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STATE DEPARTMENT OF GEOLOGY & MINERAL INDUSTRIES
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# DON'T YOU BELIEVE IT!

## Introductory

Statements, supposed to be based on a comprehensive knowledge of the mining industry, issue from non-technical official Washington sources from time to time. One such statement was in substance that mining has lost much of its element of risk and has evolved into large scale operations comparable with large manufacturing projects. This was especially enlightening to miners in the West. Now Mr. William L. Batt, Vice-Chairman of the War Production Board, is reported to have stated in a public address that many of our natural resources are approaching exhaustion - that in the field of minerals and metals after the war we shall be a "have not" nation. In his address he advocated that stockpiles of critical minerals be accumulated from imports and that our own dwindling mineral supplies be used as sparingly as possible so that they would be available for use in a possible future emergency.

If such statements did not represent the thought of leaders who shape our policies, they could be dismissed as made by persons unfamiliar with the technical side of mining, but the implications contained in the statements made by Mr. Batt are especially dangerous to the maintenance of a healthy domestic mining industry. Such statements should be carefully and fully examined.

To people unfamiliar with the mining industry, Mr. Batt's ideas sound plausible. If we are using mineral supplies at an unprecedented rate, and this is true, then the apparently logical conclusion is that the remaining reserves should be preserved in the interest of national safety. However, there are two principal fallacies involved. They are the dogmatic assumptions, first, that our known reserves have been dangerously depleted, and second, that these known reserves represent the limit of our mineral resources.

Let us examine the record of allegedly depleted reserves of metals in order to weigh these assumptions.

## Domestic Mineral Reserves

Tin: The United States always was a "have not" nation insofar as known reserves of tin are concerned. If the pre-war recommendations of many informed individuals and groups concerning stockpiles had been acted upon by those in authority, the severe shortage of tin supplies would not have developed. Adequate stockpiles of tin should be maintained after the war and of course they must represent imports.

Nickel: Many of the same conditions exist with regard to nickel. A very important difference between tin and nickel supplies, however, is that the principal source of nickel is in Canada, and delivery of this important metal is not dependent on ocean transportation. Presumably this source of supply would be available to us in a future emergency. Nevertheless, in the interest of national security, nickel should be stockpiled and as large a proportion as possible should be utilized from the production of an American-owned operation in Cuba.

Chromite: As for chromite, large reserves of low-grade chrome have been developed in this country, and post-war reserves will be much greater in the aggregate than those known before the war. Adequate reserves of metallurgical grade ore have always been lacking. Utilization of this low-grade chromite is a metallurgical and economic problem; at present there is no question of depletion of reserves. Processes for producing a metallurgical grade product from our low-grade ore have been worked out in detail. At the beginning of the war when our supplies of chrome were dangerously low and submarine sinkings were alarming, the War Production Board made strenuous efforts to get all our low-grade deposits into production. They wanted all the domestic chrome they could get and were not very critical of the grade. Of course there was a large time lag and, before the low-grade could be utilized, imports relieved the shortage. The plants to treat low-grade were then closed. In the interest of national security the low-grade should be treated on a commercial scale to produce an acceptable metallurgical product so that we should not be so dependent on foreign ores.

Manganese: Before the war our metallurgical manganese ore supplies were mainly obtained from foreign countries. The war has greatly stimulated production so that our domestic output, principally from Montana, fills a material part of our requirements. It is reported that the production from Montana and that from Cuba would supply from a third to a half of our peacetime needs. A large plant producing manganese oxide from low-grade ore is now in operation in Nevada. Large reserves of low-grade ore, some of them partially developed, are known to occur in the West. While part of our post-war requirements will necessarily be imported, our domestic industry is fully able to supply a larger proportion of our domestic demand than ever before.

Vanadium: Domestic vanadium reserves have been greatly increased during the war period. Aside from the deposits of vanadium ore in the West, large reserves of vanadium-bearing titaniferous magnetites have been developed - principally as iron ores. Processes have been perfected for the extraction of vanadium from these ores.

Molybdenum: The United States possesses by far the largest known reserves of molybdenum. In addition to the large quantity developed at the Climax property in Colorado, the large porphyry copper mines now produce a very material amount of molybdenite as a by-product of copper operations. A shortage of molybdenum is not discernible at the present time. If we were to import molybdenum ore where should we look for a foreign supply?

Mercury: As for mercury, domestic conditions are clear-cut. Production in this branch of metal mining reflects price changes more quickly than in any other. Under the price incentive, beginning in 1939, and spurred by national need as well as urgings of the War Production Board, the industry increased production enough to meet all needs. Several important new discoveries have been made as a result of intensive exploration, and the known reserves now are greater than before the war. Our large production, augmented by imports, has resulted in a large stockpile accumulation, and the domestic price has dropped sharply. Domestic production is therefore falling off. If because of low price the domestic industry sinks again into relative obscurity, as now seems likely, it would require considerable time to raise production sufficiently to meet another war emergency.

Tungsten: This country was short of tungsten when the war began as we had been mainly dependent on imports. Adequate stockpiles had not been accumulated. Under the stimulus of price as well as need, production increased and new deposits were developed so that we have been able to meet war needs. This procedure was time-consuming as it would always be with this or any other like mineral. Known domestic reserves of tungsten are greater now than ever before.

Antimony: Antimony supplies were in much the same category as tungsten when we entered the war. Most of our antimony had come from China. When these supplies were cut off, we were finally able to produce a large part of our needs through increased capacity of smelters treating antimonial lead ores, together with production from the Stibnite mine in the Yellow Pine district, and the increased output from new facilities in the Coeur d'Alene, both in Idaho. Increased imports from Mexico also added to supplies until at the present time there is no shortage of antimony. Certainly our antimony reserves have not been depleted.

Aluminum: Concerning aluminum, it is common knowledge that present reduction methods require high-grade bauxite and that domestic reserves of this grade - never very large - have been largely depleted. Large reserves of high-grade bauxite are known in the Guianas and these sources are being drawn upon. For reasons peculiar to the aluminum industry, these imports will continue after the war. The domestic industry is thus dependent on material subject to the war hazards of ocean transportation while large reserves of low-grade bauxite and very extensive reserves of high alumina clay are known in this country. Testing work to develop commercial processes for production of alumina from these lower grade materials is being conducted by private groups and by the U.S. Bureau of Mines. It seems obvious that national security demands that this testing work should receive national support. The technical problem concerned with utilization of the low-grade materials is primarily an economic one. Interest in its solution should not lapse because the immediate need for domestic sources of alumina has lessened.

Magnesium: Pre-war production of magnesium had been relatively small. Increased use of light metal alloys, occasioned by the war, multiplied the demand for magnesium many times. Fortunately for the country, the Dow Chemical Company had previously worked out plans for producing magnesium from sea water on the Gulf Coast. The facilities designed by this company were expanded without difficulty and thus the shortage of magnesium did not become serious. In addition, other processes, some not well developed, were applied and plants to use them were built. Raw materials for these plants are dolomite, brucite, and magnesite. Some of this production is costly, but at the present time it is reported that magnesium is being produced in excess of all our needs. This is an illustration of what American metallurgists and engineers can do, given time. Certainly no one who is informed can assert that domestic raw materials needed for the production of magnesium have been depleted.

Copper, Lead, Zinc: For the purposes of this discussion, copper, lead, and zinc fall in the same classification. Undoubtedly, serious inroads have been made in known domestic reserves of these metals. It is believed by the writer that a major mistake in policy was made early in the emergency period in fixing the ceiling prices of these metals, particularly copper. This policy was an effective barrier to expansion, not only in the search for new deposits but also in the utilization of marginal ore bodies. Later on, the price restrictions were grudgingly liberalized somewhat but the strings attached to the bonus prices allowed were strict enough so that nothing in the way of substantial new prospecting or the opening of new mines resulted. Thus depletion of known reserves was the inevitable result. After the war, removal of Governmental domination together with a less oppressive tax policy would put new life into the industry and would certainly result in new discoveries of copper, lead, and zinc deposits. There should be sufficient incentive to operators so that they may be encouraged not only to produce from domestic properties but also to engage actively in exploration. From evidence at hand, it appears that known world reserves of zinc are not large. The long range future for zinc is uncertain, but we should have a domestic price sufficient to encourage exploration.

Iron: Because of the huge demands of a highly industrialized nation for steel, iron ore needs stand out in national importance. Even before the war, the end of the easily mined high-grade Minnesota ores was in sight. The war has speeded up the depleting process. This does not mean, however, that the iron ore resources of this nation are approaching exhaustion. It does mean that we must soon turn to sources other than the soft ores of the Lake Superior region in order to supply our steel industry with a large part of its

requirements. These new sources are known and are very extensive. In general, it means a somewhat increased cost of ore and some metallurgical problems which are being worked out. It means also greater use of western iron ores. It seems likely that imports of iron ore from South America will increase over a period of years, but placing emphasis on need for importing large quantities of South American iron ores, for instance from Brazil, would result in weakening our iron mining industry, the backbone of our industrial progress.

## Comments and Conclusions

It is clearly evident that our mineral resources are not in the depleted condition indicated by Mr. Batt. Some of our metallic ores have greater known resources than ever before. Known reserves of copper, lead, and zinc ores have been heavily drawn upon. National policies have been largely responsible for failure to develop new reserves to replace those mined out, but this condition could be corrected. Iron ore resources are still huge even if the end of the "soft ores" is in sight.

In analyzing Mr. Batt's ideas, some rather tough questions for him to answer bob up. He says that we should 'use as little as possible of our own precious remaining supplies." They are not supplies unless they are either mined and lie on top of the ground or are developed underground. In either instance the expense of maintaining these supplies for a future emergency would be altogether too great for a private operator. If these mineral supplies are not developed their existence is not proved and therefore they are not supplies. Apparently, Mr. Batt believes that our mineral resources are all known; therefore they must be at least partially developed. If they are not known, how can Mr. Batt be sure they are approaching exhaustion?

It should be pointed out that one important factor in the depletion of domestic ore reserves in underground mines is the continued lack of mine manpower. In the majority of mines, it has been necessary to cut down development work because of this lack of miners. It is a truism to state that failure to do development work in a mining operation results in early exhaustion of ore reserves. Even if evidence exists that ore would be found if exploration were carried out, the ore is not available until it has been developed.

Another basic fact concerning the ability of the mining industry to meet an emergency, and one which quite evidently is not given sufficient weight by those not experienced in mining, is that an ore deposit may not be put into condition to pr duce simply by putting up a plant at the will of Government officials. Time-consuming development work must follow discovery. This development work is essential not only to determine the extent of the deposit but also to enable the operator to select the proper method of mining and the most economical method of treatment. The development program would always be especially time-consuming under war conditions because of difficulties in obtaining equipment and capable manpower.

No factor in industry prevents earnest application to the job at hand so much as uncertainty about policies from higher up. This matter is especially pertinent in planning post-war readjustment, and the uncertainty of Government action relative to post-war primary and secondary metal surpluses is a striking example. Mine operators have had to keep one ear - sometimes both - cocked continually toward Washington in order to keep abreast of regulations and policies. The job of developing, mining, and smelting to meet war demands has been an especially tough one - and a seemingly thankless one. A magnificent job, in spite of great difficulties, has been and is being done. Along these lines, members of Congress realize the failings of the present piece-meal tax policies and undoubtedly will make a determined effort to effect remedies. A settled tax policy would allow operators to plan ahead with some assurance that new taxes levied a year or so ahead will not kill any chance of making a profit. This uncertainty in itself is a great barrier to development of new ore deposits. As a matter of cold, hard fact, present mine taxation policies have prevented, are preventing, and will continue to prevent the starting of new mining projects.

In connection with some Government policies relating to production of war minerals, the experience of many mine operators, especially the smaller ones, has been disillusioning. These operators were eager from patriotic motives to find and produce needed minerals. Early in the emergency they were urged by Government agencies to get into maximum production as quickly as possible. When the critical need for domestic production had passed because of increase in imports, the small operator who had sweated to get into production became "the forgotten man" as far as these agencies were concerned. He was made to feel that his efforts were of no importance. If he lost money in his project, that was his hard luck. In general this type of man finds our mines. The result of his discouragement is that there is little or no prospecting going on; known mineral prospects are lying dormant. In addition he will examine any possible future emergency needs with a cynical and jaundiced eye.

"Trial balloons"are fairly common in official Government quarters. Sometimes they are meant to try out public opinion and sometimes they are designed to pave the way to a definitely planned national policy. Aside from "Lend Lease" commitments which probably must be written off, post-war foreign trade will consist largely of exchange of some of our manufactured goods for raw materials, as this will be the only method available to some countries of making payment. Possibly, as hinted in Mr. Batt's remarks, plans are being made to import as large a proportion of mineral products as possible. Some of our large corporations would be in full accord with this policy. The menace to the domestic mining industry is apparent. Our international outlook as, for example, the "Good Neighbor" policy is fine if it does not include crucifying a domestic industry which is the basis of our industrial leadership. Other countries are going to approach such post-war problems primarily from a selfish standpoint. We must be equally realistic.

We shall of course import mineral raw materials as we have done in the past peacetime era, but if there is an expansion in these imports it will be the result of a foreign trade policy set up at the expense of our mineral industry. It will not be due to depletion of our mineral resources. America can only be made a "have not" nation by inept political planning.

Probably Mr. Batt's statements were based on information furnished him from sources which he considered reliable, but in any event this is an example of official or semi-official statement not based on sound technical advice. Such statements are likely to contain inaccuracies. The far-reaching danger is that they are accepted as 100 percent accurate by people unfamiliar with the technical details.

F.W.Libbey.

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## COMING COAL ERA*

(An Abstract)

Of all the fuels available for use in the future, coal will be of paramount importance. Even the coal industry's severest competitors admit this. The future is an indefinite term, but the time that coal will assume undeniable superiority will depend largely if not entirely on two factors: The overall economic status of this country, and the extent to which the coal industry is willing to exert itself in order to secure the markets which will exist.

Using indices of business trends during other post-war periods as a guide, it has been predicted by the Bureau of Foreign and Domestic Commerce that the national income will show a steady increase during the years immediately following the war. A decline from this post-war "boom" will probably develop after a few years but the average income level has been higher and higher after each war. Coal consumption follows general business trends closely while railroad traffic and pig iron production, both heavy coal consumers, directly reflect general business conditions. Railroad men expect an upward trend in passenger and freight ton miles in the post-war era, and the forecast for pig iron production is for continued gains, although not at the peak levels of today.

* From "Coal Age" March, 1944

Bright though the future may be for coal, no substantial gains can be or will be made by merely sitting back and waiting for business to come. By dint of unceasing exploitation and promotion during the past two decades, oil has become coal's toughest competitor. Natural gas, too, is a bothersome rival but it lacks the geographical flexibility enjoyed by coal. The future of water power as a competitor of coal is dependent partly on political trends and partly on economic factors. Barring some local exceptions, coal has ably demonstrated that on an economy basis it can compete with water power.

Despite the fact that, in the United States, the reserves of crude oil are limited, this does not mean that oil has yielded to the greater reserves of coal. On the contrary, oil men in this country are looking to foreign sources to carry on. They also hope that there will be a price increase to permit further wild-catting in this country. Assuming then that oil will be a doughty rival of coal for at least some years to come, what are the factors in favor of coal over oil? A public sufficiently convinced that there is an impending oil shortage will be wary of investing in oil burning equipment, and national security will most certainly require that restrictions be placed on crude oil consumption in order to preserve stocks for future emergencies. Both of these facts tend to move home heating, steam and industrial markets into coal s hands. Oil has one big advantage in convenience, and one of coal's biggest jobs is to supply a product more acceptable to the consumer.

In the opinion of experts the greatest opportunities for coal lie not in brand new, heretofore unheard-of fields, but in markets already well established.

The major markets for coal together with prospects for future demands are tabulated below.

THE FUTURE FOR COAL IN PRINCIPAL MARKETS

| Markets | Future Trends | Research and Improvements Needed |
|---|---|---|
| Electric Power Gas Production | Greatly expanded use. Gasification to take large tonnage. | Improved firing equipment and coal research on low cost gasification. |
| Liquid Fuels | Rapidly increasing in importance. | Additional commercial research and testing. |
| By-products | Increased use as a fuel. Minor use as raw material. | Better preparation. Research on raw material uses. |
| Heating | Increased use but with strong competition. | Better preparation; better equipment. |
| Industrial | Increased use with new applications. | Better preparation; better equipment; new uses. |
| Colloidal Fuels | Probably increased marine use only. | Cost reduction; product improvement. |
| Railways | Increased traffic but competition with diesel and electricity strong. | New boiler design; better preparation. |

In the electric power and gas production field of the future, coal will enjoy a favored position. Utilities are demanding a more uniform coal, better prepared, and stoker equipment capable of disposing of ashes automatically. These problems are being met now and should be solved in due course. Of equal importance is the future manufactured-gas market. Both coal and gas made from coal compete in the same market. Gas produced from coal is a fuel

having none of the disagreeable qualities of coal, such as ash disposal, shoveling regulation, shaking, and attention. Liquid fuels for internal combustion motors is another likely possibility, which will become increasingly important as crude oil stocks diminish. Production of both gas and liquid fuels from coal yields coke as a by-product which in itself competes directly with gas. Complete one-step gasification of coal would remedy this.

In the chemical and plastics field, coal will play its most important role as a source of energy rather than as a raw product. Expansion in this industry is inevitable with coal keeping pace and probably gaining in use over oil and grain alcohols.

Domestic and space heating annually consume over 100,000,000 tons of coal - the "cream of the crop" for bituminous, while such use is the principal outlet for anthracite. Oil has given coal a stiff fight for supremacy in the heating field, although coal, aided by the benefits from continual research, has slowly been improving its position. A combination heating and cooling unit for domestic use is being studied and if successful would result in a substantial tonnage increase. "Customer satisfaction" is the main theme of all coal research today. Studies now under way are aimed at better control of heating units, interval without attention, less manual control, and the supply of better coal at a cost below that of oil. Laboratory officials are hopeful of developing a domestic stoker which will be entirely automatic and yet medium priced. Smoke abatement receives increasingly greater attention as more and more cities clamp down on smoke tolerances. Ready for use in the post-war period is a completely smokeless stove which can be banked for as long as 4 days and still heat quickly upon opening the draft. Powdered, liquid, or gaseous fuel derived from coal for domestic use are all definite possibilities, with increased convenience at a cost still below competing fuels.

Industrial users of coal for heating and steam production are primarily concerned with the cost per heat unit. Coal has a decided advantage in this respect which, coupled with an assured supply, makes it doubly attractive to large industrial users. Battelle Memorial Institute which does much work for the Bituminous Coal Research program believes that pulverized coal will be the fuel of the future. Use of this type of fuel in radiant tube boilers is receiving considerable attention.

One of the most interesting uses for coal industrially is not for steam use but in open hearth steel furnaces. This use could amount to as much as 20,000,000 tons a year although several serious engineering obstacles must be overcome.

Colloidal fuel has been the subject of much discussion but production has been very limited. Future use would be confined largely to marine service where its greater heat per unit permits a saving in storage space. High production costs at present bar it from railroad markets and will probably continue to do so.

Torn between increased rail traffic and a growing use of diesel-powered units, coal faces an uncertain future. Railroads burned 110,000,000 tons of coal in 1942, thus becoming the largest individual customer of the industry. Oil as a competitive locomotive fuel will in all likelihood not change its relative position, being largely determined by local supply. Diesel offers more widespread competition, but entirely new boiler design for coal burning locomotives can improve coal's position. The present steam locomotive has an almost complete lack of efficiency, differing so little from the original as designed by George Stevenson that he would have little difficulty in recognizing the most modern steam locomotive as being basically his design. Water-tube boilers with turbo-electric drives are the hope of researchers, rather than improvement of present models. Coal as a locomotive fuel would be very difficult to replace if its overall efficiency could be increased by 50 percent or even 100 percent, giving drawbar efficiencies of from 7½ percent to 10 percent. A comparison of diesel and coal-fired steam locomotive costs per mile for a 6 months' period on the Santa Fe line is interesting. While steam locomotives cost 68¢ a mile to operate, diesel engines cost 81¢; fuel costs were slightly higher for steam, but depreciation and repair costs for diesel units amounted to 40¢ to steam's 30¢.

The 1943 production of bituminous coal was 589,000,000 tons, with anthracite totaling 61,000,000. This year it is expected that 620,000,000 tons of bituminous and 65,000,000 tons of anthracite will be produced. There is every indication that there will be ever expanding markets for coal but they will not be won without a fight led by research groups and backed by the entire industry

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## EARL K. NIXON JOINS FREEPORT SULPHUR COMPANY AS MANAGER OF WESTERN EXPLORATION

Earl Nixon has resigned as director of the State Department of Geology and Mineral Industries to accept the position of Manager of Western Exploration for the Freeport Sulphur Company. His headquarters will be in San Francisco in order to afford a central location for the company's program of mineral and industrial investigations in the western states, western Canada, and Alaska.

Mr. Nixon was appointed the first director of the newly formed department in 1937 by the first Governing Board then composed of Senator W. H. Strayer, Mr. E. B. McNaughton, and the late Mr. Albert Burch. He organized the department, selected its personnel, and planned its projects. He had the foresight to see the need for strategic mineral development and, in addition to many other mineral industry studies, had surveys made of the State's resources of quicksilver, chromite, and manganese so that reports of these important war minerals were available when the war emergency came. Largely through his efforts three Metals Reserve Company purchasing depots were established in the State. He became consultant for the War Production Board and the Metal Reserves Company and was appointed State Emergency Coordinator of Mines by Governor Sprague.

Because of Mr. Nixon's efforts, the Oregon department has attained a prominent place among state mineral industry departments, and a few months ago he was elected president of the Association of American State Geologists. What the department has accomplished is in great measure due to his energy and ability. He will be greatly missed by his associates in the Department. Their sincere good wishes for his success go with him in his new work.

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## CRITICAL MATERIALS

According to the American Mining Congress Weekly Information Service, issue of April 15, WPB's latest (April 15) list showing "degree of criticalness" of various raw materials is substantially as follows:

"The only metals now listed in Group I (materials <u>insufficient</u> to satisfy war plus essential industry demands) are cadmium, sodium, tin, columbium, nickel, and malleable iron castings. Bismuth, platinum and tantalum have been moved down into Group II (materials <u>sufficient</u> to meet war plus essential industry demands), which Group also contains aluminum, beryllium, copper, lead, magnesium, silver, zinc and steel. Low carbon ferrochromium has been moved up into Group II from Group III. Group III (materials readily <u>available</u> for essential uses) includes antimony, calcium, gold, mercury, palladium, cobalt, molybdenum, most of the ferro-alloys, pig iron, grey iron castings, reinforcing, and rerolled rail.

"Among the chemicals listed, arsenic and its derivatives, calcium carbide, lithium chemicals, sulfuric acid, and superphosphates have been moved from Group I down to Group II; strontium chemicals from Group II to Group III.

"Most grades of lumber continue critical, with only minor changes in classification. Of the "Miscellaneous Products", barite and anthracite coal have become more critical and have been shifted from Group II to Group I, and long fibre asbestos from Group III to Group I. Low silica bauxite and fluorspar (both acid and metallurgical grades), together with second and third qualities of quartz crystals, have been eased from Group I to Group II. Lead pigments, salt, and stone, previously listed in Group III, do not appear in the latest list."

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