

CHANGING PATTERN OF ECONOMIC POTENTIAL FOR WAR - NATURAL RESOURCES

26 March 1947

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Dr. Leith

Students

THE INDUSTRIAL COLLEGE OF THE ARMED FORCES

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CHANGING PATTERN OF ECONOMIC POTENTIAL FOR WAR -- NATURAL RESOURCES.

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CAPTAIN WORTHINGTON:

Gentlemen, the speaker this morning is Dr. Charles K. Leith. Dr. Leith is an eminent geologist, well known for his studies on world minerals in their international relations. He is a co-author of the widely read book "World Minerals and World Peace," published in 1943.

In World War II Dr. Leith served the Government in many important capacities, among them, that of Chief, Metals and Minerals Branch, Office of Production Research and Development, War Production Board. He also advised numerous government agencies on mineral matters in World War I and in the period between the two wars.

In addition to his distinguished career in Government, Dr. Leith has been very active in education, having taught in institutions of higher learning since 1902. He is the author of many books and articles on geology and is a member of numerous academic societies.

His subject this morning is -- "Changing Pattern of Economic Potential for War -- National Resources." I take great pleasure in introducing Dr. Leith.

DR. LEITH:

In discussing this subject of minerals under the title which has been assigned to me, my purpose will be to try to frame the perspective and tell you the general story rather than to give you much in the way of factual and statistical material. There just will not be time to do both. So I shall have to deal to some extent with certain generalities. We are dealing with a problem that is really an unholy mixture of diverse factors, physical, technical, geographical, political, commercial, and so on, with the security factor mixed in. There are just no simple arithmetical approaches to the question, no possibility of handling that number of shifting variables in anything approaching an equation.

I propose to sketch the subject in three parts: first, the present mineral situation; second, the impending changes; and, third, the present policy of the United States, which for the moment and for sometime past has been a principal interest of mine. I assume that this group will know pretty much the general facts of mineral distribution. I will just touch a few of the high spots.

The coal resources of the world are dominantly lodged in the USA, with a belt of coal running through central and western Europe, and with

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outlying districts, not well developed, in China, South Africa, and Australia. There are practically none in Central and South America. The big developments run from the Mississippi east in what you might call the power axis eastward through the United States and eastward through the central part of Europe.

The oils are a little more widely distributed. As you know, we are the principal producer, but we have not the principal reserves today. Next, in order of importance, the principal producers are: Venezuela, the Near East, the outlying districts in the Far East and so on.

Steel and the ferrous minerals are dominantly located in the United States, again following the power belt into central Russia. A large part of the steel in the world is made in that belt, where there is the principal coal production. The outlying centers of steel in South Africa, Australia and India are very minor in proportion and are likely to stay minor in proportion.

I want to emphasize one feature of this perspective. That is that by weight steel makes up over 90 per cent of all metals used and more than 90 per cent of the material used in the last war. The same is true of industry. I may say that that figure of 90 per cent is an old figure. Since the very beginning, for one hundred years, that has been the situation.

Of the other ten per cent, copper, lead, and zinc make up the dominant part. In other words, 90 per cent of the remaining ten per cent is copper, lead, and zinc. Of this ten per cent a very large fraction of them are in some way related to the steel industry. Of course you know that manganese, chrome, tungsten, nickel and other ferro-alloy minerals are actually used in the steel industry. You would be surprised as you go over the figures to see how much copper, how much zinc, and how much lead is very closely integrated with the steel business. So steel is in the center of the picture.

Now, I suppose you are familiar with the geographical distribution of steel. As you know, the United States leads the world, with 50 per cent of the production or approximately that. Next comes central Europe following the power belt. The outlying sources are relatively small. They are not particularly gaining in the large centers. Then there are the miscellaneous rare minerals in the remaining ten per cent. There is a very long list of them. We had 95 of them in our list in the War Production Board. I will have to confess that there are probably about thirty or forty that I hardly know how to spell. As a matter of fact, we had a great deal of trouble with some of these rare minerals and elements, with new technology calling for new things and for new minerals, new qualities. There were times when we might

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have thought that the war would have to stop if we couldn't dig up some mineral in a certain quantity which we actually had never heard the name of until a few days previously, but which had actually come into the new technology. Minerals like tantalum, beryllium, and several minerals in the platinum group, not to mention the minerals in the uranium group came into the picture.

Now, the outstanding feature of the situation is the geographical concentration, due to the scale of demand. In other words, as industry has grown and war demands increased, there are only a few places in the world able to meet those demands. So naturally the demand focuses into those particular sources. Those sources are very few in number. I do not need to go into that.

Iron ore is very widely distributed around the world. Copper comes from six different regions. With lead there is a slightly larger number, but we have a concentration in a few places. For nickel we have one, for manganese three, for chromite four or five, and for quartz crystals one. One could go on indefinitely through the list and show a remarkable degree of geographical concentration. That does not mean that there are not hundreds of little showings here, there and elsewhere. But I want constantly to keep before you this idea of scale. Figuring on the basis of scale there are only a few places that count geographically in this whole minerals picture.

Another thing: Along with that concentration geographically by regions there has been a concentration of commercial control. That is not recent. It has been going on since the very beginning. As these industries grow larger and as more and more demand is centered in certain places, industry is bound to grow larger. Demand follows cheap production and the scale of production that is necessary. And so we have had clear through the minerals field a perfectly definite tendency toward concentration of commercial control, with almost no exception. It has been going on regardless of a country's ideology, regardless of conditions of war or peace. My judgment is that it is going to go further, no matter what we do about it.

Now, there is involved in that the question of monopoly, freedom of access, cartels, commodity agreements, and so on. They are very much on the carpet. I think anybody who says we are going to stop that sort of thing that we are doing should get down to the grass roots. Any plan to eliminate cartels and commodity agreements, or even big companies, run against a tide that there is no human possibility of overcoming. Excuse me if I seem to make an overstatement, but to save time I want to get these ideas across. Regardless of whether it is right or wrong, it is one of those natural, inevitable consequences of the growth of demand and the concentration in a few places.

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Another result of all this has been the growing interdependence of nations. I don't need to go into that. That is the result of geographical concentration.

Then we have going on the general spread of public control, political control, over the minerals resources of the world. It is a trend that has gone on just like geographical concentration. It started before the first world war and went on between the wars and during this war. It is still under way. The political control of mineral resources is tightening up literally all over the world. It is obvious when you come to an extreme case like uranium. Every country in the world is clamping down. In England, for instance, very little metal is moving these days except under government quotas and control. England, as you know, has nationalized coal production. What England is doing is being done in some degree by practically every other country on the globe. It is a matter of economic necessity forcing this kind of control, seeing that the minerals go where they are needed most. As I say, all countries are doing it.

We are not entirely free ourselves. We ourselves talk a great deal about getting away from war controls. But, looking over the list, you will find we have a great deal of control still. There is quite a question whether we are going to relax those controls. There are also non war controls.

When I speak about this public control I am speaking about the tariff, quotas, allocations, the actual nationalization of the whole range of material.

Now, against this background the position of the United States can be summarized very briefly. We are the richest country on the globe in minerals, but there are a lot of them that we do not have at all. Many others we have only in part. We do not escape the interdependence which is due to this geographical distribution of these minerals and materials.

With our increasing demand the reserves of materials which we have here are beginning to look smaller. Even though we might with some of them get by for a very limited number of years, the time is pretty close now when we have to start to import. People are bound to put themselves in the position of a bank--it is a position that we have every day in finance--and say, "This new manufacturing plant will need new raw materials for X years." It is not a matter of theory to them. They have to sharpen their pencils and figure out where they are going to get the stuff. They are planning and allocating funds on the basis of understandings of that sort.

We are all right in certain minerals. In manganese we are not strong. In coal we are quite strong. In molybdenum we are strong.

In iron ore we are comfortable enough so far as the total amount is concerned, but not comfortable enough in the high-grade pit ore. That has been the heart of our iron ore production. It really went a long way toward building our industrial strength during the war. When we had to run production on Lake Superior one year up to meet the requirements of the situation to 90 million tons, there was only one place where it could possibly be done and that was in the open pits. It would have been impossible without the open pits. It is impossible to open up underground mines fast enough. They could not supply in the aggregate a fraction of what these big open pits supply. One pit produced 25 million tons in the six or seven months of the summer, which is considerably more than the entire consumption for the United States up until well after the Civil War. In fact, over five times as much as the entire United States consumed annually up to that period.

Now we come down to other minerals. We find that we are beginning to run into shortages. In the platinum metals we need some from the outside. We need a good deal of black mica, especially high-grade, in the "five" or "six" sized plates necessary for insulation. We have not been able to produce much of that. We just do not have manganese in the amount needed to meet the current demand. We have an extremely small amount of nickel. In chrome we are short, in tin we are short, and in industrial diamonds and quartz crystals and asbestos we are short. I assume you are generally familiar with all of these facts.

We have led the world in the development of minerals. We have produced more from our reserves than any other country in the world. The scale of our industry, the scale of our war preparation, has been the largest in the world. It is not just a matter of theory that we must rely on foreign sources in the future. We are up against it right now. We are facing the necessity of trying to find out where these things are in foreign countries, and how to get them.

So much for the general situation. I want to give just a little attention to the question of impending changes. How is this situation changing?

Well, in the first place, scale, that is, the over-all scale of demand, is increasing all over the world, which means a necessity for further development. It means more shifts from older sources to younger sources of material.

England no longer dominates the coal situation. And we can look forward to an even smaller relative position of England in the coal picture.

In this country we have produced about 55 per cent of the world's oil, but we have only about one third of the reserves. It is obvious

that we will have to call in more and more, first, from Venezuela and, secondly, from the Near East. Some of those big shifts are under way.

Turning to the metals group, we can find some shifts, but not particularly important ones. I refer mainly to lead, zinc, and copper. There is one feature of that non-ferrous group that I want to call your attention to.

I emphasized the fact that steel is 90 per cent by weight of all metals. If all the world were industrialized on the same scale as the United States, it would have to have seven times as much raw material as we have been using so far. Now, for iron and coal seven times as much is not impossible, but for the entire remaining group of minerals, 130 or 140 of them, we just cannot see it. The chance of multiplying by seven that ten per cent of the material that supplements steel just doesn't seem to be in the cards. That, of course, is subject to certain exceptions. I just want to put the problem before you in perspective, in scale, to show the job ahead of us if we proceed to industrialize the world as we should.

Now, how about the Government's part in this picture? Discovery the world over has been lessening in rate for a long time. There has been a great deal of discussion of that. During the war there was a tremendous effort all over the world to open up new deposits, but the new reserves opened up which are on the scale to really upset the perspective in any appreciable way are pretty few. People will say, "How about this copper deposit here? How about this zinc deposit?" Granted all that, their scale is such that it just does not upset the perspective which has existed for some time.

We have gotten in this country, for instance, to where we are now consuming more oil than we produce and are beginning to import it. The discovery of oil, as you know, has been slowing down. It is not only slowing down, but it costs more. Oil is coming from deeper sources. There was a very interesting statement made by Mr. Smith in New York last week in which he gave a figure that is astonishing. He said that actually the discovery and development of new oil today is costing six times as much as the oil of ten or fifteen years ago per well, due to the depth increasing and the cost of drilling, due to increased cost of the technology, and so on. That is just an illustration. The general discovery rate is slowing up.

Of course we are going to discover minerals here, there, and elsewhere. We may get upsets, we may get changes, in the perspective. But I just want to emphasize the fact that a discovery big enough to upset it is a pretty rare case. Anything like finding a new Mesabi Range anywhere in the world is not likely to happen, and something on that scale is what the situation calls for.

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Geologically the world is getting to be pretty well known. Geologists have the oil terranes pretty well mapped out. They know generally speaking where they are likely to go. Eliminating the Pre-Cambrian areas of North America and certain other parts of the world and coming down to promising layers, they know where those layers are.

How about depletion? How is that going to change this perspective that I have sketched for you? Of course, we are cutting more and more into the zinc, lead, and iron ore deposits and the oil deposits. That is a factor which is transferring some of these demands to foreign sources and making us more and more dependent.

Depletion during the war was excessively fast. It was really appalling to some of us who have followed the figures showing the percentage of increase in the use of these things. I will just translate use into depletion, to indicate what I am talking about as compared with the First World War. Manganese 260 per cent more used. Titanium, 246 per cent; molybdenum, 123 per cent; aluminum, 330 per cent; then the series of chrome ore, 700 per cent; copper, 460 per cent; lead, 170 per cent. And so on down through the list. There are only a few as we go down the list where the percentages did not go up. I want you to see that it is a brand new situation as far as demand is concerned, which means that depletion is going on with greater speed.

How about upsets due to technological changes? We have had a vast number of those technical changes during the war. We learned how to use things in a different way. We developed a series of National Emergency steels which resulted in a very considerable saving in the amount necessary of chrome, nickel, vanadium, manganese, and so on. It was really a very dramatic change. Being short of tungsten at the start, we started to substitute molybdenum and found that it was possible. As we got into the war the shift went the other way.

We learned how to use our materials very much better, with savings all along the line. These changes are important and they do tend to modify our picture. In other words, if we can get along with less manganese, less chrome, and less nickel due to these savings, it is modifying the general features of the picture which I sketched for you originally.

But again I would like to jump over to a generalization: that those technical changes have not changed our perspective anywhere along the line in any serious degree.

I might mention just one technical change which is under way now and which is going to go further. The development of gas turbine and jet propulsion engines has called for a new series of alloys - alloys with different strengths and qualities. We got into the habit in the War Production Board of referring to these alloys as super-alloys. Normal alloys have 90 or 95 per cent iron and the rest alloy materials. In some of the super-alloys the ratios are reversed -- 90 percent of

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alloy materials and ten per cent of iron. That is a very radical change and one which, if it goes too far, will, of course, upset the perspective to some extent. But the specialists in that line expect to find new combinations and to get away from the extremes in the super alloy requirements. Some of you perhaps may have set in on some of the discussions of some of the new developments in the war. I know we were suddenly asked for quantities of chrome, manganese, and vanadium which we simply did not have. The material just didn't exist, here or anywhere else in the world, sufficient to change the steel alloys from a five or ten per cent basis to a 90 per cent basis.

There remains the question of substitution to consider. I mentioned the technological changes and substitutions that are going on. Aluminum and magnesium are coming in and substituting to some extent for steel. Any one of you who has thought of this subject can think of substitutions all along the line. An outstanding substitution is the substitution of oil for coal as a source of power, which has tended to slow down the rate of production of coal and increase that of oil. They are, however, now learning how to recover gasoline from gas and coal, which is a move in the other direction. I noticed in the paper yesterday that the Pittsburgh Consolidated has started a plant for actual production of oil out of coal. Where that will end up in the long run I would not attempt to say.

Then there is the problem of conservation. There are certain changes under way in conservation that are affecting our supplies.

As a result of all these shifts which I have discussed in the physical field we come to a growing dependence on foreign sources. It is not a case of whether we want it or not, or, whether it is good for domestic production. It is on us. The impending changes are all in the direction of a growing dependence on foreign sources.

Along with this growing dependence on foreign sources we face the problem of the political changes in the way of tightening up our access to foreign sources. You remember, in the Atlantic Charter one of the important sections refers to freedom of access, equality of economic opportunity. That is one that has been talked about a great deal in the international trade conferences. The conference that is just about to meet in Geneva is dedicated more or less to that thesis. And yet as against that there is almost every day some new measure of restriction or control and quotas on this and that mineral. Quotas are being substituted for tariffs all over the world outside the United States, and we also have government allocations of materials. That is what we are faced with. At a time when we need more of these materials the opportunity to buy them over the counter is growing less and less every day.

The time has gone by when a person can hop aboard a boat and go out and look for minerals, find them and develop them and ship them back to the United States. You have to go through a long series of

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diplomatic negotiations before you can even get off the boat. Before you can get your enterprise developed to any size, you run into difficulties that are growing in magnitude every day. That is the thing I want to emphasize. At a time when we physically need these things from abroad, it is politically becoming increasingly hard to get them.

All right. Let us go on now to the question of the future policy of the United States against this background. I want to apologize to you for talking generalizations so much.

From the standpoint of security the number one feature of the policy internationally ought to be stockpiling. We all take it for granted that stock piles are necessary in order to cushion our transition from any period of emergency. That program is under way. Stock piles, however, are limited by the capacity of production to supply not only industry, but to supply excesses to go into stock piles. The arithmetical problem does not sound good. Some of you are very familiar with that thought. If the copper mines of the world supply industry on the scale which the projected trend lines would seem to indicate, it is going to be a long, long time before we get enough copper to win the next war. We have no stock pile. The same is true all along the line. Scale comes into the problem in a big way.

In the First World War we had to have access to a large part of the world in order to win the war. We had to have greater access in the Second World War. I think it is a pretty safe guess that in the third war, access to practically all of the known minerals in the world is going to be necessary for success.

Any possible stock pile program, in my own judgment, can reach a very small part of requirements. It is going to take not only all the copper that can be produced now, but also all the copper that can be produced currently during the emergency, to win the war. How you can separate that out from the current needs of industry and get it stacked up just for purposes of security is a difficult question to answer.

I may say that the theory of accumulating a stock pile is to get the things that we don't have in this country. That theory has been somewhat modified by Congress by the introduction of the "Buy America" clause. I don't mind saying that I don't like that clause. I spoke against it in the committee of Congress. If we have the stuff in this country, I don't see that it makes any difference whether it is below current or above. I personally like to see these stock piles, if it is possible, come from outside resources.

Next in order, we obviously have to encourage discovery and exploration. That is under way by private industry. There is every incentive

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for industry to do it, and I assume that that is under way.

Recently there has been a great deal of talk about the Government coming in to help. Mr. Krug has proposed an extensive government program. Such help is all right as a supplementary procedure, but with my background of experience in this field I know that most discoveries in the past have been made by private industry; and I still think they are going to be made that way in the future. I would like to see government support confined to phases of the work which are not within the range of any individual company or private industry.

There are phases of discovery calling for government aid in the field of geophysics. In that enormously broad scientific field there is work which only the Government can do or can best do. Also the Government can do a great deal of useful work in other phases of discovery, -- taxation, for instance. It has been proposed from several sources that the depreciation allowance under the tax law be increased. To some extent that is going on. The State of Michigan right now, for instance, is considering a new law which will make it possible to spend money on exploration to develop the iron ore deposits in Michigan without taxation for a considerable period. Exploration in Michigan has been slowed by taxation for a good many years. Companies are deliberately holding back exploration and development to an extra two or three levels, because if they went below that and found any more, it would be taxed. Minnesota has a similar problem. I don't know what the answer is, but I call attention to it as one of the things which ought to be considered here in the Government interpretation.

The problem of conservation naturally involves the Government. It is a field in which the Government can do some very good things. We have several cases in this country of that. The Tri-State zinc field, for instance, is running out of ore and probably cannot be operated much longer unless they continue the subsidy. That discussion is going on in Congress today. If those mines are allowed to close down, we have an area of twenty square miles practically where, because they are connected by openings, there is going to be formed a great underground lake, which nobody is going to pump out for a long while to get at the few deposits which are left. We have other cases of that sort where the Government can come in and help on the broad conservation problem, particularly in the direction of recovering that low-grade material. One illustration is the striking success of cooperative efforts to conserve oil, fostered by the Oil States compact.

I think that most geologists and engineers will agree that the chances of meeting all our future requirements for the United States are pretty small in copper, lead, zinc, nickel, manganese, chrome and other minerals. We have done a lot of work on these minerals, a lot of expensive work, during the war; but the result of all of this extraordinary effort during the war was not very much. There are some

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very interesting figures available on that. We had to try it. We had to spend millions of dollars trying this and that process in the hope that it would add something to our reserve. But it was terribly expensive. Whatever we got helped a little bit. Yet the percentage gained was not very much.

Well, we have got them to go after foreign sources. In that field I just mentioned the reciprocal trade treaties which are under discussion and a new international trade organization being discussed in Geneva. We have the general problem of cartels and commodity agreements. We have the problem of whether we are going to accept some of these raw materials in part payment for Lend-Lease loans. If we do that, we have a very serious problem to decide how we are going to take care of private industry that has been in on that job, if we allow Russia, Greece, or any other country to make part payment that way. The machinery of international trade is something we have to consider unless we just want to make up our minds that raw material supply will drift over into public control, which we all hope will stop somewhere.

In short, our problem, the problem of our future mineral supply, is one of perfecting international understandings and agreements of some type which will give us proper access to the world resources. That is going to be necessary whether we are talking from the standpoint of an enhanced scale of future industry or whether we are talking about winning the next war. The mobilization of the world resources is going to be absolutely necessary to anybody hoping to win the next war. I think it is perfectly safe to say that neither this country nor any other country can by any human possibility hope to win the next war with the resources within its own borders. Other people have waked up to that idea too; so they are tightening up. They are getting cagey about letting us have access to their resources.

We have a problem there of public control. How far we will get with it I just don't know. I would like to say that I have been familiar with these requirements for minerals. I worked with Mr. Baruch in the last war. I have been faced with this problem for a long while. I would like to say that the next war is not going to be won without access to practically all the world resources. That access is not going to be gained except by international understandings and agreements. If we succeed in doing that from the standpoint of security alone, to say nothing of industry requirements world minerals will be tied up in such a way as to make war difficult for any other country.

Now, just a word about the question of raw materials for the bomb. You may say, "How is that going to change the picture? All this talk about needing all these extra minerals in quantity may be upset if a bomb comes into action." But the history of many weapons so far is that it doesn't really affect the lesson of others. The production of the bomb

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in itself requires a terrible lot of steel. Some of the best technicians on the job see no likelihood that the steel requirements will be lessened by the use of the bomb alone. Mr. Jay Jeffries made a statement in New York last week to that effect. Nobody can speak with certainty about it, but I think we can rely with a good deal of confidence on the history of mineral requirements. For all minerals, production starts slowly, then rises steeply, then the curve starts to flatten, but still rises. You can go through the entire list with the possible exception of coal, where oil has come in to substitute, and see every single trend line growing. Magnesium has come in and aluminum. They have replaced steel to some extent, but steel is still in. When steel came in, it replaced wood. People said, "Goodbye wood," but the use of wood still expands. That is the way with everything. And here I am going to make an extreme statement. I can see one man in the audience that is pretty sure to call me on it. I defy you to name one of those substitutes that has really replaced the particular mineral that it was supposed to substitute because as substitutes come in the mineral that is being substituted gains somewhere else.

Just one other word about these raw materials of the bomb. That subject is still classified but I may say that these minerals are subject to the same general perspective that I mentioned for the others. They are geographically concentrated. They do not often occur in nature by themselves, but are mixed up with other materials.

National control is going to the extreme in this case, naturally and some sort of international control is probable. It is not going to lie around loose. What the answer is I do not pretend to say. But the point I want to make to you is this: that the problem of raw materials for the bombs reflects in kind the problems that run right through all minerals--in different degrees, of course. We may regard these materials of the bomb as dramatizing our broader picture.

It is a problem that is not going to be settled in a vacuum. However it is settled, it will reflect back on our whole problem of mineral supply. Thank you.

CAPTAIN WORTHINGTON:

We are open for questions.

A STUDENT:

Could you analyze for us the present situation in regard to the copper resources of Chile and what the future may be there politically?

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DR. LEITH:

I haven't made it my business to follow that closely. Generally Chile has enormous resources of copper owned and operated by Americans. Chile is dependent a great deal on the copper industry and wants to continue its export to us. As they wake up to the importance of the mineral, their government is beginning to edge up on the industry with all sorts of regulations, taxation procedures and special orders. The American copper companies are on the defensive. Chile would like to see our copper tariff reduced, so that they could bring in larger quantities of copper. The question is now under consideration by our Congress. I don't attempt to predict the outcome of this political discussion. It is simply a matter of arithmetic that we must have this copper from the outside up to quite a percentage of our requirements. The consumers are complaining. Sooner or later the copper tariff will have to be cut down or eliminated entirely. But in the meantime, we have to consider the health and prosperity of domestic copper mines. Conservation comes into the picture. Our copper producers can put up a pretty plausible case against any radical or hurried move in the direction of completely abandoning the tariff.

A STUDENT:

What are the chances of getting some of our strategic short minerals from sea water?

DR. LEITH:

It is a matter of cost. Of course, sea water has a lot of things in it. We are getting magnesium out of it now and salt. But I think most everyone of our minerals is more concentrated in harder materials in the earth and there is a very wide margin of preference for them as against sea water.

A STUDENT:

When the question arises that you can't get it, the cost would be immaterial, wouldn't it?

DR. LEITH:

Yes. That is quite true. I think, though, we must keep cost in mind; not necessarily cost in terms of dollars, but cost in terms of human effort. We are in the process of digging ourselves into the environment where we just can't afford to waste our effort in digging low-grade stuff until we have to. It just loses to the human race that much energy.

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A STUDENT:

Could you talk on the comparative resources of the United States and Russia mineral-wise and the trend of depletion here and where perhaps it will lead us in 1960 or 1980?

DR. LEITH:

Yes. I could talk about it. I assume that this discussion here is more or less off the record. I don't care. I have said it many times before.

Personally, I think Russia is very much overrated in the source of mineral supply. I can't fully back that up by facts, of course; but I have had occasion to follow it for a good many years. I have talked to people who have been in particular areas. There has been so much overstatement on the part of the Russians that perhaps it has led me to an error in the other direction. I just don't believe it.

Just to give an illustration: Steel, of course, is the heart of their industrial enterprise, as in other countries. Russia has coal; there is no doubt about that, but not a great deal of iron. The best of the iron is located down in the Krivoi Rog district in the Ukraine. The steel industry started there. Then for political reasons they shifted development far to the northeast, where there is a large amount of low-grade iron at Magnetitgersk and began working their low-grade magnetite deposits. Then they built coal fields a thousand miles to the east in the Kusnetz basin.

During the war this move proved fortunate for them. But I think that cost considerations in favor of the Krivoi Rog district. The iron ore at Krivoi Rog just isn't enough for a great steel industry. Mr. R. C. Allen, of Cleveland, who had charge of the exploration for iron ore in Russia for two years with twenty-two American engineers, made an interesting statement about that. When I asked him, "How big is Krivoi Rog?" he said, "It is comparable roughly to the Gogehic Range of Lake Superior. That is one of our secondary ranges, not itself capable of supporting a very large steel industry.

At Magnetitgorsk there is some high grade ore, but much of it is pretty low-grade stuff requiring concentration. The transportation set up is bad. Russia may in the five or ten year program go some distance toward their goal of fifty million tons of steel production. But I am willing to bet that they won't reach their goal in any such period, if at all. If they do, it is going to cost so much that it will be un-economic.

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A STUDENT:

Do you include Russia in your statement that any nation that wins the third world war will have to have access to the world's fund of minerals?

DR. LEITH:

I certainly do. It may be foolish for me to make such a statement as this in the presence of war specialists; but from the standpoint of raw materials necessary to win the next war I would say that Russia is third-rate. Any country would be third-rate unless it has access to the materials of the world. For instance, Russia has coal, she had manganese; but there is a long list that she is short of, and which in these days of modern war and modern weapons can only be found across the seas.

A STUDENT:

To pursue that a little further, I wonder if you would estimate what help she can expect from border countries which are somewhat within her orbit of influence?

DR. LEITH:

She can expect some help there, but they are not rich. In other words a geopolitical concept that the "heart land" can lick the world, just doesn't hold when it comes to the natural resources. My own personal feeling is more in favor of Capt. Mahan's old thesis that sea power, allowing access to world minerals, is a dominant factor.

I want to apologize to you for making statements so sweeping, but I hope you will understand.

A STUDENT:

In this week's Time, I think it is, there is quite an article about Arabian oil and the Standard Oil of New Jersey. Will we import any of that oil? There are some 26 million barrels of reserves. Can we get a chance to use that and conserve our natural resources?

DR. LEITH:

I know the oil industry feels that the first thing will be increasing use of oil from Venozuela, where the United States has a very large interest; that the Near East oil will at first go largely to other markets, and that the flow into our markets will come somewhat further in the future. I am paraphrasing a recent statement by

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Mr. Wilson, president of the Standard Oil of Indiana.

A STUDENT:

How about marginal deposits in the United States from the commercial standpoint? Are they of sufficient magnitude to change the perspective if new processes of extraction are developed?

DR. LIETH:

I don't think so. The biggest source of low-grade ore anyone can mention is iron capable of open pit mining. In the Mesabi Range they are going further and further developing beneficiating processes. It has been under way for many years. New processes are now known which are coming into large-scale production before very long. It is going to be a gradual change. As it reaches an efficient scale, it may not cost as much as we formerly supposed. The Minnesota Experiment Station has estimated that it will not cost more than 15 to 25 cents more per ton. I don't know about that figure. But beneficiation is not going to change very much the geographical set up. The ore concentrates are going to come down the Great Lakes to the great complex of steel plants of the Lower Lakes. There isn't anywhere else in the country sufficient quantity of low-grade ore capable of efficient concentration to cause any major up set in present distribution.

When it comes to copper, the low-grade copper deposits have been pretty thoroughly explored. The quantity of undeveloped low-grade ore which comes anywhere near the commercial margin has been a good deal over estimated. The chief geologist of the Anaconda Copper Mining Company, Reno Sales, who probably knows copper as well as anyone, came down to Washington during the war, when there was a lot of talk about the necessity of opening this and that low-grade deposit. He came into my office one day and said, "Of course we want to open up low-grade all we can, but," he said, "I would like to know where all of those big deposits are."

Then there is manganese. There is very little high-grade manganese in this country. There are large low-grade resources in South Dakota, New Mexico, Montana, Minnesota and Maine. We tried quite hard during the war to develop new processes for recovering that manganese. We found we could recover some of it, but at a very large cost, which meant a diversion of excessive amounts of material and manpower.

But somebody one day said, "Let us assume some of these processes will work. What would be our total manganese supply?" The answer figures about ten years' supply for the U.S.A.

CAPTAIN WORTHINGTON:

Thank you very much, Dr. Leith. We have enjoyed your talk very much.

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