

Department of the Interior research, which is designed to complement industrial efforts, is aimed: at devising efficient concentration methods to significantly reduce the 114,000 tons of copper annually discarded as mill tailings; at developing thermodynamic and reaction kinetics data on which to base new reduction and smelting processes; at gaining the technology for improving leaching and recovery practices; and at developing new mining systems that will enable faster, safer, and less expensive extraction of ore.

FERTILIZER MINERALS

An urgent demand for food and fertilizer is being felt around the world. Rapid population growth and rising standards of living in emerging nations is expected to compound the demand.

The United States now exports \$325 million worth of fertilizer annually, and it probably will raise this figure to \$1 billion by 1970. Fertilizer exports have considerably more leverage than food exports in averting mass famine. Food worth \$1 million will feed only 70,000 people while fertilizer worth \$1 million will help provide food for 200,000 people. It is evident that expansion of the fertilizer industries can be expected at an accelerated rate and that problems associated with the efficient development and exploitation of phosphate and potash should be given high priority.

With current practice, more than one-third of the phosphate rock mineral is lost before conversion to fertilizer. Department of the Interior research is directed toward development of beneficiation methods to avoid processing losses and to allow economic mining of lower-grade deposits.

Potash presents Interior research scientists with a different type of problem. The domestic potash industry faces a competitive disadvantage in relation to the rapidly growing Canadian industry. Canadian reserves, second largest in the world, are exploited at lower costs than are U.S. deposits. Only the development of more efficient techniques to recover potash from low-grade ores and brines will prolong the existence of the domestic potash industry.

IRON

Domestic and international developments in iron ore production during the last 15 years have been characterized by rising demand, by a shift of production from the United States to foreign suppliers, and by an increase in beneficiated iron ore in proportion to total output.

U.S. consumption of iron ore is expected to increase by 34 percent between 1965 and 1980. Iron and steel manufacturers need the assurance of a high-quality, minimum-cost feed material. The ore producers need an advanced technology which will permit them to exploit domestic iron ore resources at a cost competitive with foreign ores. For meeting these needs, the Department of the Interior is conducting research to devise a technology capable (1) of recovering iron efficiently from the vast resources of domestic iron ores and (2) of making higher quality concentrates and stronger agglomerates than are currently obtained. The improved beneficiation procedures should make the domestic ores competitive with foreign imports; this would tend to stabilize the price and supply situation for American industry. The higher-grade, stronger agglomerates will further improve the efficiency of iron making because they will increase blast furnace throughput and reduce coke and flux requirements.

SULFUR

Sulfur consumption rose 44 percent in 5 years to 8 million long tons in 1965, primarily due to increased production of phosphatic fertilizers. Since 1963, demand has exceeded production; withdrawals from producer stocks have met the deficit. The drop in stocks has resulted in recent price increases. Sulfur is now at its highest price since 1919.

Nearly 65 percent of the sulfur produced in the United States is obtained by Frasch mining of domes in the Gulf Coast area. While apparently sufficient to support the present level of production, this source will not be adequate to satisfy the expected growth in sulfur demand. About one-quarter of U.S. sulfur is recovered from sour natural gas and sulfur containing refinery gases; however, a major future increase in sulfur from this source cannot be expected.

To meet projected demands for sulfur, Department of the Interior research centers on recovery from alternate sources. An economic treatment for flue gases