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--- DEPLETION OR DETERIORATION?

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MINERAL RESOURCES -- DEPLETION OR DETERIORATION?

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Recent estimates of worldwide mineral reserves tend to create a false sense of security because they set forth a total supply based upon "our current rate of consumption." This complacency is reinforced by pointing to the technology that has enabled us to mine ever-lowering qualities of raw ores, especially when each fractional lowering of the cut-off grade multiplies reserve tonnages. Counter forces at work, however, could seriously inhibit our ability to achieve the production deemed necessary in all forecasts. Thoroughly evaluating the extent of these outside forces and how they may impede expansion is beyond the scope of my presentation. The purpose here is to identify some of these disturbing forces and to assess their impact in qualitative terms alone.

A precedent for alarms of this kind was stated by Major Brooks in the 1873 report of the Michigan Geological Survey on the iron mines of the Upper Peninsula: "If ever there comes a period when our iron mines do not pay, it may be due largely to horses." He was not concerned about the ore reserves. Michigan was producing about one million tons per year at the time, and has since produced about 900 million tons. What he was concerned with was the blind faith the operators placed in the use of horses for haulage even though their continued use was uneconomic. And he went on to show unless this belief was shaken, horses would be their undoing.

DETERIORATION OF OPPORTUNITY

The winning of a mineral resource makes demands upon the collateral resources of land, air and water. It also demands time and money, as well as an opportunity to use all these factors in the required proportions. Our most immediate problem is the deterioration of this opportunity -- not the depletion of the mineral resources. Perhaps the most spectacular shrinkage of opportunity

confronting us is the luxury of being able to take our time. In the period ending fifty years ago, the world took 13 years to consume one billion tons of steel. Today, it takes just a little over two years, thus drastically reducing the availability of time. All predictions point to a worsening. If the worldwide rate of increase in steel consumption is five percent annually, the growth in iron ore production must be 34 million tons per year for each of the next ten years. The next decade after that will require an increase of 57 million tons per year. In other words, the world will soon have to add new capacity equal to Michigan's 1965 production every five months, and then, ten years from now, start adding the same new capacity every three months! This sort of trend-projecting is fraught with uncertainties. Some statisticians label it "projectile prediction." But we do have some very positive reasons to give it credence.

In some respects the entire world is now experiencing problems of growth similar to those of the United States in the late 1870's. Our population was expanding rapidly, the railroad boom was on, and industrialization was gaining momentum. The only thing restraining our phenomenal industrialization was the rate of technological invention itself. Today, in the unindustrialized areas of the world, there is no need to wait. The technology, the tools and the materials are known. Development will depend solely on the will of the people -- whether they choose to discipline themselves to the necessary social and political organization for this knowledge to be effective. Few will be able to duplicate the rate of Japan's progress. Even with piecemeal world development, the demand upon the world's mineral resources will be tremendous.

CAPITAL NEEDED

Time and money have always been entwined -- in many cases interchangeable. If time must be more intensively used to provide needed productive capacity, new plants of greater size must be built. Using iron as an example, pre-production investment in new mines is approaching $40 per

ton of annual capacity. If the new mines are designed for ten million tons per year, the accumulation of investment money is $400,000,000 for each new venture. Government policies in many countries militate against such accumulations. Money given out for immediate welfare does not accumulate in capital funds. Furthermore, some groups believe profit from mining is a form of robbing the people of their heritage. Even under a philosophy that grudgingly accepts the recapture of investment through depletion and depreciation allowances, we can anticipate a continual deterioration of the opportunity to finance the necessary growth from within the industry itself.

Among the elements, air has always been free for the taking -- "free as the air we breathe" is part of our language. This is no longer true. Heretofore industry has been able to use the atmosphere as a dump. The fugitive gas, smoke, and dust of industrial operations have been allowed to escape in the belief infinite dilution rendered them harmless. But dilution takes time and it takes space, and the space is becoming occupied by people who want to use the air for some other purpose. Industry is no longer the sole offender. Everybody is presently in the act contributing automobile exhaust and space-heating fumes. This competition between industry and people for the necessary space compounds the problem for industry. Industrial plants will have to be rigidly policed before people will take their own private restrictions seriously.

The change in scale of acceptance over the years is interesting. At one time the devastation at Sudbury was an acceptable consequence of a mining operation. Recently Mr. James Garvey, President of Bituminous Coal Research, Inc., said that if Public Health Service suggestions on sulphur content of coals burned in Midwest utility plants were followed, only 8.7% of the coals now used could qualify. Much research is underway on removing sulphur from coal, but, so far, the processes are costly. Whatever the costs, vast tonnages of this important energy resource will be downgraded.

WATER RESTRICTIONS

The opportunity to use water is another example of resource restriction. In many parts of our country, all known sources of water have already been pre-empted. New water used may have to be purchased by fishermen, boaters, swimmers or just viewers of scenery -- all carrying more votes than miners. If miners are the intruders, they are going to have to make themselves acceptable in this society. Water will have to be returned, if it is allowed to be used at all, in as good a condition as received -- again adding just one more cost toward the deterioration of a mineral.

SPACE RESTRICTIONS

The use of land in producing minerals has even a greater impact on people than water. Besides the mine itself, land is required for waste dumps, tailing ponds, access roads, and rights-of-way for pipe and power lines. Although strip mining is the most notorious competitor for land use, there are other mines where the pressure of people is making the competition quite intense. One given too little consideration is the quarrying of rock for road metal and concrete aggregate.

In our eastern states, a good many quarries started in wide open country have been surrounded by suburban development. When that happens, the operators find themselves subject to all sorts of costly restrictions. The size of explosive charges is limited; dust and noise thought to be the usual accompaniment of quarrying suddenly become intolerable nuisances; access and transport become restricted by load limitations on vehicles. Some quarries are unable to continue. Those financially able to do so, move to new locations farther out in the country, with a consequent increase in the cost of rock to the communities served. In such instances, the reserve represented by the abandoned quarries is not depleted -- the rock is still there. It simply deteriorated to the point where it is no

longer an economic resource. The only way this situation could have been avoided would have been to buy up, at a very early date, all the land that would ever be needed. Even if this foresight had been exercised, the mere approach of urban development would have increased taxes making the land impossible to hold. An impending further consequence of this squeeze is even more serious. After one or two moves outward from a huge metropolitan area, the operators are going to meet the outward moving quarries from other metropolitan centers. When this collision takes place, the next move will have to be a big one.

Another mineral opportunity affected by population encroachment is solution mining of rock salt. In former years, the subsidence resulting from pumping took place in wide open areas of no consequence. Today, the occupation of the land over salt deposits may entirely prohibit extraction by this method.

USERS PAY COSTS

You may say this is all very well for the few examples cited, but are there not vast areas of undeveloped land unexplored for minerals? This is true, but remember, the value of minerals, especially low-priced bulk minerals such as stone and salt, is largely a matter of location. Mining far removed from the point of use greatly increases the price to the user. We must also remember wide open spaces have their protagonists, too. A few years back, exploration was denied inside our Porcupine Mountains State Park. The western states experienced many similar examples of competitive pre-emption. This kind of hindrance to mineral acquisition is bound to increase price to the user. If the increase is enough to cause curtailment of consumption, we have another instance of deterioration of an otherwise minable deposit.

These examples illustrate a trend in resource opportunity inter-

ference. For the moment at least, this conflict can be resolved by the simple interplay of supply and demand. If the increased cost is worth the price, then one of these conflicting opportunities will prevail and the over-all resource allocation pattern will adjust itself. But for the mineral producer, the cost of victory must be compensated by an increase in the real price of the minerals to the consumer.

AVAILABILITY ENGENDERS COMPLACENCY

The theme of this paper can be stated in a different way. We are not going to run out of minerals in the sense that the cornucopia will be empty. In fact, we will never run out at all. But this simple truth has engendered a complacency blinding us to the intermediate adjustment somewhere between satiety and hunger. What, for instance, would be the effect of doubling the pre-production investment cost in an iron mine during the next ten years? Add to this the increase in operating costs to make the operation acceptable to people crowding in with their own objectives. Answers to such questions are being sought in a U. S. Bureau of Mines study.

Our present system of expansion of individual opportunities, each from its own center of interest, is akin to what the operations research people call sub-optimization. This refers to the perfection of one component of a system without regard to what it does to the other components. Highway planners seem to have fallen victim to this narrow-minded approach, judging from the violent reactions generated in one city after another all over the country. Why, for instance, do we need vast wild areas set aside if all we are going to use them for is viewing from the seat of an automobile? Couldn't we solve this by substituting panoramic three-dimensional television billboards and use the land for something else? In the field of mining, what can a miner afford to invest in the development of an ore deposit after someone has built a

million-dollar ski resort on top of it.

POPULATION PROBLEMS

There is a peculiar quality to the population density problem of our country. Although we have a relatively low density over all, our population is so mobile, and can range so far from home, density problems can be created in many different places at different times, all by the same people. Park rangers complain of bumper-to-bumper traffic; our state parks are jammed with people who left crowded conditions in town to enjoy crowded conditions in the parks. This activity creates a popular demand for more stretch-out room, and any encroachment, however small, is militantly opposed by large numbers of people. Therefore, miners are the victims of an unreal pseudo-density influencing resource management as effectively as an actual but less mobile density.

Much thinking recently upon availability of world resources is sub-optimal. To questions such as "Can we feed the expected additions to our population?", the answer has been "Yes". But I do not find any analysis of the cost to the other needs generated concurrently. Apparently the the energy problem can be solved if we look at fuel resources as the sole ingredient of the problem. But what are the costs to the land, water and air resources?

In the light of all predictions concerning the tremendous increase in the demands for minerals, energy, fertilizers and food, the question is not of running out, but of leveling off. Can all these demands be satisfied simultaneously, or must one of them bend to the fulfillment of the others, and what will be the side effects if it does?

VALUES

The grand-scale studies in progress for some time now, definitely point the way. Now that we know the way, it is time that we proceed with

better inventories of our resources, our lands, our soils, our minerals and our waters. We should be thinking about the relative values of all these resources under several systems in which they could be combined. And while we are thinking about values, let us not forget the things that make life worth while for the mind and the soul as well as the body. Let us not forget that all of man's evolution has been geared to a cycle of seasons, having a span of 365 days. Now within one generation we expect him to gear his biological time clock to a flip-flop switch. Unless the frustrations, the phobias and the neuroses generated by this trauma are considered in future resource allocation, all of the material studies will go for nought.