

# **WORKSHOP PROGRAM**

## **KNOWLEDGE TO DRIVE THE TRANSITION TO SUSTAINABLE DEVELOPMENT OF MINERAL RESOURCES**

The earliest evidence of mining is at least 40,000 years old. Agriculture, which arose perhaps 12,000 years ago, is a relative newcomer in human societies.

The quest to acquire and use minerals has driven much of human history. The desire to find new ways to make earth resources into things people can use, or to extract or process them more efficiently has driven much of our technological progress, as we have moved from the Stone Age through the Copper, Bronze and Iron Ages into the Age of Silicon.

Through much of this history, mineral development has been associated with conflict and strife: conquest, invasion, labor wars, or community struggles with mine developers. It has also produced improvements in living standards and dramatic technological advances. Like the societies of which it is a part, the record is a complex and mixed one.

Modern conditions of increased population and increased demand for an ever longer list of minerals require a transformation of the minerals production system, in ways we only dimly understand. The challenges are many, and daunting. Perspectives include these:

- Relieving extreme poverty in the developing world will require greater quantities of materials, even if we were to find ways to reduce the consumption levels of the rich. It is hard to imagine development without access to electricity, or access to electricity without copper. What materials do we need to alleviate poverty and where can we get them?
- Producing greater amounts of minerals seems to require exploring more places and mining more places. But increased population requires more land for other things as well, and there is a widespread view that minerals production is in conflict with other uses of land. Where is it all right to mine? Will local communities consent to mining? Can they be induced to accept it? How?
- If communities are going to accept mineral development as a neighbor, they need to benefit from it. How can the neighbors share in the benefits? How can we solve the issues by consent rather than coercion?
- Producing and processing minerals is very energy intensive; mining and smelting competes for energy with all kinds of other human activities? Does increased minerals supply require more energy devoted to mining and processing? How can that work?
- For poor countries, mineral development may be one of the few means of attracting foreign investment. But the track record of mining investment as a source of balanced and equitable development is questionable. What is needed for minerals development to be a motor of a kind of development people want?

- The transition to a renewable energy system would require unprecedented quantities of some commodities that few have heard of: not just massive production of lithium batteries for electric cars, but production of lanthanum, tellurium, indium, or neodymium. A large part of the supply of many of these materials is controlled by Chinese entities and China has been cutting its exports. What challenges will this pose?
- Increased difficulty of supplying the world with minerals implies that we should use available supplies more wisely. Are we? What is needed to ensure a dramatic increase in reuse, remanufacturing and recycling of minerals, greater efficiency in their use, and better materials stewardship?
- What is the basis of understanding between investors in the traditional mining investment countries of Europe, North America and Japan investors the so called “emerging economies” of countries like Brazil, India, and China? Are there ways of mediating these conflicts, or will they have destructive or dangerous results?

Challenges like these can easily test our values and our commitment to rational, information based approaches to making decisions. If we are to understand these challenges and how to respond to them, we require a new kind of research agenda for sustainable development of mineral resources. This agenda needs to include the traditional fields of geology and mineral engineering. But it needs to go far beyond that to include a wide variety of investigators far removed from what has traditionally been thought of as “mining research.”

### **A START ON THE RESEARCH AGENDA**

The objective of our workshop is to identify areas in which there is a need for deeper understanding through research, and:

- To help understand why they are important;
- To discuss how and by whom they might be done;
- To understand better where they fit in an overall research agenda; and
- To help refine and shape these ideas and get them on a path that may lead to their becoming fundable research proposals.

In short, we view this workshop as an incubator for future research ideas. We will have to help us in that process:

- Outstanding University of Arizona faculty from a variety of disciplines;
- Directors of the Lowell Institute for Mineral Resources; and
- Several very articulate industry leaders with deep understanding of the pressures on the minerals sector and some of the areas in which we need to deepen understanding through research.

## **AGENDA**

We are working on a detailed agenda that will be circulated shortly. It will include some basic framework on the work of the Lowell Institute and some suggested research needs.

We anticipate devoting the majority of the day to 'brainstorming' research ideas with interested faculty, with the objective of stimulating thinking about what kind of innovative ideas may be developed. Some of these will be ideas we may suggest. Others will, we hope, be ideas brought to us by faculty attendees.

We do not require elaboration of ideas to a deep level of complexity, development of proposals, or elaborate written documents. We simply request that they be developed to the point that they can be the subject of discussion, through a simple process we will outline.