5 January 1968, Volume 159, Number 3810 SCIENCE

Meeting Needs for Heavy Elements

Advancing technology and a higher standard of living are creating demands for every chemical element. The special properties of many of the metals are being exploited. For instance, gold is used for spinnerets in forming synthetic fibers, for electrical contacts in switches, and for new brazing alloys used in joining semiconductor devices to metals or in joining glass and other insulating materials to metals. Nonmonetary use of gold in the United States has more than tripled in the past 10 years, and the expansion continues. Use of other metals, such as the platinum group, silver, tin, and antimony, also has been growing. The quantities involved are substantial, and in none of these is the United States self-sufficient. To meet present needs, the United States must expend annually more than a billion dollars for imports of these elements. Our industrial growth in the future could be limited by inability to pay for expanded requirements of heavy metals.

For nearly 60 years following the discovery of gold in California in 1848, the United States was the world's leading producer of gold. Today, our production is only about 4 percent of the free world's total. The rich placer deposits are exhausted, and once-profitable mines have been closed. Recently, however, because of expanded activities by the Geological Survey and the Bureau of Mines, the outlook for gold has improved. The Geological Survey is providing a better assessment of the occurrence of gold, and the Bureau of Mines is devising better and cheaper means of recovering it.

The Survey has devised a sensitive field procedure to assess the occurrence of gold in rocks. Following sample preparation, the gold is extracted and measured by spectrophotometry. Using this method, the Survey has been examining a large number of samples. Average rocks contain 5×10^{-9} part of gold, or an amount worth about a half cent per ton of rock at the current price of $35 per ounce. When rock undergoes weathering or other geochemical processes, concentration of the gold can occur. The Geological Survey estimates that between 10^9 and 10^{10} ounces of gold are present in about 50 cubic miles of rock located in northwest Wyoming. This corresponds to a concentration of about 100×10^{-9} and an average value of about 10 cents per cubic yard. However, local concentrations higher than the average exist, and mining in some of these localities might prove to be economical.

In Nevada the Survey method has pinpointed two ore bodies, one at Carlin (already being exploited) and another at Cortez. Both ores average about 10 parts per million, or 0.3 ounce per ton, and can be mined by open pit methods.

Among other projects, the Bureau of Mines has been seeking better ways of extracting gold from ores and has been investigating the possibility of leaching in place. In the established leaching procedure cyanide solutions are used. The poisonous character of the cyanide and its ineffectiveness in the case of some ores are undesirable features. The Bureau of Mines has discovered that malononitrile is an effective, nontoxic substitute for HCN.

The new government-sponsored heavy metals program has been in operation for a year and a half. It promises some amelioration of our balance of payments problem and a better assessment of our natural resources. However, the gap between prospective needs and proven reserves is great, and the problem deserves the attention of many competent scientists and engineers.—PHILIP H. ABELSON