



U.S. Geological Survey Open-File Report 96-096

## Data Base for Undiscovered Deposits of Base and Precious Metals Released on CD-ROM

**NOTE:** A recompilation of this report has been released as [Open-File Report 02-198](#). The recompilation was undertaken to (1) make the data compatible with Microsoft Windows operating system, Macintosh operating system, Linux, and other types of Unix computers; (2) provide a more user friendly browser; and (3) correct a number of errors and numbering inconsistencies in the original Circular 1178.

Following a 2-year effort, the U.S. Geological Survey (USGS) has released Open-File Report 96-96, *Data Base for a National Mineral-Resource Assessment of Undiscovered Deposits of Gold, Silver, Copper, Lead, and Zinc in the Conterminous United States*. This is the first time that probabilistic estimates of the amounts of undiscovered gold, silver, copper, lead, and zinc in conventional types of mineral deposits have been provided in a single report. The results of the assessment are presented in an interactive Compact Disc Read Only Memory (CD ROM).

### Assessment Method

For this assessment, the conterminous United States was divided into 12 regions Adirondack Mountains, Central and Southern Rocky Mountains, Colorado Plateau, East Central, Great Basin, Great Plains, Lake Superior, Northern Appalachians, Northern Rocky Mountains, Pacific Coast, Southern Appalachians, and Southern Basin and Range. The assessment, which was conducted by regional assessment teams of scientists from the USGS, was based on the concepts of permissive tracts and deposit models. Permissive tracts are discrete areas of the United States for which estimates of numbers of undiscovered deposits of a particular deposit type were made. A permissive tract is defined by its geographic boundaries such that the probability of deposits of the type delineated occurring outside the boundary is negligible. Deposit models, which are based on a compilation of worldwide literature and on observation, are sets of data in a convenient form that describe a group of deposits which have similar characteristics and that contain information on the common geologic attributes of the deposits and the environments in which they are found. Within each region, the assessment teams delineated permissive tracts for those deposit models that were judged to be appropriate and, when the amount of information warranted, estimated the number of undiscovered deposits. A total of 46 deposit models were used to assess 236 separate permissive tracts. Estimates of undiscovered deposits were limited to a depth of 1 km beneath the surface of the Earth.

The estimates of the number of undiscovered deposits of gold, silver, copper, lead, and zinc were expressed in the form of a probability distribution. Commonly, the number of undiscovered deposits was estimated at the 90th, 50th, and 10th percentiles. A Monte Carlo simulation computer program was used to combine the probability distribution of the number of undiscovered deposits with the grade and tonnage data sets associated with each deposit model to obtain the probability distribution for undiscovered metal.

### Assessment Results

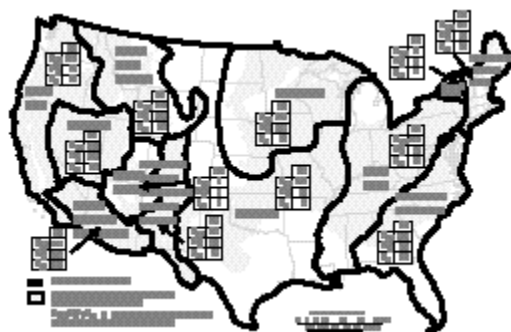
The greatest amount of undiscovered copper is anticipated to occur in undiscovered porphyry copper deposits in the Southern Basin and Range region of the country. Although this part of the country has been extensively explored, the amount of undiscovered copper that is estimated to exist suggests that a greater effort might be devoted to improving exploration technologies and to developing a better understanding of the occurrence of this type of deposit.

The greatest amount of undiscovered gold is anticipated to occur in the Great Basin region of the country in principally two deposit types hot-spring gold-silver and sediment-hosted gold. Of the two types, hot-spring gold-silver is expected to contain the greater amount of gold. This is a deposit type that warrants a greater effort in data gathering, particularly for those tracts that were delineated as being permissive for this type of deposit, but for which quantitative estimates were not made.

The greatest amount of undiscovered silver is anticipated to occur in sediment-hosted (red-bed) copper deposits mostly in the Northern Rocky Mountains region of the country. There were tracts in this region which were not assessed quantitatively; this suggests that more detailed information is needed for assessing those areas judged permissive for this deposit type. The large areas of these tracts also suggest that the recognition criteria for this type of deposit needs to be improved.

The greatest amounts of undiscovered lead and zinc are anticipated to occur in the East Central and the Great Plains regions of the country, principally in replacement type deposits exemplified by the Mississippi Valley type. The large areas of these tracts suggests that greater efforts should be made to improve recognition criteria so as to delineate better the areas of permissiveness for this type of deposit.

The accompanying [map](#) shows the combined permissive areas for the conterminous United States and estimates of the gross value of the estimated contained metal at today's prices for gold, silver, copper, lead, and zinc in undiscovered deposits in each of the 12 regions of the country. For each region, the 10th fractile (upper), the 90th fractile (lower), and the mean estimate of the gross value is given. At today's prices, the gross value of gold, silver, copper, lead, and zinc in undiscovered deposits is estimated to be \$1.2 trillion. This can be compared with the gross value at today's prices of the discovered (past production plus remaining reserves) gold, silver, copper, lead, and zinc, which is calculated to be \$1.4 trillion. Thus, for conventional-type deposits in the conterminous 48 States, excluding discovered material (identified resources) that have not been produced and are not currently classified as reserves, about as much is left to be discovered as has already been discovered.



## Use of Assessments

The uses of national assessments in long-range planning are primarily threefold. First and foremost is a look to the future. Current mineral inventories are necessarily finite and tied directly to current technologies. To meet future demands, new sources of raw materials must be found and new technologies must be developed to accommodate the processing of materials for the most part at progressively lower grades or for new materials that provide a property needed by society. Second is an ability to identify emerging issues. As a nation's economy evolves, greater attention needs to be paid to land use and the state of the environment.

National assessments provide the framework for addressing these issues at the regional and local levels. The need is to know where future resources may be located, how much metal such resources may contain, and what environmental impacts may result from the extraction of such resources are important considerations. Third is the role of national assessments in risk management. At issue are risks associated with resource adequacy, economic security, and environment degradation. By assessing the comparative risks, meeting society's immediate needs will avoid unnecessarily pre-empting solutions to future needs. National assessments are critical tools for making prudent decisions for the future.

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## Ordering Information

Copies of Open-File Report 96 96, *Data Base for a National Mineral-Resource Assessment of Undiscovered Deposits of Gold, Silver, Copper, Lead, and Zinc in the Conterminous United States* on CD-ROM can be obtained from the [USGS Information Services](#), Box 25286, Denver Federal Center, Denver CO 80225 0046, Tel: 303 202 4210; Fax 303 202 4695.

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