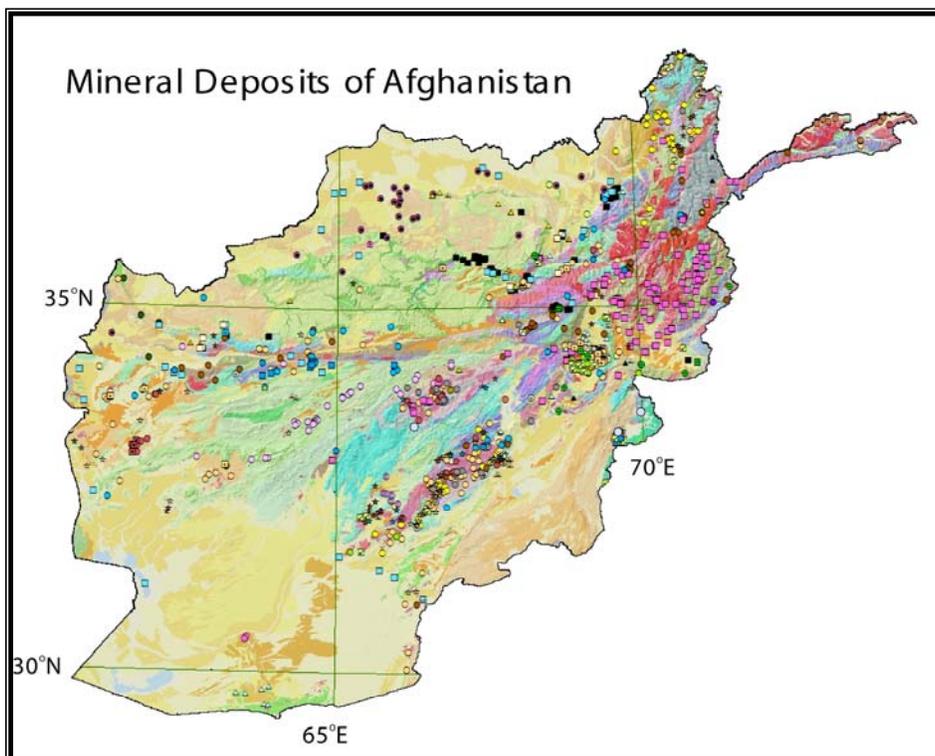


## Assessing the Mineral Resources of Afghanistan

Afghanistan has experienced decades of instability due to internal strife, occupation, and oppressive rule. As this period of conflict and neglect comes to a close there is tremendous need for reconstruction of the country's infrastructure and industries in order to restore and sustain stability and economic prosperity. A viable minerals industry will be an important component of any reconstruction effort, by supplying local raw materials for infrastructure development, by attracting foreign investment in the development of the country, and by creating jobs. Currently, the minerals industry represents only about one percent of the country's GNP. This is unrepresentative of Afghanistan's mineral wealth.

The U.S. Geological Survey (USGS) has initiated work to create a current and comprehensive inventory of Afghanistan's known mineral resources and to assess Afghanistan's undiscovered mineral resources. An up-to-date inventory of known resources will identify resources that can be brought into production quickly to aid rebuilding and attract immediate foreign investment in minerals development, and will be used as a foundation for a mineral resource assessment. An assessment of undiscovered resources is required for informed resource and land use planning, and for attracting international exploration activity and future resource development.

The USGS mineral resource assessment program is being implemented in two phases. Phase I activities (12-18 month duration) involve the acquisition, compilation, and interpretation of existing geologic and mineral-resource related data, and a preliminary mineral resource assessment based on existing data and information. Phase II activities (36 month duration) will focus on the acquisition of new data through field-based research projects that will generate new information on the geologic context of Afghanistan's mineral resources. Training and capacity building activities with Afghan Geological Survey (AGS) geoscientists will be conducted during all phases of the USGS assessment program.



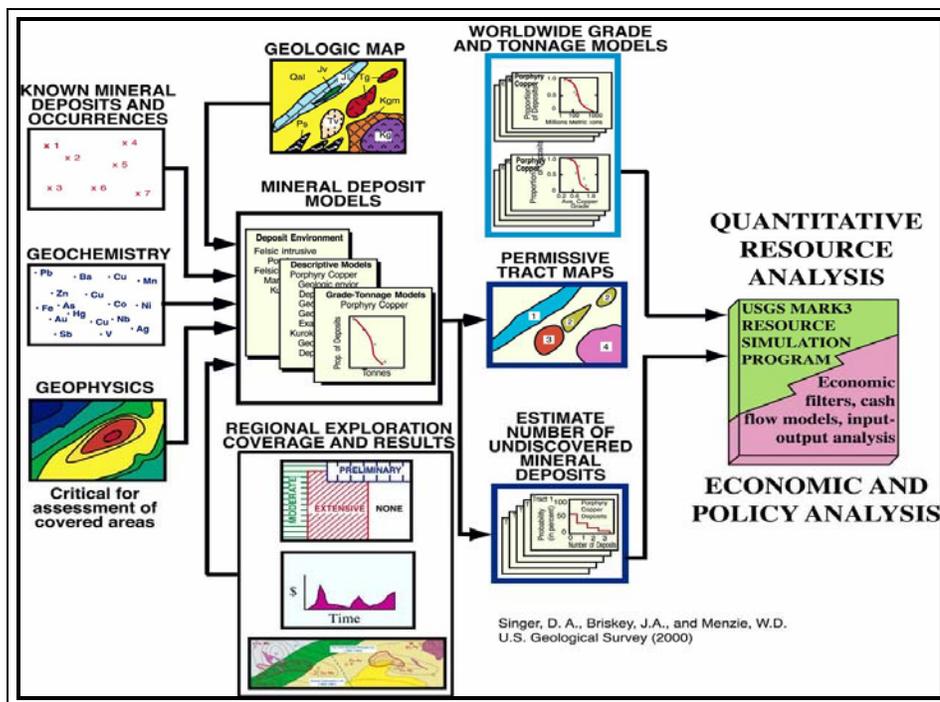
**Figure 1.** Geologic map of Afghanistan showing the distribution of mineral deposit types.

## Mineral Deposits Map

A comprehensive mineral deposits database, containing over 1000 mineral localities, has been compiled from existing data and is being updated using current deposit model theory and classifications. A mineral deposits map of Afghanistan, showing the distribution of mineral deposit types has been created from this database (Fig. 1). This inventory of known mineral deposits and occurrences, classified by mineral deposit type, rather than by commodity, will be the foundation for assessing the country's undiscovered mineral resources.

## Mineral Resource-Related Data and Information

A large amount of relevant mineral-resource related information resides in data depositories outside of Afghanistan, primarily in Europe and the Former Soviet Union. Considerable effort is being made to identify, evaluate, and acquire relevant data as needed. A 1:500,000-scale geologic map of Afghanistan has been digitized and will provide the geologic base for the mineral resource assessment. Other data being sought include regional stream-sediment geochemical and lithochemochemical data, and regional airborne and ground geophysical data. Geophysical and geochemical anomaly maps will be generated from acquired data as possible. Satellite spectral and hyperspectral data (Landsat ETM+, ASTER, and Hyperion) is being processed to map hydrothermal alteration zones in igneous rocks of Afghanistan.



**Figure 2.** Flow sheet showing the components of the USGS 3-part mineral resource assessment method and the central importance of the mineral deposit model.

## Assessment of Undiscovered Resources

The assessment for undiscovered mineral resources will utilize USGS 3-part assessment methodology (Fig. 2) and will result in (1) a series of maps outlining areas that have been defined as permissive for the occurrence of undiscovered deposits of a particular mineral deposit type (qualitative assessment), and (2) probabilistic estimates of undiscovered resources where the data is sufficient to do so (quantitative assessment). The permissive tract maps will identify mineral exploration target areas, including areas with undiscovered resource potential beneath

younger rocks and sediments in the northern and southern basin regions (Fig. 1). The assessments will be conducted at 1:500,000 scale, as this is the largest scale of available country-wide geologic data.

The goal of this assessment is to provide mineral resource maps for commodities and related mineral deposit types that will be important (a) for providing materials needed in the reconstruction and expansion of the country's infrastructure, and (b) for attracting foreign investment in a developing minerals industry. The mineral resources to be assessed will be divided into three categories: (1) industrial mineral resources (e.g. limestone, sand and gravel, clay, potash) (2) metallic mineral resources (e.g., copper, iron, gold, rare-earth metals), and (3) precious and semi-precious stones (e.g., emerald, ruby, lapis lazuli).

## **Capacity Building and Future Research**

Training of Afghan geoscientists will be an integral part of this assessment program. Training during Phase I will focus on developing an understanding and expertise in (1) mineral deposit identification and deposit model classification, (2) mineral resource assessment methodology, and (3) minerals information management. All three of these capabilities are essential in building and maintaining a viable national mineral resource stewardship.

Phase II field activities will strive to improve our understanding of the nature and distribution of known and undiscovered mineral resources in Afghanistan and will provide data and information that can be used in future assessments and exploration programs. These will include geophysical and geochemical surveys, characterization of remote sensing spectral anomalies, characterization and classification of mineral occurrences, mineral deposit genesis studies, dating of mineralizing events, and regional metallogenic analysis studies. A very important means of long-term transfer of technology and expertise will be creating mentoring relationships between USGS and Afghan geoscientists while conducting Phase II collaborative research.

Training will be provided at two levels. One level of training will consist of in-house training by USGS geoscientists through on-the-job assistance and through organized workshops that focus on the mineral resources of Afghanistan and neighboring countries. Another level of training that should be pursued by eligible Afghan geoscientists is formalized higher education at U.S. academic institutions. The USGS will provide assistance in identifying programs pertinent to the training requirements of individual Afghan geoscientists.

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