mineral Resources is a global center that bridges pure and applied research in

- Science
- Engineering
- Health
- Social Science
- Business
- Leadership and Policy

to provide guidance on responsible stewardship and development of mineral resources.

Fast Facts:

35 research projects

306 total participants

79 industry & government participants

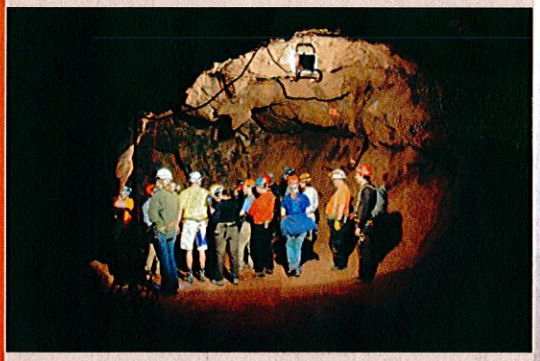
25 faculty directly involved

52 students

Collaboration with 3 universities, 2 government agencies, 1 national lab

78 publications

1 start up company



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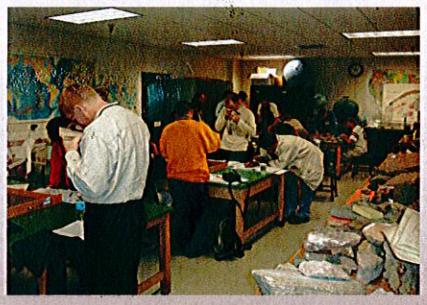
IMR

Lowell Institute for Mineral Resources

Current Research Themes

- Water
  - — Use of effluent for sulfide flotation
- Energy
  - — Installation of solar PV on active mine tailings
- Resources
  - — Mine, District, Regional geological studies
  - — Raman Spectroscopy mineral database
- Smaller Footprint
  - — Optimization & control room setup
- Healthy/Safe Communities and Workforce
  - — Dust source apportionment
  - — Behavior-based safety systems

Mary M. Poulton, Ph.D.
Director
Mark D. Barton, Ph.D.
Associate Director



IMR Partners

Science Foundation Arizona
David and Edith Lowell
Freeport McMoRan
Peabody Energy
Newmont Mining
Resolution Copper
Augusta Resources
BHP Billiton
Anglo American
Barrick Gold
Animas Resources
ASARCO
Bronco Creek-Eurasian Minerals
Arkenstone
Caterpillar

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Why Arizona?

Overcoming challenges

In Arizona, we consider these as some of the key challenges:

- **for mineral resources**
  - **— Discovery and development**
  - **— Safe sustainable production**
  - **— Deeper mines, smaller footprints**
  - **— Economically sound**
- **or other concerns**
  - **— Competing land uses**
  - **— Environmental sustainability**
  - **— Other resources: water, energy**
  - **— Maintaining our communities, economy and infrastructure**

Why now?

Time of unprecedented challenges

- **Extraordinary world demand for resources**
- **New demands on materials for infrastructure and technology (e.g., solar)**
- **Growth, competing concerns, land use**
- **Climate change & arid environment**
- **High expectations for sustainable practice**
- **Radical changes in globalized industry**

Current Research Projects

Lowell Institute for Mineral Resources

SX Mine:
Build new mine safety training center
Install state of the art research hoist

Mine Safety Gaming Simulator:
3D virtual environment for safety training

Mine Health and Safety:
Behavioral based safety protocol analysis
Biodiesel health effects

Dust Source Apportionment on Navajo Nation:
Analyze dust and model wind patterns near legacy uranium tailings

Effluent Project:
Study use of effluent & other low quality water for sulfide flotation

Raman Spectroscopy (RRUFF):
Build Raman Spectra database for all known minerals

Solar Energy:
Materials needs for renewable energy
Analysis of silica resources in Arizona
Installation of PV panels on active mine tailings

Economic Geology:
15 projects at mine-district-regional scale in Arizona, Nevada, South America, Africa and Mexico

Mine Technology:
Optimization of operations
Control room design
Simulation models
Expert system for coal wash plant

Water:
Hydrogeological investigation for slope stability
Model 4D hydro geophysical data

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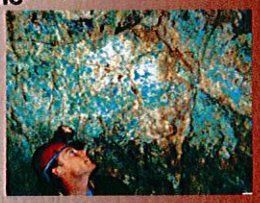
Workforce Capacity

Lowell Professional Programs in Mineral Resources

Over 500 geologists and engineers have been involved in a Lowell program at the UA in the past 5 years from more than 51 companies and 22 countries.

- **Professional Science Masters in Economic Geology**
- **Master of Engineering in Mineral Resources**
- **Professional Certificate programs**
- **Lowell Field Courses (2)**
- **Lowell Short Courses (10)**



Lowell Field and Short Courses

Field Courses
Field Mapping Course—September
Porphyry Cu, IOCG—December

Short Courses

- **Mineral Economics**
- **Contract Law**
- **Corporate Organizations**
- **Mineral Asset Valuation**
- **Stakeholder Engagement**
- **Social and Environmental Impact Assessment**
- **Managing Public Outrage**
- **International Minerals Trade**
- **Acquisition & Finance of Minerals Projects**
- **Mine Information Technology**