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BUREAU OF MINES ☆ UNITED STATES DEPARTMENT OF THE INTERIOR

Minerals and Materials

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Minerals vs. the Environment: Do We Have to Choose?

Also in This Issue:

- Alaska's National Petroleum Reserve
- The Importance of Sulfur

FOREWORD

Either protect the environment or exploit it. Are the choices really that simple? The Associate Director for Information and Analysis for the U.S. Bureau of Mines, David S. Brown, thinks not. In an article beginning on Page 1, Brown points out that modern society must continue to have access to the earth's minerals for the same reason that it must learn to protect its environment: Both are necessary for survival.

A major, largely unexplored source for new minerals may be the huge National Petroleum Reserve, on Alaska's Arctic shore. Enviromentalists would like to turn the Reserve, which is larger than 13 states, into a wildlife refuge. In his article, starting on Page 7, Robert S. Hoekzema--a supervisory physical scientist for the Bureau of Mines in Anchorage--describes the need to study mineralization in the reserve while there is still time.

Far to the south of Alaska, in the sun-baked hills of West Texas, is the largest sulfur mine in the Western World. The most important of all industrial chemicals, sulfur is used primarily to manufacture phosphatic fertilizers. The article, starting on Page 15, tells the story of sulfur production from the Frasch wells of Culbertson County, Texas, to the fertilizer plants of central Florida.

Harold Kennedy, Editor
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Mineral information and data are provided by the commodity and country specialists, research personnel, and State mineral officers of the Bureau of Mines.

The U.S. Bureau of Mines is charged by Congress to help ensure that the United States has an adequate and dependable supply of minerals to meet its defense and economic needs at acceptable social, environmental, energy and financial costs. Founded in 1910 to study "the safety of miners," the Bureau also is required to collect, analyze and disseminate information on minerals and to conduct minerals research.

As part of its statutory mission, the Bureau publishes *Minerals and Materials* six times per year. The Secretary of the Interior has determined that the publication of this periodical is necessary in the transaction of the public business required by law of this agency. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget. Views expressed in articles do not necessarily reflect Bureau of Mines policy. Comments and inquiries should be addressed to the Editor, Minerals and Materials, U.S. Bureau of Mines (MS 5201), Washington, D.C. 20241.

Minerals and the Environment: We Don't Have To Choose Between Them

by David S. Brown

What troubles me so often about debates over the environment, which I have heard since I entered government in the late 1960's, is that the issues are so often presented as a false dilemma--the either-or fallacy in logic. The either-or fallacy allows only two possible choices: Either protect the environment or exploit it. In reality, however, there may be a few more options. The diverse, often competing, values that the Earth offers require us to weigh and balance those options through a range of policy options. A quality environment and economic growth and opportunity are not mutually exclusive.

First, let me acknowledge that I support a set of resource values recognized in U.S. laws and deemed important down through history for the success of free, progressive, and secure societies: the importance of access to raw materials. Increasingly, however, mineral raw materials have been viewed at best as not particularly relevant to a sophisticated, technologic society, and at worst monstrously destructive of our natural environment. Both perceptions, in my judgment, are wrong.

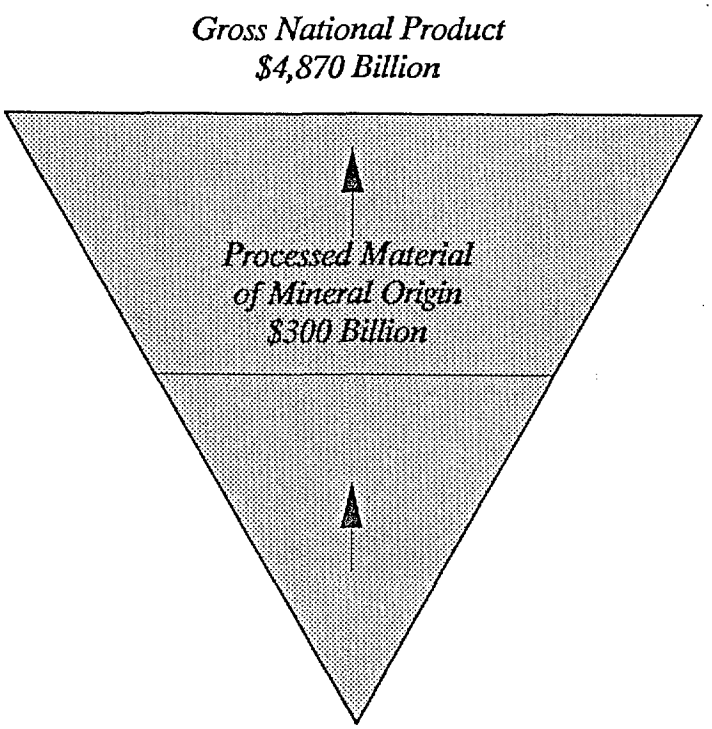
I start from a very simple premise: Everything is made from something--either renewable or nonrenewable resources. So the substance of things, if you will, and where and how we obtain this is of vital importance and concern. Mineral elements, whether common or exotic, are essential societal building blocks.

You can think of national economies as great pyramids with service and commercial sectors at the top, followed by light, then heavy industries. At the base are agriculture, energy and raw materials. These base industries historically have been singled out for special emphasis and treatment by governments because they create wealth. In 1988, the value of materials produced from raw nonfuel minerals mined in the United States was $300 billion. Dependable, reasonably priced food, energy, and minerals have determined the growth of nations and the course of history. They determine whether a superpower, for example, will have maximum options to protect its security and interests when they are challenged or threatened in the world.

"...we now seem to have forgotten that umbilicallike connection to our natural resource base..."

Once, Americans better understood the dependence on the Earth to supply our basic needs. Yet, we now seem to have forgotten that umbilicallike connection to our natural resource base and the need to properly conserve, develop and manage it for today and future generations. Other nations seem not so jaded. The Canadians, the Australians, the South Africans and the Chinese, among others, are committed to the orderly

How Nonfuel Minerals Feed the National Economy



Nonfuel minerals are the bottom tip of a vast inverted pyramid that is the national economy. In 1988, American mines produced an estimated $30 billion in raw minerals--unprocessed ores, sand, gravel, stone and so on as they come out of the ground. Those minerals were used to turn out a total of $300 billion in finished metals, brick, glass, cement, fertilizers, and other processed materials. These processed materials were the necessary building blocks for all goods and services making up the Gross National Product, an estimated $4,870 billion in 1988.

inventorying and use of their mineral storehouses. Certainly, Third World development is inextricably linked to natural resources. Minerals are key to laying the economic infrastructure in much of the Third World. Third World nations understand this completely.

To most Americans, on the other hand, electricity comes from a wall socket, gasoline from a pump and chrome from Detroit. Yet, each American will use 40,000 pounds (lb) of new materials each year. A new-born citizen in his lifetime will use, among other things--

- 91,000 lb of iron and steel.
- 795 lb of lead.
- 757 lb of zinc.
- 1,500 lb of copper.
- 3,593 lb of aluminum.
- 360,500 lb of coal.
- More than 1.2 million lb of sand, gravel, stone, clay and cement.

We tend not to sense minerals in our lives because their identities are commonly hidden in the finished product. Yet, what we take for granted comes to us by farsighted planning, exploration, often risky investments and the commercial development of the Earth's diverse mineral endowment.

The Economy's Mineral Base

Mining may not be the dominant industry it once was in this country, but it is not a relic of the past. Nor can we allow it to become a relic. America's future must be more than Americans selling each other insurance policies, cutting each other's hair and playing with Japanese lap computers. Today's knowledge-information-service-oriented economy rests on a sound, viable minerals base. For example--

- When we work at our computers, we are using beryllium, gallium, germanium, lithium, platinum-group elements, quartz crystals, rare-earth minerals, rhenium, selenium, silicon, strontium, tantalum and yttrium.

- The aircraft that flies you to business or vacation destinations is made of chromium, titanium, cobalt, manganese, nickel and tantalum.

The list is endless. Energy industries require 29 different nonfuel minerals to harness and deliver the energy they use. Our telephones uses 42 different minerals. The

The world's food supply depends upon a steady supply of fertilizer, made from phosphate, nitrogen, sulfur and other minerals found in the earth.

electronic industry uses 85 elements. Surgical tools and artificial organs require high-tech metals.

Whether high tech or soft tech, we need minerals, and these minerals need to be found, mined, concentrated, smelted, refined, and made into useful products for consumer and industry. And the matter of where we get these minerals at reasonable costs and in dependable supplies becomes of paramount importance.

"A basic geologic principle is the Earth's resources are where you find them, not necessarily where you want them to be."

The lifeblood of mining is access--access to lands that need to be explored and inventoried for their mineral values. Access to public lands here in the United States is particularly important because those lands have the greatest overall mineral resource potential. Surprisingly, as the last decade of the 20th century approaches, much of these mineral resources are unexplored and undeveloped.

Yet, of the three-quarters of a billion acres of public lands in the United States, more than half is withdrawn or restricted in some form to mining access. Tens of millions of additional acreage are being proposed for similar lockup, even though our national policy for these lands is to have multiple uses such as livestock grazing, wildlife habitat, timber harvesting, recreation, and mining. Conflict arises when one of these multiple uses becomes the exclusive use. When preservation, for example, excludes all other uses to which the land can be put, those other values are lost--including the opportunity to explore for minerals.

Minerals are invisible resources. Animals can be counted, water measured, recreation uses calculated, game harvest tallied and even aesthetic qualities observed. But subsurface resources are usually concealed, making them more difficult to assess. You have to have access to assess. A basic geologic principle is the Earth's resources are where you find them, not necessarily where you want them to be.

Often, the same geologic forces that created the mountains and their scenic beauty--the volcanic action, faulting uplifts, and movement of tectonic plates--are also the forces that account for the migration and deposition of minerals in those areas.

To Have and To Have Not

The formation of minerals in the Earth's crust also occurred without regard to our desires or needs. Inequality of mineral distribution is a geologic fact. Some states are more richly endowed than others. Some nations are more blessed with minerals than others. Many Third World countries have vast, yet-untapped mineral resources. The United States, for its part, is both a "have" and a "have-not" nation.

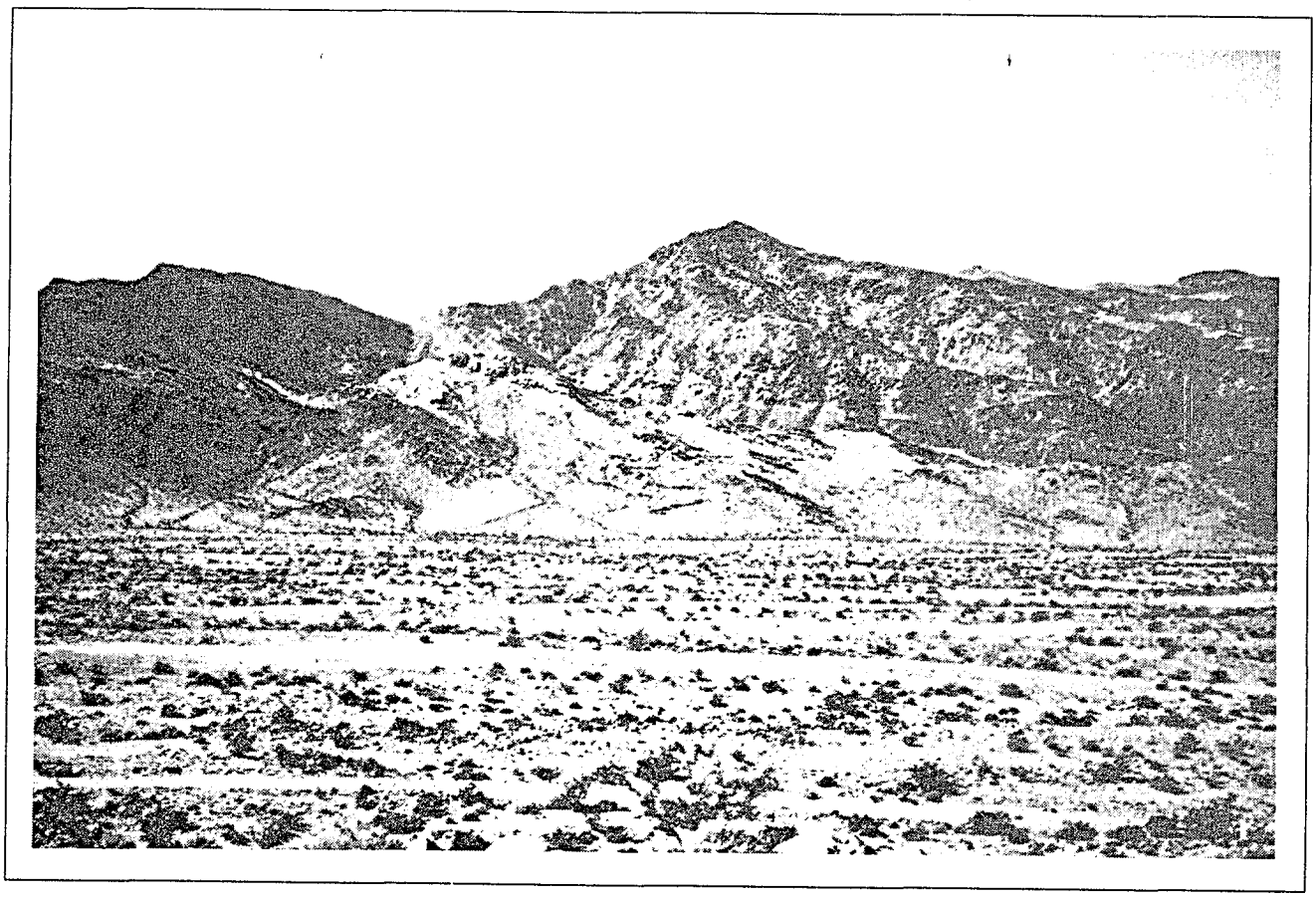
"About 3,000 mineral elements are found in the Earth's outer crust."

About 3,000 mineral elements are found in the Earth's outer crust. The range of products is phenomenal, running from the most precious gems to sands for computer chips to rare strategic minerals upon which our defense security rests.

When it comes to strategic and critical minerals, such as cobalt, manganese, chromium, and platinum-group minerals, the Earth worked overtime in southern Africa. That region holds a virtual monopoly on those elements so essential to modern technologies and defense security. How stable and how reliable a source southern Africa may be in the future is of no small consequence, particularly for the United States, where strategic and critical resource are rare. When they do occur, they often are in lands withdrawn or proposed for withdrawal from exploration and mining access.

Therefore, we import most, if not all, of our strategic and critical minerals. The public policy issue is how can we reduce or mitigate these imports which are, after all, subject to disruption of market distribution. There are several actions which in combination can help lessen, but not eliminate, our strategic and critical-mineral import dependence: recycling, conservation, substitution, and increasing domestic supplies. Tremendous advances in our geologic understanding and in exploration and development technologies can allow us to get at strategic and critical minerals without doing harm--even in some environmentally sensitive parts of the United States.

One current example where the multiple-use land concept is under attack is the California desert, where some want to put



Protecting wilderness areas, such as the California desert, and providing the minerals required for national prosperity need not be mutually exclusive goals.

millions of acres of land into a wilderness area, making it off limits for exploration and mining.

The California desert area is one of the most highly mineralized areas of the world. Some 65 known minerals worth $1.2 billion a year are mined in the desert. Its unique geologic terrain, for example, houses the richest known commercial deposit of rare-earth elements in the world. Rare-earth elements are used in the new superconductors that could revolutionize electrical transmission, communication and transportation.

The U.S. Geological Survey and the Bureau of Mines have studied only about 20% of the total desert area or one-third of the Wilderness Study Area. Our work has revealed significantly more resources than thought possible, particularly minerals used in energy, pollution control systems, and ceramics, and chemical refining.

" We should not blindfold ourselves to the earth's mineral endowment."

So, we have here one of those ironies of the American political process. Having declared superconductivity the technologic race of the century with the Japanese, at the same time we may be barring access to the one part of the country that has the raw materials that the new technologies require. We should not blindfold ourselves to the earth's mineral endowment.

Being a good steward of the great natural heritage God has given us means knowing what you have and applying foresight and skill to see it is used for the enjoyment and benefit of this and future generations. Having a quality environment and developing mineral resources are not mutually exclusive goals. We can and must have both.

David S. Brown is Associate Director for Information and Analysis of the U.S. Bureau of Mines. This article was developed from his speech on May 17, 1989 to the 27th Annual International Affairs Symposium at Lewis and Clark College in Portland, OR.