REPORT...

of

LEGISLATIVE COMMISSION on TAXATION of IRON ORE

SUBMITTED TO
THE MINNESOTA LEGISLATURE
OF 1955

#12438
O.D.

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INTERIM COMMISSION ON TAXATION OF IRON ORE

SENATE MEMBERS	HOUSE MEMBERS
Thomas P. Welch, Chairman Buffalo, Minnesota	Fred A. Cina, Vice-Chm. Aurora, Minnesota
B. G. Novak, 2nd Vice-Chm. 747 Van Buren, St. Paul	Lloyd Duxbury, Jr., Secy. Caledonia, Minnesota
C. E. Johnson Almelund, Minnesota	Alf L. Bergerud Edina, Minnesota
Archie Miller Rte. 2, Hopkins, Minn.	Roy Dunn Pelican Rapids, Minn.
Elmer Peterson Hibbing, Minnesota	Gordon Forbes Worthington, Minn.
A. O. Sletvold Detroit Lakes, Minn.	H. P. Goodin 3415 Knox Ave. N. Minneapolis, Minn.
Thomas D. Vukelich Gilbert, Minnesota	Alfred I. Johnson Benson, Minnesota
Donald O. Wright Plymouth Bldg. Minneapolis, Minn.	Francis LaBrosse Duluth, Minnesota

O. A. Blanchard, Director
Frank E. Downing, Engineer
Martha May Wylie, Secretary

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State of Minnesota

INTERIM COMMISSION ON TAXATION OF IRON ORE

238 State Capitol – St. Paul 1, Minnesota

O. A. BLANCHARD, Director

December 20, 1954

To the President of the Senate
To the Speaker of the House

Honorable Sirs:

In accordance with Laws 1953, Chapter 522, this Commission submits herewith its report on the taxation of iron ore.

Respectfully submitted,

INTERIM COMMISSION ON TAXATION OF IRON ORE

By Thomas P. Welch
Thomas P. Welch, Chairman

TPW:mw

Preliminary Statement

This Commission was created by Chapter 714, Laws of 1951. By Chapter 522, Laws of 1953, the Legislature re-appropriated the unused portion of the original 1951 appropriation enabling this Commission to continue its investigation and study of iron ore taxation.

Membership of the Commission did not change and is composed of the same 16 members, eight from the House of Representatives appointed in 1951 by the Speaker and eight members from the Senate appointed in 1951 by the Committee on Committees. The Commission is made up of an equal number of majority and minority members of both Houses and this plan of equal representation was carried out in the selection of officers of the Commission and in the appointment of its subcommittees.

The purposes for which this Commission was created are embodied in Section Two of the above named Chapter 714, Laws of 1951, which reads as follows:

> "Such Commission shall make a comprehensive, detailed and complete investigation and study of all the factors contributing to a sound iron ore tax policy for this state, including information regarding the quality and extent of Minnesota's iron ore reserves and those in other parts of the world; the cost of developing Minnesota iron ores and those in other parts of the world; the advisability of using the Lake Erie price as a tax base; the impact of National Defense considerations; and the possible construction of the St. Lawrence Waterway by either Canada or the United States or both, upon the Minnesota iron ore industry, and other related factors, for the purpose of formulating a stable and fair policy for the taxation of iron ore and in order that the state shall receive the maximum possible benefit from this natural resource."

The officers elected in 1951 were unanimously voted to continue in their respective offices in 1953, and they are as follows:

Senator Thomas P. Welch, Chairman

Representative Fred A. Cina, First Vice Chairman

Senator B. G. Novak, Second Vice Chairman

Representative Lloyd Duxbury, Jr., Secretary

Also, O. A. Blanchard, Director; Martha May Wylie, Secretary to the Director and Frank E. Downing, Engineer and former head of the Mining Division of the State Tax Department, Consultant, all employed during the '51-'53 interim, were continued in their employment by the Commission during the '53-'55 interim.

In 1951, the Commission set up five subcommittees to explore various subjects, which subcommittees were continued in 1953. They are as follows:

1. **Quality and Extent of Minnesota Iron Ore Reserves and Competitive Reserves Elsewhere.** Membership: Representatives Cina, Chairman, Duxbury and Goodin; Senators Novak, Wright and Welch.
2. **Cost of Mining and Developing Minnesota Ores and Competitive Ores in Other Parts of the World.** Membership: Senators Sletvold, Chairman, Miller, Elmer Peterson; Representatives Forbes, LaBrosse and A. I. Johnson.
3. **Advisability of Using the Lake Erie Price as a Tax Base; and Other Pertinent Tax Data.** Membership: Senators Miller, Chairman, C. E. Johnson, Vukelich; Representatives A. I. Johnson, Bergerud, Dunn.
4. **Impact of National Defense Considerations.** Membership: Representatives Dunn, Chairman, Goodin; Senators C. E. Johnson and Sletvold.
5. **St. Lawrence Waterway.** Membership: Senators Elmer Peterson, Chairman, Wright; Representatives Forbes and LaBrosse.

In 1953, the Commission appointed four more subcommittees, as follows:

1. **Labor Credits.** Membership: Senators Elmer Peterson, Chairman, Wright; Representatives Duxbury, A. I. Johnson.
2. **Drilling Permits, etc.** Membership: Senators Vukelich, Chairman, Sletvold; Representatives Forbes, Goodin.
3. **Tax on Ore Carriers.** Membership: Representatives LaBrosse, Chairman, Forbes, Bergerud; Senators C. E. Johnson, Miller, Novak.
4. **Taconite Tax, etc.** Membership: Senators Wright, Chairman, Novak, Welch; Representatives Cina, Dunn, LaBrosse.

The subcommittees made reports to the Commission.

To familiarize the members of the Commission with operations in the iron ore industry, and for the purpose of obtaining "on the spot" information to determine what competition foreign ores would present to Minnesota, by direction of the Commission, the following inspection trips were made and hearings held:

Inspection trips by Commission:

1951 – 5 day inspection trip of the Cuyuna and Mesabi Ranges.

1953 – Inspection trip to the taconite area.

1954 – Inspection trip to Venezuela.

Inspection trips and hearings held by subcommittees:

1952 – Reserve Subcommittee went to the Alabama Ore field and Steel Plant at Birmingham, Alabama; the Canadian fields at Steep Rock Lake, Ontario and Labrador-Quebec; the steel plants at Pittsburgh and Morrisville, Pennsylvania and Sparrows Point, Baltimore, Maryland.

1952 – Subcommittee on National Defense and Subcommittee on Great Lakes St. Lawrence Seaway attended hearings and took testimony in Washington, D.C.

1954 – Subcommittee on Tax on Ore Carriers attended hearings and took testimony in Cleveland and Washington, D. C.

During the past interim ('53-'55), the Commission and its subcommittees continued to hold hearings on the various subjects relating to iron ore taxation and the administration of the law. Engineers, geologists, the Commissioner of Taxation, representatives of labor organizations, tax organizations, the mining companies, both large and small, fee owners of mining property, representatives from municipalities and school boards in the taconite area and individuals were all given an opportunity to present their views to the Commission.

On June 9, 1953, the following letter was sent to all members of the Legislature:

"TO THE MEMBERS OF THE LEGISLATURE:

"By virtue of Chapter 522, Laws 1953, this Commission will continue its study of iron ore taxation and endeavor to formulate a stable tax policy on iron ore, for submission to the next Session of the Legislature.

"All of you received a copy of the factual report submitted to the Session just ended. If you have read this report you may have some suggestions or information helpful to the Commission and the Legislature.

"The purpose of this letter is to give every member of the Legislature an opportunity to convey his or her ideas to the Commission, so that we will have ample time to do the research and obtain the facts on the suggestions presented. If possible, send in your suggestions or recommendations before July 1, 1953.

"If you do not have a copy of our report, just drop me a line and one will be sent to you.

"The problem confronting this Commission is very important

and complex. The final determination of this problem rests with the Legislature and for this reason we solicit and shall appreciate your suggestions, so that every phase of the subject can be explored and included in our next report."

Two replies were received by this Commission.

Based on the investigation and study made both during the interim of '51-'53 and the interim of '53-'55, the Commission submits the following report:

Glossary of Terms Used in This Report

Alumina — Oxide of aluminum; clay.

Beneficiation — Any process of treating low grade iron ore material, beyond simple crushing and screening, to remove impurities or moisture from the crude material, thereby increasing the iron content of the product.

Bessemer Ore — Ore containing phosphorus in the amount of .045% or less.

Concentrate — The product of any method or process of ore beneficiation.

Direct Shipping Ore — Ore that can be used without beneficiation.

Dried Iron — The metallic iron content of iron ore when dried at 212 degrees Fahrenheit.

Gross Ton (U.S.) or Long Ton (Br.) — 2,240 pounds. Adopted from Great Britain along with our other units of weights and measures. Iron ore is bought and sold by the gross ton. Common carriers base their freight charges on the number of gross tons shipped.

Heavy Media Concentration — A process using a medium heavier than the rock particles in the ore material being treated, but lighter than the iron ore particles being recovered. (In this process the iron ore particles over ¼ inch in size can be separated from the particles of rock.)

Hematite — Non-magnetic iron ore. Chemically it contains two parts iron to three parts oxygen.

Iron Ore Material or Low Grade Iron Ore — Iron-bearing material having low iron content, and a high content of silica, alumina, or moisture, or a combination of all three.

Jigging — Washing of ore material, followed by use of jigs, with combined vibration and rising water current through the ore.

Leach — To percolate slowly through a mass, (such as rock) gradually removing the more soluble elements. In the case of iron-bearing rocks, the leaching action is that of very slow breaking down over long periods of time.

Magnetite — Magnetic iron ore. Chemically it contains three parts iron to four parts oxygen.

GLOSSARY

Manganiferous Iron Ore — Iron ore containing not less than 2% of manganese, and usually not more than 30% manganese. (Most Minnesota manganiferous ores have a manganese content of 2% to 10%.)

Merchantable Iron Ore — Marketable; acceptable for use in making steel. This term includes **direct shipping ore** and **concentrate.**

Mouth of Mine — The point at or near the mine at which the loaded ore cars are released to the railroad company for shipment. This, in the case of direct shipping ore, may be at the actual mouth of the mine; in the case of concentrate, it would be the point near the treating plant, where the loaded cars of the finished product are released to the common carrier for shipment.

Natural Iron — The metallic iron content of iron ore as it occurs in its natural bed; or before drying the ore at 212 degrees Fahrenheit.

Net Ton U.S. & Br. — 2,000 pounds. Used as the unit applied to manufactured iron and steel.

Non-Bessemer Ore — Ore containing more than .045% of phosphorus.

Nodulizing — A process similar to that of **pelletizing,** but using a different method, and a degree of heat slightly higher than that used in pelletizing. The product (nodules) will average slightly smaller and possibly harder than the 5/8-inch to 3/4-inch **pellets.**

Paint Rock — Iron and aluminum in combination with silicon and oxygen.

Pelletizing — A process involving first the forming of very fine ore particles into balls or **pellets** having about 10% of moisture; and second the roasting of the pellets at a temperature below that of actual melting, to harden them so that they will stand handling without excessive breakage.

Silica — Silicon dioxide; sand; quartz; flint.

Sintering — A process for agglomerating, or compacting together (by heat) the very fine particles of iron ore common in some mines, so that the product can be used in the blast furnace.

Specific Gravity — The ratio of the weight of any given volume of a substance to the weight of an equal volume of water.

Spirals — Machines using the principle of centrifugal force combined with rising water current, to recover ore particles smaller than 1/4-inch in size, and larger than 60-mesh size.

Taconite — Iron-bearing rock, known as chert, very dense and hard.

Washing of Ore — The removal of impurities, such as free silica or free alumina by use of water.

Brief History of Iron Mining in Minnesota

EARLY MINING DAYS IN MINNESOTA

The discovery of iron ore in Minnesota was reported by J. G. Norwood in 1850.

Thirty-four years after the Norwood discovery, the first iron ore was shipped from the Vermilion Range, a shipment of 62,124 tons from the Soudan Mine. In 1892, the first Mesabi Range shipment went forward from a shaft at the Mountain Iron Mine. The actual knowledge of existence of Mesabi iron ore dates back much further. 1911 saw the first shipment of iron ore from the Cuyuna Range's Kennedy Mine.

Strangely enough, the Vermilion's first ore came from an open cut at the Soudan Mine, while the Mesabi's initial shipment was mined from a shaft. This situation was soon reversed, and for many years nearly all of the Vermilion's ore has been from underground mines; while on the Mesabi, underground mining has steadily declined until, in recent years, it has accounted for less than 5% of the total output.

OPERATING CHANGES

Year by year, the quantity of earth and rock to be removed to uncover ore is increasing. The early rule of one foot of overburden, for each foot of ore uncovered, has long ago been discarded. Later a rough limit of 100 to 140 feet was estimated as the practical limit of stripping even with deep underlying ore. These figures have now been doubled.

In early days, 5 cubic yard cars and small "dinkey" engines were used in removal of overburden from open pit ore. In 1906, 7 cubic yard cars came into use, on standard gauge railroad tracks. By 1911, 24-yard cars were common, and these were soon followed by 30-yard cars. Even more remarkable is the transition, first from hand labor and use of teams and scrapers in removal of overburden, to use of the railroad, or "A-frame" type of coal-fired steam shovel; then the electric shovel; then the caterpillar-mounted full revolving shovel, still in common use; and more recently, the heavy dragline, used with screening bin, and conveyors that move the earth a mile or more from pit to waste pile.

In the larger pits, with favorable grades, railroad haulage still holds its place in open pit work.

LAKE DRAINAGE FOR MINING

Mainly to aid in the production of ore to meet the demand in World War II, Syracuse Lake on the Eastern Mesabi was drained to permit

removal of overburden, and the mining of ore. Since 1943, over 12 million tons have been mined.

In the western part of the pit area, where stripping was in progress in 1942-43, the depth of overburden was 130 feet. In the southeast part of the present pit, where excavation is pushing southward, the combined depth of surface and rock capping exceeds 350 feet.

On the Cuyuna Range, the eastern lobe of Rabbit Lake was pumped out in years 1947-50, and a large dredge was brought in for removal of a large quantity of lake-bed mud, or peat. This part of the work completed, the dredge was dismantled. The pit area, lying inside a roughly circular area enclosed by a dyke, was pumped out, and removal of clay, sand and boulders, roughly two-thirds of the original volume, was continued with standard equipment. Mining of ore began in 1952, but was interrupted by abnormal flood conditions.

These two examples emphasize the acute demand for iron ore, vital for winning the war, and for overtaking the pent-up demand accumulated during war years.

More than one-third of all the iron ore mined in Minnesota in this century, up to the end of the late war, went to meet the needs of World Wars I and II.

RECENT MINING DEVELOPMENTS

The South Agnew Mine, formerly operated as an underground mine was developed for open pit mining in 1946 and 1947. This operation pioneered the use of heavy drag-line removal of surface stripping and long conveyors for moving earth for over a mile to waste piles. Shipments to the end of 1953 were 6,640,000 tons.

The old Morton Mine, where shaft sinking and initial underground development were carried on by Tod-Stambaugh Co. in 1912-17, is now being developed as an open pit by the Hanna Company, using the same equipment that served to open the South Agnew.

In the Chisholm-Fraser area, the Fraser-d'Autremont-Shenango look like a single operation. The Fraser group has been extended to include the Humphrey, the Alworth, and the St. Clair properties. Another new pit is the Forster, east of the Fraser. The first shipment was made from this pit in 1950. Shipments to the end of 1953 were over 6,000,000 tons.

Near Buhl, the old Wanless underground mine, which produced 2,500,000 tons in the years 1914-28, and abandoned, was reopened in 1950 by Cleveland-Cliffs Co. as an open pit. Also, in the same district in 1951, a new open pit was developed by the Snyder Mining

Company, including their Whiteside Mine (formerly underground) and the Kosmerl Mine of Oliver.

In the Virginia area, a large sintering and nodulizing plant was built by Oliver Iron Mining Co. in 1950-51.

On the eastern Mesabi, the Schley Mine, first mined by shaft in the years 1910-23, then by open pit from 1941-45, was reopened and widened by Inter-State Iron Co. in 1950, for 1951 production.

The St. James Mine, at Aurora, formerly worked as an underground mine, was opened for pit mining in 1951, by the St. James Mining Co. (Oglebay, Norton & Co.)

BENEFICIATION

OF LOW GRADE ORE

Primitive Metallurgy Action of Heat

It has been said that the art of metallurgy was born at the campfire of a savage; and that the accidental melting of metal in a stone led the way to steel. Heat was then, and still is, one of the **main elements needed in making iron and steel from iron ore.**

Beneficiation and Concentrate Defined

Beneficiation is any process used to treat low-grade iron ore to make it into a **merchantable product,** or a product, known as **concentrate** that can be economically used in the **manufacture of steel.** With waning supplies of **direct shipping ore** in Minnesota, mining men are finding that they now have to depend more and more on some form of upgrading of the leaner classes of ore, to make a product that is really fit for effective use in the blast furnace.

These different forms of treatment, beyond simple crushing and screening, include **washing, jigging, heavy media separation, use of spirals, flotation, drying,** and **sintering.**[1]

Crushing and Screening

Crushing and screening, formerly classed as two of the various forms of beneficiation, are now regarded as part of (1) the **mining operation** in the case of direct shipping ore; or (2) the **beneficiation plant operation,** in the case of ore that has to be concentrated. This is due to the current general recognition of the importance of ore preparation as to **sizing,** to make the ore more readily reducible in the blast furnace. If crushing and screening were now counted as true beneficiation methods, the ratio of concentrate to total ore shipped, instead of being 33%, would be nearly 100%.

Action of Water in Concentration of Iron Ore

What **heat** is to the smelting of **iron ore, water** is to the vital process of changing **ore material** into **iron ore;**[2] thus mechanically hastening the age-long natural processes of concentration due to the leaching action of underground water. Simple washing combines

(1) Percentage of concentrate in total iron ore production in Minnesota

	% of Concentrate in shipments
1910	0.6
1920	12.5
1930	18.2
1940	18.8
1950	30.5
1958	33.1

(2) An exception to this general statement is the use of heat to drive off the excess of moisture in certain types of ore, not treatable by washing, to save on freight. The amount of ore so treated is relatively small. Another exception is sintering, using heat to improve the structure of fine powdery ore and to drive off moisture to save on freight.

the action of water with the effect of differences in specific gravity of ore and rock.[3]

Ore Washing Experimental work by the Oliver Company on the Western Mesabi Range led to the building of the Trout Lake Concentrator at Coleraine, in Itasca County, in 1908. This plant, still the largest of its kind in Minnesota, has been in operation for over 40 years. Early machines have been remodeled or replaced. The process of ore beneficiation has been in a state of progressive change, with many improvements in machines and methods. This plant, originally employing only straight washing of ore by use of water only, now also makes use of heavy media, and other recent methods. Built in three sections, it is well adapted to changing techniques.

Preliminary Steps Beneficiation, or rather concentration, is usually not fully achieved by the use of any one machine or method. Certain peculiarities or characteristics of the crude ore material are studied, taking into account the following differences between the iron ore particles and those of the accompanying rock:

1. Physical structure of ore material, whether coarse or fine, hard or soft, clayey or sandy.
2. Differences in size range of ore particles and rock particles.
3. Differences in weight of ore and rock particles (specific gravity).
4. Differences in hardness of ore and rock.

Straight Washing 1. A large amount of fine sandy material would suggest a straight washing process as the step following coarse screening.

Crushing and Screening 2. Large rock particles are removed by coarse screening and go to waste piles. Large ore chunks are reduced to desired size by crushing, followed by either straight washing or heavy media treatment.

Gravity Methods 3. This principle suggests the method of treatment in most Minnesota plants. Straight washing, jigging, heavy media and spirals all make use of this principle.

Abrasion and Flotation 4. If the ore particles are softer than the rock, or where a thin coating of ore is found to cover rock grains, abrasion may remove the ore as fine particles, recoverable by spirals or by flotation.

(3) Specific Gravity of:

Hematite (iron ore)	5.1
Quartz (silica)	2.65
Slate (Silica & alumina)	2.50

Plant Design Fitted to Special Types of Ore Material Since no one machine can cover the entire process of iron ore concentration, the plant has to be designed to fit the type and peculiarities of the ore material to be treated. A modern plant, designed to treat ore from several mines, would probably include units for crushing, screening, straight washing, heavy media, and possibly flotation.

Following the building of the Trout Lake Plant by the Oliver Company, other companies soon became active in the work of ore beneficiation. Well up in front were Butler Brothers, whose pioneering work in the Nashwauk area has been notable indeed. As in the Oliver Company, some of the former Butler men are now among the top operators on the Central and Western Mesabi Range, the home of "wash" ore. Also, on the Eastern Mesabi, Stanley Mining Company has been doing an outstanding job on hard, rocky ore material.

In fact, all the major companies, and also some of the smaller companies, entering the field since 1940, have made very good progress in solving the increasingly difficult problems of treating complex and rocky ores.

Nature of Crude Ore Material Most crude wash ore contains very coarse particles of rock, and also a large amount of fine decomposed taconite, resembling sand. The iron ore particles are mainly in the intermediate size range.

Ore Washing Brief Description Simple washing of "sandy" ore combines the use of water with the difference in specific gravity as between ore and rock. Enough water is used to make a fluid mixture, which is kept in motion and also under steady concentration by the action of an upward water current, which lifts the sandy particles so that they are drained off in the overflow at the lower end of the classifier. The heavier iron ore particles settle to the bottom, and are moved upward along the inclined trough of the machine by a rotating spiral blade, and discharged on a conveyor at the upper end, going to the shipping bin. The weight of the concentrate will generally average about 55 to 60 per cent of the weight of crude ore treated.

Jigging In most wash ore deposits, the bulk of the silica to be removed to produce a good concentrate is in the form of fine "sand." This part of the concentration has been described. When this step has been completed, and the fine silica-bearing ore material is gone, the remaining ore material consists mainly of ore and rock in the sizes above one-half inch. Jigs will work on sizes from one-quarter inch to one and one-half inch.

The use of jigs has been quite general in some parts of the Mesabi

Range. Like ordinary washing, this method makes use of a rising current of water, aided by a device that creates repeated surges of water through the stream of ore. Good results are obtained on some types of ore when crushed to between one-quarter inch and one inch size. As generally applied, however, jigs have somewhat the same limitations as straight washing, as far as finer ore particles are concerned.

There is one jigging plant in the Virginia area,[4] using jigs of special design, which for the past 5 years has been producing a usable grade of concentrate from a lean ore stockpile that, at first glance, does not appear to have any promise at all as washable material. Here, however, the recovery, measured in weight of concentrate as compared to weight of crude ore going into the plant, is quite low, due to the large amount of impurities in the crude ore material.

Ordinarily, the recovery, or the ratio of weight of concentrate to weight of crude ore to the jig plant, runs from 30% to 50%. Until quite recently, three jig plants were in operation on the Mesabi Range.

Heavy Media The Heavy Media process was developed to replace the use of jigs. This is now a standard process on the Mesabi Range. Feed ore going to the heavy media plant is usually pre-washed to remove fine material, and then crushed to pass a one-inch screen.[5]

The terms **"heavy media"** or ("heavy medium"), **"sink-float,"** and **"high-density"** are synonymous. The commonly used term is **"heavy media,"** in which finely ground ferro-silicon, with a silica content of 15%, is held in suspension in water, forming a solution with a specific gravity of 2.7 to 3.3. The ore particles or pieces above one-quarter inch size settle to the bottom of the cone-shaped body of the separating unit, then go to the shipping bins, while the rock particles rise to the top, and are removed to waste pile. (Here again, the range of sizes of ore particles from one-quarter inch down to 60-mesh are now being recovered by special units described further on in this section.)

This machine gives good results on ore materials where fairly good separation can be obtained in the size range above one-quarter inch diameter.

The ferro-silicon can be readily recovered for re-use with relatively small loss.

Humphrey Spiral The most difficult step in beneficiation, as far as size of ore particles is concerned, appears to be in the range from one-quarter inch diameter down to 60-mesh. (60 screen openings per lineal inch.)

(4) Charleson Plant, Virginia, Minn.
(5) Some of the concentration plants are now producing entirely heavy media concentrate.

For this step, use is made of the principle of centrifugal force, in combination with water, in a cone-shaped vessel.

One process,[6] described as among the most successful in handling this size of ore material, makes use of what is called "abrasion grinding," followed by treatment in Humphrey spirals. In this process, the relative **hardness** of the ore and rock particles comes into play. Here, the rock particles, which are partly decomposed taconite, are easily reduced to fine sizes in a ball mill using less than the usual number of steel grinding balls.

When the ore and fine silica next go through a Humphrey Spiral using a whirling and rising water current, the fine silica particles are floated out in the overflow, while the iron ore pieces settle to the bottom.

Dutch State Cyclone This process, also using the principle of centrifugal force in combination with a rising and whirling water current, is described by Holt as follows:[7]

Ore material with particles too fine for treatment by heavy media is mixed with finely ground magnetite and water. The mixture is pumped to the Cyclone unit (which operates on the same principle as the Humphrey Spiral, the rising and whirling current of the medium). The overflow, carrying the waste material, and the underflow, containing the concentrate, are each put through a separator to recover the magnetic medium. As to results, Mr. Holt has this to say: "This process for treating fines may, when perfected, approach in efficiency the sink-float process (heavy density) on the coarse sizes."

Flotation Referring to oil flotation, Mr. Holt notes experimental work on iron ore in Minnesota using this process; and observes that the future of oil flotation for iron ores will rest in the ability to apply the method economically.

Beneficiation of Low Grade Ore Summary As pointed out by G. J. Holt in his 1946 article,[8] "almost every man-made or natural force known today, except atomic energy, has been turned toward the problem of iron ore concentration. Processes involving gravity, hydraulics, buoyancy, magnetism, electrostatics, heat, and centrifugal force have been tested in attempting to solve the future of our iron ore industry."

Beneficiation of Taconite Beneficiation of Taconite, as distinguished from beneficiation of low grade ore, is fully explained herein under Taconite Section.

(6) Holt, Grover J. Gen. Manager, Cleveland-Cliffs Iron Co. Progress in Iron Ore Beneficiation Canadian Mining and Metallurgical Bulletin, Nov. 1950, p. 636.
(7) (Same as above)
(8) Grover J. Holt—Late Developments in Beneficiation of Iron Ores. Blast Furnace and Steel Plant—Jan. 1946.

Brief History of Iron Ore Taxation

The first law taxing iron ore and mining products was enacted on November 22, 1881, at a special session of the Legislature. (1881 Extra Session, Chap. 54). The act imposed a tonnage tax of one (1) cent for each gross ton of iron ore mined and shipped or disposed of and this tax was in lieu "of all the taxes or assessments upon the capital stock, personal property and real estate used in producing the ore." The tax was to be distributed 50% to the General Revenue Fund of the state and 50% to the county or counties in which the mines were located. The law was entitled "An Act to encourage mining in this state by providing a uniform rule for the taxing of mining property and products."

In 1896 the Attorney General, in an opinion, declared the law unconstitutional and in 1897 the Legislature repealed the law. In 1898 the State Supreme Court, in the case of State of Minnesota vs. Lakeside Land Co., 71 Minn. 283, held the tonnage tax law of 1881 unconstitutional because it was in conflict with Article 9, Section 1, of the State Constitution. During the time the Act was in force taxes collected thereunder amounted to $100,600.09.

Since the repeal of the tonnage act of 1881, iron ore, whether mined or unmined, has been taxed like other property on the ad valorem basis, but at 50% of its full and true value, which is higher than the percentage of full and true value on any other class of property.

Originally, Article 9 of the State Constitution provided that "taxes to be raised in this state shall be as nearly equal as may be; that all property on which taxes are to be levied shall have a cash valuation and be equalized and uniform throughout the state and that property should be taxed according to **its true value in money.**"

In 1906, this Section of the Constitution was amended, by what is commonly called the "wide open tax amendment" and provides that "taxes shall be uniform upon the same class of subjects." Article 9 of the Constitution was amended in 1922 so that every person, copartnership, company, joint stock company, corporation or association, engaged in the business of mining or producing iron ore or other ores in this state, is required to pay an occupation tax on the value of all ores mined or produced. This tax is in addition to all other taxes provided by law. The first occupation tax law enacted by the Legislature under the amendment fixed the rate at 6% of the value. This rate remained in effect until 1937. It has been amended several times and the rate at present is 12%.

In 1923 the Legislature enacted the "Royalty Tax Law" which imposes a tax on all royalty received during each calendar year, for permission to explore, mine, take out and remove ore from land in this state. The royalty tax was originally 6% and has gradually increased to the present 12%.

In 1941 the Taconite Tax law was enacted.

A digest of the present laws and an explanation of how they are administered follows:

DIGEST OF MINNESOTA LAWS APPLICABLE TO IRON ORE TAXATION.....

AD VALOREM TAX

OCCUPATION TAX

ROYALTY TAX

TACONITE AND IRON SULPHIDES

EXEMPTION FROM INCOME TAX

AD VALOREM TAX

Under our tax laws the word "person" includes firm, company, or corporation. Minnesota Statutes 1953, Section 272.03, Subdiv. 9.

1. General Provision Minn. Statutes 1953, Sec. 272.01 Property Subject to Taxation

All real and personal property in this state, and **all personal property of persons residing therein,** including the property of corporations, partnerships, banks, banking companies and bankers, is taxable, **except such as is by law exempt** from taxation.

2. M. S. 1953 Sec. 272.03 Subdivision 1 Real Property Defined

For the purposes of taxation, **real property** includes **the land itself,** and **all buildings, structures,** and **improvements** or **other fixtures** attached thereto, and **all rights or privileges belonging or pertaining to it and all mines, minerals, quarries, fossils,** and **trees on or under it.** (Thus it is clear that special effort was made to obtain a definition that is **all-inclusive.**)

3. M. S. 1953 Sec. 272.04 Mineral, Gas, Coal, and Oil Owned Apart from Land

This section provides for the assessment and taxation of **mineral interests** that may be owned separately from interests in the surface of the land; and for their identical treatment both as to taxation and as to sale for delinquent taxes.

4. M. S. 1953 Sec. 272.05 Reserved Timber or Mineral Rights

This section deals with lands conveyed or **transferred either to the U. S. or to the State of Minnesota,** or to **any governmental subdivision** of either one, in which the **timber or mineral rights** are **reserved by the owner.** It provides for the same tax treatment of such rights as would apply to other real property, regarding both taxation and sale for delinquent taxes.

5. M. S. 1953 Sec. 273.01 Listing and Assessment Time

All real property subject to taxation shall be listed and assessed **every even numbered year** with reference to its value on **May 1 preceding the assessment, and all real property becoming taxable in any intervening year shall be listed and assessed** with reference to **its value on May 1 of each year.** Personal property, however, is assessed on May 1 of each year.

Provision is also made in this section for the **assessment of mineral lands** leased by the State **after May 1 of any year,** on the basis of **value of all ore shipped therefrom before May 1 of the next year.**

(This provision avoids the escapement of tax, on lands leased after May 1, on ore that may be mined before the following May 1. By mutual agreement, between the Department of Taxation and the Mining Company, this same provision has been followed in the case of privately owned mineral property.)

6. M. S. 1953 Sec. 273.02 Omitted Property

This section provides for entry on the tax records of any real or personal property found to have been omitted or undervalued in any preceding year; such entry being for the year or years originally omitted.

6-a. Subd. 1 Discovery
6-b. Subd. 2 Limitation

A time limit of six years is herein provided for **entry of omitted property** in the records; and for **correction of the valuation or classification of real property,** the time limit is **one year after December 1** of the year in which the property was **assessed or should have been assessed.**

6-c. Subd. 3 Rights Not Affected

Rights of a good faith purchaser of property **acquired prior to the correction of assessed value thereof** by the county auditor are not affected. In the case of **rights adversely affected** by action of the auditor, **application may be made** for reduction under the provisions of Sec. 270.07, relating to powers of the **Commissioner of Taxation.**

7. M. S. 1953 Sec. 273.11 Valuation of Property

All property to be valued by itself, at its true and full value. Value of **land,** and of **buildings or structures,** to be **listed separately.**

8. M. S. 1953 Sec. 273.12 Assessment of Real Property

Duties of assessor: To consider every factor that affects market value, including **other comparable lands,** so as to **secure uniformity,** and **avoid discrimination.**

9. M. S. 1953 Sec. 273.13 Subdivision 1 Classification of Property

All real and personal property, **subject to general property tax,** and **not subject to any gross earnings or other lieu tax,** comes under this section.

9-a. Subdivision 2, Class 1 — Iron Ore, Mined or Unmined

To be assessed under **Class 1, at 50 percent of its full and true value. Unmined ore to be assessed with and as part of real estate** where same is located. **Underground ore (ore mined by under-**

ground methods) and **placed in stockpile after August 1 of any year** and **before the next May 1 . . . for 2 taxable years after being mined, shall be listed and assessed in the district where mined, at its unmined rate. Ore and land to be valued separately.**

9-b. Class 1-a Ore Processed Within Minnesota

All direct products of the blast and open hearth furnaces that are utilized in the form produced, and are not further processed, shall constitute class 1-a, and shall be valued and assessed at **15% of the full and true value thereof.**

10. M. S. 1953 Sec. 273 Subdivisions 1 & 2 Definitions

. . . The following words, terms and phrases, for purposes of Sections 273.14 to 273.16, are given these meanings: "person" may be an individual, co-partnership, company, joint stock company, corporation, or association.

10-a. Subdivision 3 Deposit

A body of iron-bearing materials best mined as a unit.

10-b. Subdivision 4 Low-Grade Iron-Bearing Formations

Commercial iron bearing deposits, exclusive of paint rock, located below surface, which in their natural state need beneficiation to make them fit for use; and which then produce, in tons, less than 50% of the original tonnage of crude ore material delivered to the treating plant; and which must be mined using good engineering and metallurgical practice to produce such concentrate.

10-c. Subdivision 5 Beneficiation

The process of concentrating that part of the crude ore entering the beneficiating plant by removal of silica and moisture therefrom.

10-d. Subdivision 6 Concentrates

Products of a beneficiating plant, so improved as to be fit for blast furnace use.

10-e. Subdivision 7 Tonnage Recovery

Ratio of weight of concentrate to weight of crude ore entering beneficiating plant.

11. M. S. 1953 Sec. 273.15 Classifications of Low-Grade Iron Ore

Low-grade iron-bearing formations defined in Sec. 273.14 are classified according to **recovery** ratio, as follows:

For tonnage recovery between 49 and 50%, the assessed value is 48½% of full and true.

For tonnage recovery between 48 and 49%, assessed value is 47% of full and true.

For each further drop of 1% in tonnage recovery, the percentage of assessed to full and true value is to be cut another 1½% of the

full and true value; but the assessed value is not to go below 30% of the full and true value in any case.

The land, exclusive of such formations, is to be assessed as otherwise provided by law.

12. M. S. 1953 Sec. 273.16 Determination of Classification

Classifications of iron-bearing formations under Sections 273.14 to 273.16 are to be determined as follows:

Anyone mining low-grade ore such as above described, whose tonnage recovery of concentrate for a taxable year has been below 50%, may file a petition with the Commissioner of Taxation, requesting classification of their deposit under the provisions of Sections 273.14 to 273.16. The taxpayer must furnish such data and information as the Commissioner may require. The Commissioner then submits such petition and data to the University of Minnesota Mines Experiment Station. The latter considers the deposit referred to in the petition as a unified commercial operation; and, based on all data furnished, next files a written report thereon with the Commissioner of Taxation, who, after hearing duly held, may approve or disapprove such report. If a reclassification is made covering such deposit, the Commissioner of Taxation has to give appropriate notice thereof to the interested taxing districts.

If the Commissioner disapproves such classification, his findings and order thereon may be reviewed by a writ of certiorari from the supreme court on petition of the aggrieved party presented to the court within 30 days after date of such order. Such classifications are also subject to further review by the Mines Experiment Station, from time to time, upon request of the Commissioner of Taxation, or upon further petition by the taxpayer. Valuations determined hereunder are subject to the provisions of Sections 270.19 to 270.26.

13. M. S. 1953 Sec. 273.19 Lessees and Equitable Owners

This section relates to property held under lease for a term of 3 years or more, or under purchase contract either from the State or from any religious, scientific, or benevolent institution, or any railroad or other organization whose property is not taxed like other property; or when the property is school or other state land, and is considered, for tax purposes, as belonging to the current holder thereof.

The ad valorem tax goes to the State, counties, townships, school districts and local taxing districts according to the levy of the respective taxing units.

OCCUPATION TAX

1. Constitution of Minnesota, Article IX Section 1

Following the fundamental provision in Article IX, Section 1 of the Constitution, that the power to tax shall never be suspended, or contracted away, comes the specific provision, in Section 1-A, for the **occupation tax.**

2. Section 1-A Providing for Occupation Tax
(a) Occupation Tax Not a "Lieu Tax"
(b) Time of Payment of Occupation Tax

The constitution provides that **anyone engaged in the business of mining or producing iron ore or other ores in this State,** shall pay to the State of Minnesota an **occupation tax on the valuation of all ores mined or produced,** which tax **shall be in addition to all other taxes provided by law,** said tax to be due and payable from such person . . . **on May 1 of the calendar year next following the mining or producing thereof.**

(c) Valuation of Ore as Basis of Tax

The **valuation of ore** for the purpose of determining the **amount of tax** to be paid shall be ascertained in the manner and method **provided by law.** (Method to be described later.)

(d) Apportionment of Occupation Tax

Funds derived from the tax herein provided for shall be apportioned: **50% to the State General Revenue Fund, 40% to the Permanent School Fund, and 10% to the Permanent University Fund.**

3. M. S. 1953 Sec. 298.01 Occupation Tax on Producing Ores

This section repeats the provision, number 1-A, Article IX, of the State constitution, for payment of the occupation tax by **producers of iron ore in Minnesota;** and states the rate of such tax as 11% for 1947 and each year thereafter, computed on the **valuation of ores mined or produced** by any person during the preceding calendar year.

4. M. S. 1953 Sec. 298.011 Validated by the Constitutional Amendment to Art. IX, Sec. 1 Adopted Nov. 27, 1950. Veterans' Compensation Fund

This section sets forth: "Notwithstanding the provisions of Section 1-A of Article 9 of the constitution, a portion of the **proceeds of the occupation tax, on the valuation of all ores mined or produced, . . . equal to the proceeds of a tax of 1% on such valuation . . . shall be paid into the Veterans' Compensation Fund before the remaining funds derived from the occupation tax are apportioned by Sec. 1-A of Article IX of the constitution.**"

This amendment when approved by the people

and proclaimed, all as provided by law, was made effective Jan. 1, 1949. In the event that the provisions of the preceding sentence are held unconstitutional, the remaining provisions of this section are to stand as valid and continue in full force and effect. "This section of the constitution shall expire on Dec. 31, 1958, except as to the proceeds of the occupation taxes theretofore levied and thereafter collected."

5. M. S. 1953 Sec. 298.02 Low Grade Ore; Credit for Cost of Labor

Any taxpayer coming under the provisions of Sec. 298.01 may qualify for a credit for high labor costs of mining, development, or beneficiation, as defined in this section, as follows:

(a) This applies to underground mines, and to open pit mines where over 40% of the crude ore produced has been beneficiated by processes more difficult than ordinary crushing and washing; and allows a credit of 10% of labor cost at such mines in excess of 60 cents and not over 78 cents per ton of concentrate produced; and 15% of that part of cost of such labor above 78 cents per ton of concentrate produced.

(b) Other mines (Open pit). On the first 100,000 tons allow a credit computed in the same manner as under (a). On all concentrate in excess of 100,000 tons from any mine, 10% of labor costs in excess of 96 cents per ton of concentrate; provided that the maximum allowable credit be limited to 75% of the computed gross tax, in the case of underground and taconite operations, and to 60% as applied to all other operations, of the total of the tax computed under the provisions of M. S. 1949, Sec. 298.01.

(c) But the labor credit shall not exceed 7.3% of the aggregate amount of occupation taxes, excluding such taxes levied for the Veterans' Compensation Fund (Sec. 298.011) assessed against all mines in the state for said year prior to the deduction of said credit. At the time of his final determination of occupation tax pursuant to Sec. 298.09, Subd. 3, the Commissioner shall reduce the credit otherwise allowable to each mine hereunder by such equal percentage as will bring the total within such limitation.

6. M. S. 1953 Sec. 298.02 Subd. 2. Credit in Lieu of Cost of Labor

In lieu of the **labor credit,** at the election of taxpayer, **a credit** may be allowed against the occupation tax, as follows: **two-thirds of one per-cent of the gross tax for each one percent of the total production of iron ore from any mine which is made into pig iron, sponge iron, or powdered iron within the State.**

7. M. S. 1953 Sec. 298.03 Value of Ore. How Ascertained Specified Statutory Deductions Under Sec. 298.03

The law specifies **the value of the ore, where brought to the surface of the earth, as the basis of the tax; "such value to be determined by the Commissioner of Taxation."**

(1) Mining (cost of labor and supplies).
(2) Development – open pit.
(3) Development – underground.
(4) Royalty paid.
(5) That part of the realty tax allocated to ore mined in calendar year.
(6) The amount or amounts of all the foregoing subtractions shall be determined by the Commissioner of Taxation.

8. M. S. 1953 Sec. 298.04 Ores Subject to Tax

This section provides that **all ores mined or produced after** December 31, 1936, shall be subject to the provisions of Sections 298.01, 298.03 and 298.04.

9. M. S. 1953 Sec. 298.05 Mining Companies to Report Annually

Producers of iron ore are required hereby to file, on or before March 1 of each year, with the Commissioner of Taxation, under oath, a report, in such form and containing such information as the Commissioner may require, covering the operations of each of their mines during the preceding calendar year.

10. M. S. 1953 Sec. 298.06 Commissioner to Determine Tax

Upon receipt by the Commissioner of Taxation of such report, he shall determine . . . whether the report is correct or not; and if found correct, he must, on or before May 1, determine the amount of tax due from each person.

11. M. S. 1953 Sec. 298.07 When Report Is Incorrect Commissioner to Fix Amount of Tax

. . . If the report is found by the Commissioner to be incorrect . . . he shall find and determine the amount of tax due from such person.

12. M. S. 1953 Sec. 298.08 Procedure When No Report Is Filed. Penalty

If any iron ore producer in Minnesota fails to make the report as required under Sec. 298.05, at the time and in the manner therein provided, the Commissioner of Taxation shall . . . **ascertain the kind and amount of ore mined or produced, together with its valuation, and determine the amount of the tax due. . . . There shall be added thereto a penalty for failure to report, equal to 10% of the tax imposed, to be treated as part of the tax.**

13. M. S. 1953
Sec. 298.11
Time for Payment of Taxes. Penalties

If the tax provided for in Secs. 298.01-298.16 is not paid before June 15 of the year when due ... a penalty of 10% thereof shall immediately accrue; and 1% per month is added to such tax until paid.

14. M. S. 1953
Sec. 298.17
Occupation Taxes to be Apportioned

All occupation taxes, except the 1% dedicated to the Veterans' Compensation Fund, are distributed as follows: 50% to the State General Revenue Fund; 40% to the Permanent School Fund; and 10% to the Permanent University Fund.

15. M. S. 1953
Sec. 298.19
Ore-Carrying Roads to Report to Commissioner

Every railroad company or other common carrier receiving iron ore for original shipment from any Minn. mine is required to report in writing to the Commissioner of Taxation, on or before May 10 and November 10 of each year. The report is to state the **number of tons received for shipment as provided in Secs. 298.19 and 298.20 up to and including the last day of April and the last day of October of each year; including the total tons received for shipment from each mine, and tons received since the date of the last preceding report. The report also has to show the place where the ore was received for shipment and name of shipper in each case.**

16. M. S. 1953
Sec. 298.22
Subd. 1

This section provides that, beginning May 1, 1941 (to Apr. 30, 1942), **5%**; and beginning May 1, 1942, **10%** of all amounts credited into the general revenue fund, from the proceeds of the **occupation tax,** is appropriated to the **Iron Range Resources and Rehabilitation Commission.** This section also creates the office of Commissioner thereof, who is to be appointed by the Governor, with advice and consent of the Senate. **This Commissioner is authorized to use such amounts of this appropriation as he may deem necessary and proper in developing the remaining natural resources** of any county in need as a result of **removal of its natural resources;** and in the vocational training and rehabilitation of its residents.

ROYALTY TAX

1. M. S. 1953
Sec. 299.01
Tax on Severance of Ore from Land Rate

This section provides for a tax of 11% upon **all royalty received during each calendar year, for permission to explore, mine and remove ore from land in Minnesota.**

2. M. S. 1953
Sec. 299.011
Veterans' Bonus Tax on Royalties

This new section provides for a **1% tax on all royalty received in each calendar year after 1948,** in addition to the 11% tax levied by Section 299.01. **Proceeds of this 1% tax** are deposited in the state treasury to the credit of the **Veterans' Compensation Fund.** This section became effective January 1, 1949, and is to expire on December 31, 1958, **except as to the collection of taxes theretofore levied and unpaid.**

3. M. S. 1953
Sec. 299.02
Definitions
Subd. 1. Royalty

Royalty, as here defined, is the amount in money or value of property received by any person having any right, title, or interest in or to any tract of land in this State for permission to mine and remove ore therefrom.

Subd. 2. Person

The word "person" includes individuals, copartnerships, associations, companies and corporations.

4. M. S. 1953
Sec. 299.03
Reports to Commissioner of Taxation

This section provides for a report to be made by each **recipient of royalty on mineral lands in Minnesota.** This report is to be made and filed with the Commissioner of Taxation on or before February 1 of each year, reporting the **amount of royalty received by such recipient during the preceding calendar year;** also such other information as the Commissioner may require.

5. M. S. 1953
Sec. 299.04
Contents of Reports by Payors of Royalty

This section prescribes the duty of every person **paying royalty,** on or before February 1, to file with the Commissioner a report covering the preceding calendar year, showing

(1) **the number of tons mined from each tract of land on which he pays royalty;**
(2) **the amount of royalty paid on each tract of land separately;**
(3) **the name and post-office address of each person to whom royalty is paid;**
(4) and such other information as the Commissioner of Taxation may require.

6. M. S. 1953
Sec. 299.05
Tax on Royalties Assessment by Commissioner

This section provides for the determination, by the Commissioner, of the amount of tax due; and, on or before May 1 of each year, he is to make a certificate of tax due, and the amount paid thereon; and file one copy of the certificate with the State Auditor on or before May 1 of each year, and one copy with the State Treasurer.

7. M. S. 1953 Sec. 299.03 Lien of Tax

This section makes the royalty tax a specific lien upon the land from which the ore is removed and provides that every person paying royalty to another which is subject to the tax, shall withhold the amount of the tax upon such royalty and remit the same to the State Treasurer.

8. M. S. 1953 Sec. 299.13

The proceeds of the 11% royalty tax are credited to the State General Revenue Fund.

TACONITE AND IRON SULPHIDES

1. M. S. 1953 Sec. 298.23 Taconite and Iron Sulphides Defined

Taconite: ferruginous chert, compact, siliceous, fine-grained and hard, which cannot be made merchantable by simple methods of beneficiation.

Iron sulphides are defined as chemical combinations of **iron** and sulphur, known as pyrrhotite, pyrites, or marcasite, that cannot be made merchantable **except by methods beyond ordinary washing.**

2. M. S. 1953 Sec. 298.24

This section provides for a tax on taconite and iron sulphide concentrates, of 5 cents per ton of merchantable iron ore concentrate as produced, plus 1/10 cent per gross ton for each 1% that the iron content of the concentrate exceeds 55%, when dried at 212° Fahrenheit.

3. M. S. 1953 Sec. 298.25 Additional Taxes

The above tax is **in addition to the occupation tax and the royalty** tax, but **is in lieu of any other taxes except those on the land, and on other products than iron ore or iron sulphides,** that come under the general property tax law.

4. M. S. 1953 Sec. 298.26 Tax on Unmined Taconite or Iron Sulphides

This section provides in any year when at least 1000 tons of iron ore concentrate are not produced, **for a tax on the unmined taconite or iron sulphides at the mill rate prevailing in the taxing district, with the provision that the tax shall not exceed $1.00 per acre.**

5. M. S. 1953 Sec. 298.27 Collection and Payment of Tax

This section specifies that the tax provided by Section 298.24 **is to be collected and paid in the same manner and at the same time as provided by law for payment of occupation tax.** The same is true as to form and manner of filing of reports; as to hearings; and as to collection of the tax, including provisions for penalties and for appeals.

6. M. S. 1953 Sec. 298.28 Apportionment of Proceeds

The Taconite Tax is distributed as follows:
One-fourth to city, village or town;
One-fourth to the school district;
One-fourth to the county;
One-fourth to the State.

EXEMPTION FROM INCOME TAX — M. S. 1953, Section 290.05

(2) Corporations, individuals, estates, and trusts engaged in the business of mining or producing iron ore; but if any such corporation, individual, estate, or trust engages in any other business or activity or has income from any property not used in such business it shall be subject to this tax computed on the net income from such property or such other business or activity. Royalty (as defined in Section 299.02), shall not be considered as income from the business of mining or producing iron ore within the meaning of this section.

ADMINISTRATION OF TAX LAWS.....

AD VALOREM TAX LAWS

Dept. of Taxation Form. No. 110

OCCUPATION TAX LAWS

Dept. of Taxation Form. No. 37

ROYALTY TAX LAWS

TACONITE TAX LAWS

AD VALOREM TAX

M. S. 1953
Sec. 273.11
Valuation of
Property

This section reads in part as follows: "All property shall be assessed at its full and true value in money.... In valuing property upon which there is a **mine** or quarry, it shall be valued at such price as such property, including the **mine** or quarry, would sell for at a fair, voluntary sale, for cash."

M. S. 1953
Sec. 273.13
Classification
of Property
Subdiv. 2
Class I

"Iron ore, whether **mined** or **unmined,** shall constitute Class One and shall be valued and assessed at 50 per cent of its full and true value."

Not enough sales of iron ore property have been made to establish any dependable basis of value. For this reason other methods had to be found to obtain the proper and fair value of such property for purposes of taxation.

The members of early tax commissions in Minnesota gave this problem a great deal of time and study. One of their first difficulties was the question of how to insure the reasonably correct determination of the amount and grade of ore in the many mineral properties in Minnesota.

For Details of this Agreement See Section on "Reserves"

The 1909 agreement made by the Tax Commission and the Board of Regents of the University of Minnesota has proved to be a most fortunate solution of that problem. The work done for the former Tax Commissions and for the present Department of Taxation by the School of Mines of the University of Minnesota acting as engineers for the Department of Taxation in making estimates of ore reserves has been of great value to the State.

The Tax Commission of 1908, in their method of classification of iron ore deposits for determination of value for tax, used a method somewhat similar to that in use today. Assuming a life of 20 years and a discount rate of 4%,* they valued the iron ore known at that time; and, based on these results, developed what is known as the "Class Rate" system. This first valuation included four or five classes. Later the number of classes was increased to nine.

The highest class rate was 33 cents per ton (assessed value) for open pit ore of high grade that could be developed and mined at low cost. From that top rate, the other rates on open pit ore ranged downward, based on the grade of ore and costs of mining. Similarly, there

* Compounded annually. The factor for 20 years at 4% compounded annually is .4564, or nearly the same as the Hoskold factor for 25 years at 6% and 3% (.4575).

were several classes of underground ore, the rates grading downward from 24 cents as the **assessed value of ore in the ground.** Over the years, there were four horizontal increases in all class rates on iron ore, each adding 5% to the former rates. These increases were made in the years 1910, 1912, 1914, and 1920. By 1920, the original rate of 33 cents, first applied to open pit ore in the Hull-Rust and Mahoning mines at Hibbing, had become 40.1 cents, a rate that held for over 20 years. Other rates were likewise increased.

There have been no horizontal (general) reductions in class rates at any time. The Oliver Iron Mining Company and others, in the Ore Tax case of 1934, protested the use of class rates, and urged the method of present worth of future profits. The lower court approved the present worth method of valuing iron ore properties for taxation, and the decision was affirmed by the Supreme Court in 1936. (198 Minn. 385). The Tax Commission, however, did not give effect to the decision of the Court until 1938; and it was left to the present Commissioner of Taxation, in the valuations of 1940, to make a real beginning at the task of changing over from the class rate system to that by present worth, commonly known as the application of the Hoskold formula.

A brief explanation of the general method of the use of this formula is as follows: First obtain the expected total future net income (profit) during the life of the mine. Since it cannot be known definitely when any one mine will be exhausted, engineers make use of what is known as the **Range life,** or the expected term in which all of the presently known ore will be mined out. The Hoskold formula makes use of two interest rates, the first, known as the **risk rate,** (now fixed at 6%) being that assumed to give a fair return on money invested in the mine; and the other, a lower rate, termed the **capital return rate,** (now fixed at 3%) being the rate which, compounded annually over the mine life, will amount to the present mine value. The factors to be applied for the various interest rates and terms of years are shown tabulated in Baxter & Parks Valuation Handbook, and need not be worked out for each valuation.

Valuation by Method of Present Worth of Future Profits

The change-over was of necessity a gradual one. By 1950, most of the major deposits in St. Louis County were being valued by the present worth method. On most underground property, and on a small number of open pit reserves having mainly low grade ores, with high development costs, it was found that the present worth method showed no value, or at best a small value. In the case of underground properties, some of them producing mines, the former class rates were retained. In others, a lower rate was established as a result of the computations. In the case of underground

reserve properties, as yet undeveloped, there has been a change in rates, usually a decrease from the former class rates, based on the iron content of the ore.

Marginal Properties

In the case of a few low-grade open pit reserves, some of which contain large tonnages, but with very high estimated development costs, the values were what are referred to in the 1934 court case as "upset" or arbitrary "lump sum" values. With the rapid advances being made in furnace techniques, and in improved methods of beneficiation, it could not be said that any sizable iron ore deposit had **no value.** However, no calculation by present worth methods would show substantial value. Therefore, in the case of such a property, a lump sum value is recommended to the Commissioner by his mining engineers and, when given his approval, is certified to the county auditor.

Form No. 110 Dept. Taxation

It is estimated that well over 80% of the reserve tonnage in St. Louis County, including most of the direct shipping ore, is being valued by the present worth method, under the **Hoskold formula,** heretofore explained. Two copies of form 110 showing the actual working out of the May 1, 1952 valuations, one on an active mine, and the other on a reserve property, are shown on pages 49 to 54, inclusive.

Existing Laws

The 13 sections of Minnesota law that apply to the ad valorem tax on iron ore have been briefly summarized. These sections form the foundation for what is done by the Mining Division of the Department of Taxation, in working out detailed valuations of the principal mineral properties. The engineers then recommend to the Commissioner the results of their calculations.

Preliminary Discussions

In the preliminary discussions preceding the valuations, also in the progress of the work, matters of purely technical knowledge or experience are decided by the engineers. Any matters involving policy are referred to the Commissioner.[1]

Procedure in Calculations of Value

Reference is now made to form 110, sheet No. 1 of the valuation form of this report. At the upper left are: the name of the mining company that controls the property being valued, the name of the mine, or of the mineral property (if undeveloped), and the name of the tax district in which the property is situated. At the upper right is shown the legal description, including the subdivision or subdivisions, also the section, township and range numbers.

(1) Thus the Mining Division, working with the Commissioner of Taxation, carries out the administration of the Minnesota laws affecting valuation of iron ore; also acting in accord with the rulings of the Supreme Court in the case of State vs. Oliver Mining Co. (198 Minn. 385) and Village of Aurora, et al, vs. Commissioner, (217 Minn. 64).

Next comes the date of the calculation, taken at May 1 of the year of the valuation.

Part 1 of the calculation is headed: **ESTIMATED FUTURE INCOME PER TON.**

The first item, **A, Reserve Tonnage in Ground,** is next shown as the tonnage estimated by the School of Mines at May 1 of the current year, expressed in gross tons of open pit ore, of underground ore, and total ore in the property being valued.

Since it would not be possible for the engineers of the School of Mines to review all mineral properties, or even all operating mines, every year, the tonnage shown is either: (a) that found by the School of Mines for May 1 of the current year, or (b) that last determined by the School of Mines, corrected by shipments from the date of their latest estimate to May 1 of the current year.

Exceptions

The foregoing is the general procedure. There have been a few exceptions. In cases where new ore has been found by the mining company, but the School of Mines review could not be completed in time for the equalization for the current year, the company's increased figure has been used for that one year, and then corrected or revised in the review made by the School of Mines for May 1 of the succeeding year. However, it has not been customary, in cases of a **decrease** in tonnage as shown by mining company estimates beyond that due to shipments, to make downward changes without a School of Mines review of the property in the current year.

Another exception occurred many years ago on the eastern Mesabi Range, where the property being estimated had not been explored by drilling. Guided by the results of drilling on adjoining lands, the School of Mines made their estimate of tonnage and grade of ore in the property, based on what had been found on the adjacent explored lands. While this is not a frequent occurrence, it has happened in several cases, in different districts on the Mesabi Range. In a recent instance, ore had been proved by drilling of lands one half mile apart. At the request of the Commissioner, the owners agreed to an arbitrary estimate of ore in the half mile strip that had not been drilled, thereby adding substantially to the mineral valuation of that year. The company was not bound to make any such agreement in the absence of drilling.

Procedure in Calculations of Value

The second item is on **line B, Lake Erie Market Value Per ton.** This term has been in use for many years. The best reason for its use is that the greater part of ore from Minnesota goes by boat to Lake Erie ports, there to be transferred to railroad cars for shipment

to various furnaces, at widely varying distances from Lake Erie, and at greatly different costs for railroad freight. But the one point of **stable ore value,** accepted by both buyers and sellers of ore, is the **port of transfer,** which, in most cases, is the **Lake Erie Port.** Ore values are quoted there at rail of vessel and are accepted as freely as the price of wheat or corn on the Duluth or Chicago Board of Trade, or the price of livestock at South St. Paul, Chicago, or Omaha.

Lake Erie Value of Ore

For reasons of business economy, the ore price set, usually early in each year, generally holds throughout the year. Some operators claimed that certain mines are operated on too narrow a margin to work without knowledge of the value of standard ore grades for that far in advance. For reasons of budget and intelligent planning a value guaranteed for a year is desirable to the mine operator, the steel-making company and the State of Minnesota.

Values are quoted on old Range ore, including the ores mined in Michigan and on the Vermilion Range of Minnesota. Ores of the Mesabi and Cuyuna Ranges are in one group as Mesabi Bessemer or Mesabi non-Bessemer, and are quoted; and this group also includes Fillmore County.

Dried Iron vs. Natural Iron

For the year 1952, the quoted market value of $9.05 per gross ton at Lake Erie means the value of **Mesabi non-Bessemer ore containing 51.5%** of natural iron. The first thing done with a 5-foot sample of iron ore, after it has been collected at the drill, is to dry it at 212° F. Its iron content in its dried state is fairly dependable.[2] But the complete analysis made by the chemist includes the percentage of moisture as found by the loss in weight on drying. If the ore sample, before drying, weighs 10 lbs. and its dry weight is 9 lbs., the loss is 1 lb., or 10% of the weight of the original ore. Then, if the analysis shows 60% in metallic iron in the dried ore, the engineer multiplies the 60% by 90% (since 10% of the original ore was water), and the product, or 54%, is the "natural" iron content of the ore.

At the top of sheet 2 of form 110 is space for entering the different tonnages of ore in the mine, as reported by the School of Mines, and the average analysis of each tonnage; and the computed total tonnage of Bessemer ore with its average analysis;[3] the total non-Bessemer ore with its average analysis, also the manganiferous grade, if any, is entered on a separate line, with its average analysis.

(2) Analysis includes: 1 Dried iron; 2. Phosphorus; 3. Silica; 4. Alumina; 5. Manganese; 6. Moisture. From Nos. 1 and 6, the natural iron is computed.

(3) In some of the older drilling, it has been found from the analyses of the ore when mined and sampled, that part of the silica in the ore when washed up from the bottom of the drill-hole, was separated out and washed away in the process of recovering the ore sample, leaving a sample lower in silica, and higher in iron, than the actual average silica and iron content of the ore in the ground. This difference ran from ½% to 2% or more in metallic iron, with a corresponding error in silica. More recent drilling, using improved methods of sample recovery, gives closer results.

Computation of Ore Value at Lake Erie The next step is the computation of value of ore at Lake Erie, usually based on an average of a five-year period, of which the last is the current year. The same five-year period is taken for costs of mining, development, beneficiation and transportation. While the taxing authorities are not bound to use any statistical period, this method usually is preferred as giving a fairer average, both as to ore values and as to costs of operation. The use of only the one current year for ore value might be ruled out as inconsistent since that figure should be matched by use of the current year's costs which cannot be accurately known before the following year. This is further explained in a later section.

Revision for Analysis The "Revision for Analysis," referred to in 198 Minn. 385, was adopted to correct the conditions above described, where drilling results were not found fairly well borne out by the analysis of the ore when mined. While many of the properties in that case were reserve properties, and undeveloped for mining, others had been operated, but were later closed down. The experience at these mines, as regards higher silica in the ore as mined than that indicated by analysis of drill sample, formed the basis of the so-called "Revision for Analysis" allowed by the court.

In recent years few mines have been opened without careful advance structure drilling, hence the need of any revision of drill analysis will gradually disappear.

Year 1952 Taken as Example In the valuations made in 1952, the arithmetical average of the non-Bessemer price for the years 1948, '49, '50, '51 and '52 was $7.654. The 1952 Lake Erie non-Bessemer value of 51.50% natural iron ore was $9.05, or about $1.40 more than the value used in the calculations.

Iron ore in ground is assessed in even numbered years. 1954 figures not available for this report.

The question has been asked: Why use an ore value in 1952 valuations that is $1.40 less than the actual value for that year?

The answer to that is: If the Commissioner were to use the current value, he should also use current costs. But the current costs cannot be accurately known until too late for the current year's equalization, which has to be certified to the county auditor on or before November 15 of each year. Therefore, to be consistent, use is made of ore values, and operating and transportation costs, for the same term of years.

While it is true that the 1952 ore value was known at the time of the valuation, and the exact cost figures were not then known, it was held that the known costs for the preceding four years, and the estimated 1952 costs, would give a fairly close average cost for the five-year period.

Profit Per Ton What is important is a fair estimate of what is known as the "profit spread," or **average profit per ton,** on any mine being valued. The foregoing method is believed to be the one best suited to that purpose.

Value of Ore The value of the ore at Lower Lake ports having been found by the use of the usual premiums or penalties for structure and premiums for low phosphorus content (in the case of Bessemer ore); and the penalties for low iron and high silica; the value of each grade or group of ore is extended, and the weighted average value is then computed for the total reserve of ore in the mine.

Before entering this value on line B, the allowance of ½% is made for **shrinkage,** an allowance made uniformly to all companies.

Operating Costs Having determined the value of the ore at Lake Erie, the next step is to determine the deductible costs, to arrive at the **net value.**

Active Mines If the mine being valued is an active mine, with several years' record of shipments, a careful study is made of the records of that mine and also of other mines near by, over the preceding four years, as shown by reports made for determinations of the occupation tax.

C-1 Mining
C-2 Beneficiation
C-3 Miscellaneous
C-6 Rail and Lake Freight

Next, the estimate is made of the costs for the current year. These studies cover the items of **MINING, BENEFICIATION, MISCELLANEOUS,** (C-3 on sheet 2 of form) and **RAIL AND LAKE FREIGHT.** The above estimated costs averaged for the 5-year period are entered on sheet 1 of the form. The study also includes the costs of these items over the range as a whole.

C-4 Development Cost per ton for development, taken as of the date of the valuation, is found by multiplying the number of cubic yards of remaining surface and of rock stripping by the unit cost of each for the 5-year period; and dividing the result by the total number of tons of open pit ore remaining in the mine on May 1 of the current year.

C-5 Items C-1 to C-4 and item C-6 have been discussed. Item C-5, MINE PLANT is allowed at the range average cost for the 5-year period.

C-7 Item C-7, **MARKETING EXPENSE,** has been given an allowance, uniform to all companies at 5 cents per ton.

C-8 Item C-8, **SOCIAL SECURITY TAXES** were originally computed at an average cost of 2 cents per ton for open pit ore, and 6 cents per ton for underground ore, and that allowance has been made uniformly in all present worth calculations by the Department of Taxation up to and including 1952.

C-9 Item C-9, **AD VALOREM TAX FOR OPERATING PERIOD.** This tax is computed by a formula involving the use of the factors tabulated at the top of sheet 3 of form No. 110.

H, in the case of iron ore is 0.5 (Ratio of assessed value to full and true)

L, **tax period,** varies with the estimated operating life of the mine being valued.

M, the **mill rate** divided by 1000.[4] The estimated mill rate being 145 mills, M would be .145.

F, the **Hoskold factor,** depends on the range life term used in the valuation.

This is gradually decreasing as the ore is being depleted. The term used in 1952 was 30 years.[5]

P, the **Lake Erie value of ore,** has already been discussed.

C, includes cost items C-1 to C-8, plus interest (C-12).

S, includes C-1 to C-8 only.

D, or **depletion,** taken at 15% of gross mine value.

B, the reciprocal of the operating life. That is, the percentage of the operating life that applies to the operations of the one calendar year.

The foregoing items are included in varying proportions, in the somewhat involved formula for the tax. It was found necessary to include all of the factors that in any way affect the tax. The formula has been held by some as being too complicated. It was worked out by Mr. McAdams, the present Chief Mining Engineer of the Department of Taxation, and has been in use for the past eight years.

C-10 Item C-10 is the occupation tax allowance, obtained by the method outlined on sheet 3 of form No. 110. Here are deducted from the market value of ore, as used on sheet 1, the sum of items C-1 to C-9 inclusive. Item C-9 is computed as directed in Minn. Statutes 1951, Section 298.03, paragraph (5):

(4) To reduce mills to decimal part of $1.00.
(5) The factor for 30 years, at 6% and 3%, is .41142.

"A percentage of the ad valorem taxes . . . equal to the percentage that the tons mined or produced during such year bears to the total tonnage in the mine." Actually, assuming an average annual production per year for the term of years entered opposite "Natural Operating Life" at bottom of sheet 3; and if that number of years is ten, then 1/10 of the ad valorem tax would be the part allowed in C-10. The sum of those 9 items, taken from the Lake Erie value, leaves what is termed "profit." While the rate of the occupation tax is 12%, after the labor credit allowance, the average rate is 10.5%, the allowance actually deducted, as indicated under item C-10, on page 3 of form 110.

C-11 Federal Income Tax The 1952 Federal tax rate was 52%. This calculation form also appears on **sheet 3.** First, for computing the depletion allowance, take from the Lake Erie value of ore the items of transportation and marketing expense, leaving what is termed gross value at the mine. 15% of the **gross value** is usually taken as the depletion allowance. In case the amount so figured exceeds **50% of the net profit,** the latter is used as the depletion allowance instead of 15% of the **gross value.**

Then from the Lake Erie market value of ore is taken the sum of items C-1 to C-10 plus the depletion allowance, leaving net profit for Federal tax. This, multiplied by the current rate of tax, gives the Federal tax per ton.

C-12 Interest **Interest on development, plant and working capital.** The method of computing the interest is given near the bottom of sheet 3 of form 110. Note that the interest rate was set at 5% by the Board of Tax Appeals in 1943. Costs for development and plant are entered from sheet 1 of the form. The total of these two costs is next multiplied by 5% **times 50% of the operating life, plus* one,** giving the interest on plant and development, to be entered in the table at the right.

The form shows, on sheet 3, below the computation of interest on plant and development, the method of figuring the interest on working capital. What has been done more recently was to take the average as worked out on a large number of operating mines, or about 5 cents per ton, and enter that figure in the small table at the right, on sheet 3. Adding that to the interest allowed for development and plant from the table above, gives the total allowance for **interest on development, plant and working capital.**

* It is assumed that the interest charge on plant and development will decline uniformly over the mine life. The total of the annual interest charges is computed by the simple arithmetical formula for the summation of a series.

D These various items having been entered on sheet 1, their totals entered opposite **D** and subtracted from **B**, the market value per ton, leaving the amount to be **E** entered opposite **E**, the estimated future income per ton.

Part II Application of Hoskold Formula Then comes the second part of the valuation, the calculation of present worth of the estimated future income per ton, by use of the Hoskold formula. In the case of operating mines, fairly well developed, there is no deferment period; and the full range life is entered on the line just above Part II, and also in the space opposite F.

The Hoskold factor for 6% and 3%, over a term of years called the Range Life, ranges from .41142 for 30 years to .45752 for 25 years. That is, each dollar due in equal yearly payments over a 30-year term is now worth $.41142; and each dollar due in equal yearly payments over a 25-year term is now worth $.45752 at discount rates of 6% and 3%. The factor is entered as indicated on form 110, and the product of that factor by the remainder opposite E is the amount of item F. The space opposite G remains blank in the case of active mines, there being no inactive taxes; and H is the same as F. Also, since there is no period of deferment, I is the same as F. Then the full and true value (J) is the product of A, the tonnage in reserve, by the final computed present worth per ton (I); and the assessed value is 50% of J. A detailed copy of an actual valuation of an operating and a reserve mine is shown on pages 49 to 54.

Undeveloped or Reserve Properties **RESERVE PROPERTIES – (UNDEVELOPED FOR MINING)** Here the procedure is similar to that outlined for the active mines. However, since there is yet no record of mine operation to be applied direct, many of the cost factors will have to be obtained by study of operating mines in the same area, or in areas having similar physical conditions. Among such factors are C-1 to C-5; (Mining, Beneficiation, Miscellaneous Costs, Development, and Plant); C-9 (Ad valorem tax for operating period); C-10 (Occupation Tax); C-11, (Federal Income Tax, involving items C-1 to C-10); and C-12, (interest on Development, Plant and Working Capital); Item C-6, (Transportation & Marine Insurance); and Item C-7, (Marketing Expense) are uniform for all mines, whether active or reserve properties. Item C-8 (Social Security Taxes) may be taken at the Range average.

The main difference in procedure is in Part II, the computation of present worth. Here, assuming a Range Life of 30 years on May 1, 1952, the three-year deferment period is used as the average time for getting the property developed and ready to produce iron ore. Therefore Item F, instead of using the Hoskold factor for 30 years, takes the factor for 27 years, .43798, as compared to the 30-year factor at 6% and 3% or .41142.

Next, the inactive tax, at a rate below that for the active mines, is computed for the 3-year inactive period assumed for time of development, and entered opposite G. This is subtracted from F, leaving H, the balance before deferment at 5%. To this balance is applied the deferment factor of .86384 (the factor for 3 years at 5%), giving the result I, the final present worth per ton. Then the product of item A, (number of tons in reserve) by I, the present worth per ton, gives the final full and true total value.

Following the first calculations of value of the various major ore deposits by the Mining Division, informal discussions are held with the engineers of the several mining companies. There is a discussion of the different items of cost, and where there are any apparent errors, it may be necessary to make certain changes. As has been stated, questions involving matters of policy are referred to the Commissioner. Minor differences of opinion or judgment can usually be adjusted between engineers.

The time of the annual hearings before the Commissioner, on mineral property valuations is usually set about October 20. Notices of the tentative valuations are mailed out to the companies at least five days before the date of the hearing, and usually an effort is made to allow a week or ten days. In cases where there is a decrease in assessed value, beyond that due to mining of ore, in excess of $15,000, notice has to be sent to the city, town, or village where the property is located, also to the school district, and to the county.

At the mineral hearings, a record is made of all those present and all of those interested are given an opportunity to be heard by the Commissioner. A record is made of the proceedings and the transcript is used in making up the list of final values. In case of changes, the engineers review the particular calculations that are involved, taking into account the protests by taxpayer, or by communities, and making such changes as they consider to be warranted.

They then make their recommendations of assessed value to the Commissioner. When approved by the Commissioner, the valuations are certified to the auditor of the county in which the ore deposit is located.

It should be emphasized that the work of the engineers of the Mining Division has to do with valuing the iron ore properties, recommending their findings to the Commissioner of Taxation. The tax levy is made in the county, and its subdivisions, where the ore deposits occur.

Stockpiles Form No. 116 has been prepared by the Commissioner for valuing iron ore that has been mined and stockpiled, and which remains in stockpile on May 1 of the assessment years.

Distribution The ad valorem tax goes to the State, counties, townships, school districts and local taxing districts according to the levy of the respective taxing units.

Dept. of Taxation - No. 110

COMPANY: "A"

PROPERTY _____ DESCRIPTION _____

TAX DISTRICT: _____

COMPUTATION AS OF May 1 19 52 OF PRESENT WORTH
OF ESTIMATED FUTURE INCOME FROM OPERATION

PART I: ESTIMATED FUTURE INCOME PER TON

ITEM		OPEN PIT	UNDERGROUND	TOTAL
A	Reserve Tonnage in Ground May 1 19 52	23,707,517	23,000	23,730,517
B	Lake Erie Market Value Per Ton	7.054*		
C	Estimated Costs Per Ton:			
	1. Mining	.476		
	2. Beneficiation	.060		
	3. Miscellaneous	.180		
	4. Development (Future)	.199		
	5. Plant (Future)	.195		
	6. Rail & Lake Freight & Marine Insurance	2.670		
	7. Marketing Expense	.050		
	8. Social Security Taxes	.020		
	9. Ad Valorem Realty Tax for operating period	.288		
	10. Occupation Tax	.364		
	11. Federal Income Tax	.841		
	12. Interest on Development, Plant, and Working Capital.	.261		
D	Total of Item C	5.604		
E	Estimated Future Income (Item B minus Item D)	1.450		

PART II: COMPUTATION OF PRESENT WORTH (Range Life: O.P. 30 yrs _____)

F	Present Worth of Item E: O.P. 27 Years at 6 % & ___ % (Factor .43798 U.G. ___ Years at ___ % & ___ % (Factor ___)	.6351		
G	Less Inactive Taxes: O.P. 3 Years and return at 5 % U.G. ___ Years and return at ___ %	.0602		
H	Balance Present Worth Before Deferment	.5749		
I	Present Worth Per Ton: O.P. Deferred 3 Years at 5 % (Factor .86384) U.G. Deferred ___ Years at ___ % (Factor ___)	.4966		
J	Final Computed Present Worth (Item A times Item I)	11,773,152		

Assessed Value (O.P.)	23,707,517 @ .2483	5,886,576		
U.G.	23,000 @ .0420		966	
TOTAL	23,730,517	5,886,576	966	5,887,542

* Market value taken at 5-yr. average, years 1948, '49, '50, '51, '52.

ADMINISTRATION OF LAWS

PROPERTY: "A"

COST DETAILS AND COMPUTATIONS

(A) & (B) ORE TONNAGES: ANALYSES: SELLING VALUES (Per Ton):

Ore (Incl. Conc'ts.)	TONS	IRON Orig.	IRON Disc.	Phos.	SILICA Orig.	SILICA Disc.		Moisture	Nat'l. Iron	Lake Erie Value	
See May 1-1944 Computation											
Bessemer	3,846,000	57.42	56.12	.034	9.20	10.63		13.00	49.09	7.4413	
Non-Bessemer	19,884,517	57.57	56.57	.068	8.17	9.60		14.50	48.37	7.0209	
Total Ore	23,730,517									7.0890	
								Less 1/2%		.0354	
										7.0536	

METHOD OF MINING AND QUANTITIES INVOLVED

	TONS OF ORE Open Pit	TONS OF ORE Underground	WASTE MATERIAL IN ORE Material	WASTE MATERIAL IN ORE Tons	WASTE MATERIAL IN ORE Cu. Yds.	STRIPPING Material	STRIPPING Cu. Yds.
Direct			Lean Ore			Surface	
Conc'ts (Wash)			Rock (Solid)			Lean Ore	
Conc'ts (Jig)			Rock (Broken)			Rock (Solid)	
						Rock (Broken)	

(C) ESTIMATED COSTS PER TON:						OPEN PIT	UNDERGROUND
ITEM C-1, MINING:							
Method	Material	Tons	COST Per Ton	COST Total			
O.P.	Direct Ore						
	Concentrates						
	Lean Ore				Tons of Ore		
Total O.P.						.476	
Underground							
ITEM C-2, BENEFICIATION: (Concentrating, crushing and screening, etc.) Including transportation to plant, plant depreciation, interest and taxes on plant.						.060	
ITEM C-3, MISCELLANEOUS: (Administration, Legal, Fire Insurance, Medical and Hospital, Compensation, Stockpile Loading, Taxes on Stockpile and Equipment.						.180	
ITEM C-4, DEVELOPMENT:							
Method	Stripping	Cu. Yds.	Cost per C.Y.	Total Cost			
O.P.	Surface	10,038,738	.47				
	Rock						
	Lean Ore						
	Special Costs				Tons of Ore		
	Total			4,718,207	23,707,517	.199	
Shaft and U.G. Development				$			
ITEM C-5, PLANT:							
Open Pit $		÷		Tons =		.195	
Underground $		÷		Tons =			

ADMINISTRATION OF LAWS

PROPERTY: "A"

ITEM C-9, AD VALOREM TAX PER TON (ACTIVE):

Factors:	Open Pit	Underground	
N Factor (Ratio Assessed Value to T. & P. Value)	.5		
L Tax period	10.5		
M Mill Rate ÷ 1000	.0760		
F P.W. Factor	.41142		
A MLNF	.16416		
P Lake Erie Value	7.054		
C C-1 to C-8 plus C-12 (Costs during active period)	3.807		
S C-1 to C-8	3.850		
D Depletion (15% Gross Value at Mine)	.650		
R Reciprocal of Operating Life	.050		

O.P. Tax per ton = $\frac{.16416\ (3.4847 - 3.8070 \div 1.9481 \div .2873) = .31405}{1 + .16416\ (.558 - .0032)} = \frac{.2878}{1.09108}$

U.G. Tax per ton = .5548

ITEM C-10, OCCUPATION TAX:

	O.P.	U.G.	O.P.	U.G.
Market Value of Ore, Item B			7.054	
Less Items C-1 to C-8, Incl.	3.850			
Proportion of Real Property Tax 1/20	.014		3.864	
Occupation Tax Profit			3.190	
Tax = 11.4 % (O.P.) and ____ % (U.G.) of Profit			.364	

ITEM C-11, FEDERAL INCOME TAX:

Market Value of Ore, Item B			7.054	
Less Transportation & Marketing Expense			2.720	
Gross Value at the Mine			4.334	
Depletion allowance, 15% of Gross Value			.650	
NOTE: If depletion allowance above exceeds 50% of the net profit, use 50% of net profit				
Market Value of Ore, Item B			7.054	
Less Items C-1 to C-10, Incl.	4.502			
Depletion allowance	.650		5.152	
Net profit for Federal Income Tax			1.902	
Tax = 44.2% of Profit			.841	

ITEM C-12, INTEREST ON DEVELOPMENT, PLANT & WORKING CAPITAL:

	INITIAL Open Pit	INITIAL Underground	FUTURE Open Pit	FUTURE Underground
Development:	.199			
Plant:	.195			
TOTAL	a	b	c	d

Computation of Interest:
(a) .394 x 5 % x .50 (20 Yrs. + 1) = .207
(b) ____ x ____ % x .50 (____ Yrs. + 1)
(c) ____ x ____ % x .50 (____ Yrs. + 1)
(d) ____ x ____ % x .50 (____ Yrs. + 1)

.102

Working Capital:

	Open Pit Cost	Mo.	Cost x Mo.	Interest	Underground Cost	Mo.	Cost x Mo.	Interest
Mining				Multiply Total by monthly interest return rate				Multiply Total by monthly interest return rate
Miscellaneous								
Transportation								
Supplies	*				*			
Taxes								
TOTAL								

Total Interest Per Ton: .054 + .261 = .054 / .156

* Mining Cost x 40%

Natural Operating Life	20
Average Annual Shipment	
Average Monthly Shipment	

ADMINISTRATION OF LAWS

Dept. of Taxation - No. 110

COMPANY: "B"

PROPERTY _____ DESCRIPTION _____

TAX DISTRICT: _____

COMPUTATION AS OF May 1 19 52 OF PRESENT WORTH
OF ESTIMATED FUTURE INCOME FROM OPERATION

PART I: ESTIMATED FUTURE INCOME PER TON

ITEM		OPEN PIT	UNDERGROUND	TOTAL
A	Reserve Tonnage in Ground May 1 19 52	2,760,775	279,429	3,040,204
B	Lake Erie Market Value Per Ton	7.220		
C	Estimated Costs Per Ton:			
	1. Mining	1.002		
	2. Beneficiation	.116		
	3. Miscellaneous	.190		
	4. Development (Future)	.109		
	5. Plant (Future)	.169		
	6. Rail & Lake Freight & Marine Insurance	2.670		
	7. Marketing Expense	.050		
	8. Social Security Taxes	.020		
	9. Ad Valorem Realty Tax for operating period	.198		
	10. Occupation Tax	.327		
	11. Federal Income Tax	.749		
	12. Interest on Development, Plant, and Working Capital.	.124		
D	Total of Item C	5.724		
E	Estimated Future Income (Item B minus Item D)	1.496		

PART II: COMPUTATION OF PRESENT WORTH (Range Life: O.P. 30 yrs. _____)

F	Present Worth of Item E: O.P. 30 Years at 6 % & 3 % (Factor .41142) U.G. ____ Years at ____ % & ____ % (Factor ____)	.6154				
G	Less Inactive Taxes: O.P. ____ Years and return at ____ % U.G. ____ Years and return at ____ %					
H	Balance Present Worth Before Deferment					
I	Present Worth Per Ton: O.P. Deferred ____ Years at ____ % (Factor ____) U.G. Deferred ____ Years at ____ % (Factor ____)	.6154				
J	Final Computed Present Worth (Item A times Item I)	1,698,980				
	Assessed Value (O.P.) 2,760,775 @ .3077	849,490				
	(U.G.) 279,429 @ .0530		14,810			
	TOTAL 3,040,204 @	849,490	14,810	864,300		

ADMINISTRATION OF LAWS

PROPERTY: "B"

COST DETAILS AND COMPUTATIONS

(A) & (B) ORE TONNAGES: ANALYSES: SELLING VALUES (Per Ton):

Ore (Incl. Conc'ts.)	TONS	IRON Orig.	IRON Disc.	Phos.	SILICA Orig.	SILICA Disc.		Moisture	Mat'l. Iron	Lake Erie Value
O.P. Bessemer	67,545	58.67		.034	11.00			11.00	52.22	7.9586
Non Bessemer	2,293,211	56.48		.078	9.16			13.00	49.14	
P.RK..Ore	119,712	51.34		.080	11.60			16.00	43.13	
	2,412,923								48.84	7.1606
Bess.W.O.C.	113,891	59.50		.040	10.50			10.00	53.55	8.1246
N.B. W.O.C.	166,416	58.00		.050	10.00			10.00	52.20	7.7580
Total O.P.	2,760,775									7.2559
							Less 1/2 %			.0363
										7.2196
U.G. Non-Bess	279,429	57.29		.099	10.07			14.00	49.27	7.2634

METHOD OF MINING AND QUANTITIES INVOLVED

	TONS OF ORE Open Pit	TONS OF ORE Underground	WASTE MATERIAL IN ORE Material	WASTE MATERIAL IN ORE Tons	WASTE MATERIAL IN ORE Cu. Yds.	STRIPPING Material	STRIPPING Cu. Yds.
Direct			Lean Ore			Surface	
Conc'ts (Wash)			Rock (Solid)			Lean Ore	
Conc'ts (Jig)			Rock (Broken)			Rock (Solid)	
						Rock (Broken)	

(C) ESTIMATED COSTS PER TON: — OPEN PIT — UNDERGROUND

ITEM C-1, MINING:

	Method	Material	Tons	COST Per Ton	COST Total		OPEN PIT
65%	O.P.	Direct Ore	2,480,468	.950			
		Concentrates	280,307	1.461			
		Lean Ore				Tons of Ore	
	Total O.P.				$ 2,765,973	2,760,775	1.002

ITEM C-2, BENEFICIATION:
(Concentrating, crushing and screening, etc.)
Including transportation to plant, plant depreciation, interest and taxes on plant. Cr. & Scf. 2,480,468 .095 — .116
Conc 280,307 .300
2,760,775

ITEM C-3, MISCELLANEOUS:
(Administration, Legal, Fire Insurance, Medical and Hospital, Compensation, Stockpile Loading, Taxes on Stockpile and Equipment. 2,480,468 .180; 280,307 .277 — .190

ITEM C-4, DEVELOPMENT:

Method	Stripping	Cu. Yds.	Cost per C.Y.	Total Cost		OPEN PIT
O.P.	Surface	25,000	.45			
	Rock	80,000	.90			
	Lean Ore PRK	311,000	.70			
	Special Costs				Tons of Ore	
	Total			300,950	2,760,775	.109
Shaft and U.G. Development						

ITEM C-5, PLANT:
Open Pit $ OP(Direct 2,480,468 .160 Tons = — .169
$ (Conc. 280,307 .246 Tons =

PROPERTY: "B"

ITEM C-9, AD VALOREM TAX PER TON (ACTIVE):

Factors:	Open Pit	Underground
H Factor (Ratio Assessed Value to T. & P. Value)	.50	
L Tax period	5.00	
M Mill Rate ÷ 1000	.11782	
F P.W. Factor	.41142	
A MLMP	.12118	
P Lake Erie Value	7.220	
C C-1 to C-8 plus C-12 (Costs during active period)	4.313	
S C-1 to C-8	4.326	
D Depletion (15% Gross Value at Mine)	.675	
B Reciprocal of Operating Life	.111	

O.P. Tax per ton = $\frac{.12118\ (3.5667 - 4.313 + 2.1890 + .2894)}{1 + .12118\ (.558 - .0071)} = \frac{.21099}{1.06676} = .1978$

U.G. Tax per ton = .5509

ITEM C-10, OCCUPATION TAX:

	O.P.	U.G.	O.P.	U.G.
Market Value of Ore, Item B			7.220	
Less Items C-1 to C-8, Incl.	4.326			
Proportion of Real Property Tax 1/9	.022		4.348	
Occupation Tax Profit			2.872	
Tax = 11.4 % (O.P.) and ____ % (U.G.) of Profit			.327	

ITEM C-11, FEDERAL INCOME TAX:

Market Value of Ore, Item B			7.220	
Less Transportation & Marketing Expense			2.720	
Gross Value at the Mine			4.500	
Depletion allowance, 15% of Gross Value			.675	

NOTE: If depletion allowance above exceeds 50% of the net profit, use 50% of net profit

Market Value of Ore, Item B			7.220	
Less Items C-1 to C-10, incl.	4.851			
Depletion allowance	.675		5.526	
Net profit for Federal Income Tax			1.694	
Tax = 44.2% of Profit			.749	

ITEM C-12, INTEREST ON DEVELOPMENT, PLANT & WORKING CAPITAL:

	INITIAL Open Pit	INITIAL Underground	FUTURE Open Pit	FUTURE Underground
Development:	.109			
Plant:	.169			
TOTAL	a	b	c	d

Computation of Interest:

(a) .278 x ____% x .50 (____ Yrs. + 1)	.070				.042
(b) ____ x ____% x .50 (____ Yrs. + 1)					
(c) ____ x ____% x .50 (____ Yrs. + 1)					
(d) ____ x ____% x .50 (____ Yrs. + 1)					

Working Capital:

	Open Pit Cost	No.	Cost x No.	Interest	Underground Cost	No.	Cost x No.	Interest
Mining				Multiply Total by monthly interest return rate				Multiply Total by monthly interest return rate
Miscellaneous								
Transportation								
Supplies	*				*			
Taxes								
TOTAL								

Working Capital	.054			.054
Total Interest Per Ton	.124			.096

* Mining Cost x 40%

Natural Operating Life	9	
Average Annual Shipment	300,000	
Average Monthly Shipment		

OCCUPATION TAX

Occupation Tax Reports. Items Reported by Taxpayer

A standard report form No. 37, prepared by the Commissioner of Taxation, is mailed to each mine operator about January 1. Two copies of this form, filled in showing the computations on one high cost and one low cost mine appear on pages 60 to 90. On these forms, for reporting mining operations of any specified mine for the preceding calendar year, are given all of the items required for making out the calculation of the occupation tax. On page 1 is the name of the mine being reported. Page 2 shows all of the legal descriptions included in the mine; and begins the record of **open pit development.** Sec. A covers the years before 1921; and sec. B covers years from 1921 to date. (This is because the Occupation Tax Law became effective in the year 1921.)

Development

Development costs are amortized and the total of unamortized costs appears on line 5 of sec. 1-B. This total is combined with the estimated total of future expenditures, on line 7. This total, divided by the estimated tonnage in the mine at the beginning of the year, line 8, gives the average development cost per ton, shown on line 9. This multiplied by the number of tons produced in the preceding calendar year, gives the total development allowance for the year.

On page 3 of the report is supplementary data on the open pit development account; and on pages 3 and 4 is the full underground development account. Page 4 also shows a summary of the direct ore and concentrate mined in the calendar year.

Tons and Analysis of Ore Produced in Calendar Year

On page 5 of the report are listed the several tonnages of **Bessemer, non-Bessemer,** and **manganiferous** ores mined or produced in the last calendar year, with total tons of each class, with its average analysis in **natural iron, phosphorus, manganese, silica, alumina,** and **moisture;** and the market value of the ore at lower lake ports for the calendar year involved.

Screen Analysis

Also, on page 5 of the report, is a request for results of the screen analyses of the season's ore, by grades, – Bessemer, non-Bessemer, and manganiferous. Ores having more than 27% of particles passing through a 40-mesh screen[6] are given a structure penalty allowance, graduated according to the percentage of contained material finer than 40 mesh, reaching a maximum allowance of 20 cents at 39%. For all percentages of such fine material over 39%, the allowance remains unchanged at 20 cents per ton.

(6) This means 40 screen openings per lineal inch.

Stockpiled Ore and Analysis — Space is provided at the bottom of page 5 for tonnages of Bessemer, non-Bessemer, and manganiferous ores removed from the mine but not listed under item 3, at top of page 5, for which separate analyses were kept; or, tonnages shown under item 3, page 5, which were placed in stockpile and not shipped in the calendar year; each to be shown with its complete analysis.

At the top of page 6 of the report is a form for reporting the following items: total tons mined, loss by beneficiation, and net production in tons; also the summary of the development cost.

Open Pit Mining Costs — On page 6 also appears the detail of the open pit mining costs under 17 separate subdivisions, showing totals for open pit labor, supplies, and total mining cost.

Administration and Costs Underground Mining Costs — At the top of page 7 is the form for reporting the administration and miscellaneous costs.

Also on page 7, is the form for reporting full details of the underground mining costs and administration costs, fully itemized as in the case of open pit costs.

10-A — On page 8 of the report are given the items of miscellaneous expense not reported under 9-B and 9-D, which are allowed in full.

10-B — The following items on page 8 are requested as part of the report, **but are not allowable as deductions** for purposes of occupation tax.

Administration — Offices outside of Minnesota

Contributions, donations, entertainment, association dues, advertising, discounts, etc.
Contingent expense
Legal expenses
Maintenance of dwellings and misc. bldgs.
Depletion, interest, etc.
Idle Mine expense

The form next covers the statutory and non-statutory deductions allowable in arriving at the taxable value.

Tentative Determination of Tax — The engineers of the Mining Division of the Department of Taxation, using the information furnished in the report of the mining company (form No. 37) enter the essential data on the forms No. 37-A made by the Commissioner for the orderly and uniform determination of the tax, following the provisions of the occupation tax law as previously quoted.

The first step is the **tentative determination** of the tax. The heading shows the name of the operating company, the name of the mine being reported, and the calendar year of the operations reported.

Market Value Defined — Lines 1 to 4 of form 37-A are self-explanatory. Line 5 shows the lower lake value of the ore mined or produced in the calendar year reported.

Market Value How Computed — Using the published lower lake price for standard Mesabi Range non-Bessemer ore of 51.50% natural iron, adjusted for analyses of actual average natural iron and silica, also for any changes in rate of rail or lake transportation and taxes thereon since the latest previous price publication for iron ore at lower lake ports; the ore value is computed, at lower lake ports, for the calendar year of the report. Since ore settlements are made on upper railroad weights minus an allowance for shrinkage, this item is also deducted, and the remainder is the **net value of the ore at lower lake ports,** the figure to be entered on line 5. (Shrinkage is claimed at 1% of upper railroad weights. The Commissioner allows for shrinkage at ½%, for the reason that ½% is considered to be more nearly the true shrinkage change, or loss, in handling ore between upper R. R. weighing stations and lower lake weights.)

Lines 6 & 7 Stockpile Loading and Beneficiation — These items need no further explanation.

Line 8 Transportation — Transportation cost includes the following items: (1) upper rail freight rate effective at the date of the latest previous price announcement; (2) lake vessel freight rate effective at that date; (3) in case of a midyear change in ore prices,* any increases in either rail or lake freight,** from date (1) above, to the date of ore price change; (4) all taxes on such changes, (if increases). The sum of the foregoing items will apply to the tonnage produced from January 1 of the calendar year in question to the effective date of the price change.

Similarly, the cost of transportation for the remainder of the calendar year includes the following: (1) rail and lake freight rates effective at date of price change; (2) any increases in either rail or lake freight between date of midyear price change and the end of the calendar year; (3) all taxes on such increases.

* For example, the change by OPS on Sept. 12, 1952, effective July 26, 1952.
** This clause, known as "buyer's account" clause, has become standard practice within the past few years; being a clause accompanying the price announcement each year, stating that any increases after that date shall be for "Account of the purchaser". This has the effect of a like increase in ore value.

Line 9 Marketing — Claimed at 10 cents per ton, this item has been uniformly allowed to all companies at 5 cents per ton, as more nearly representing actual sales or marketing costs.

Line 10 — **Miscellaneous** (minor) costs: Cargo analysis and marine insurance. Items 6 to 10 are the **non-statutory** deductions; their total subtracted from the Lake Erie value of ore, leaves the **value at the mouth of the mine.**

M. S. 1953 Sec. 298.03 Statutory Deductions (From value at mouth of mine) — Then come the statutory deductions specified in the law:

(1) Mining cost in calendar year
(2) Development cost (open pit)
(3) Development cost (underground)
(4) Depreciation of mine plant and equipment
(5) Royalty paid in calendar year
(6) Miscellaneous items, including costs of engineering, laboratory, and miscellaneous items under 10-A of the company report
(7) Percentage of ad valorem taxes levied for such year equal to the percentage that the tons mined or produced bears to the total tonnage in the mine
(8) The amount or amounts of all the foregoing subtractions to be determined by the Commissioner of Taxation

Value of Ore for Tax — The remainder after deducting the sum of the above items, from the value at mouth of mine, is **line 15** of form 37-A — **Value of ore for purpose of tax.**

Gross Tax for Labor Credit — **Line 16** — 11% of the amount on line 15 is shown as "Gross Tax at 11%." (It is on this amount that the labor credit is allowed.)

Veterans' Compensation Line 17 — 1% of the amount on line 15 is set aside to apply on the Veterans' Compensation Fund.

Total Gross Tax Line 18 — The total of amounts on lines 16 and 17 of form 37-A is the total gross tax of 12%.

Labor Credit Line 19 — Line 19 shows the amount of the labor credit, computed as per Section 298.02.

Net Tax Line 20 — Line 20, the amount remaining after deducting from the total gross tax (line 18) the amount of the labor credit (line 19) is the net amount of the tentative occupation tax due and payable.

Examples Tax Computations for 1953. Operations of Two Mesabi Mines — From page 60 to page 74 is shown a copy of a company report on 1953 operations of a low-cost mine; and on page 71 to page 74 is form 37-A showing the detailed calculation as indicated above. Note that there is no labor credit. Page 75 to page 90 shows similar data on a high-cost mine for 1953.

M. S. 1953 Sec. 298.09 — Provision is herein made for the mailing of notice to each taxpayer, stating:

(1) The amount of tax tentatively found to be due from him.
(2) On May 15, or on the first secular day after May 14, a hearing is held. Taxpayers are present, and may protest any items in the calculation of tax. The calculations are hereafter reviewed in the Mining Division and the revised results are discussed with the Commissioner.
(3) After the hearing, the Commissioner makes his order either affirming or modifying the original determination.

M. S. 1953 Sec. 298.10 — The Commissioner certifies the amount of taxes to the State Auditor on or before June 1. The Auditor makes a draft on each taxpayer for the amount of tax certified and delivers the draft to the State Treasurer for collection.

Audits — All company reports and all calculations of occupation tax are subject to audit by an expert accountant regularly employed by the Department of Taxation who has full access to all company records, wherever such records are kept. Such audits are made within three years after certification of the tax and may result either in increases or decreases from the tax as originally certified.

Distribution — An occupation tax of 11% is distributed as follows:

50% to the State General Revenue Fund;
40% to the Permanent School Fund, and
10% to the Permanent University Fund.

Since 1949 an additional occupation tax of 1% goes to the Veterans' Compensation Fund. 10% of the amount going to the State General Revenue Fund is appropriated to the Iron Range Resources and Rehabilitation Commission.

FORM NO. 37

STATE OF MINNESOTA
DEPARTMENT OF TAXATION

OCCUPATION TAX REPORT

OF

"A"

(OPERATING COMPANY)

(POST OFFICE ADDRESS)

Made pursuant to the provisions of Section 298.05, Minnesota Statutes 1949, as Amended

COVERING OPERATIONS OF THE

MINE

During the calendar year ending December 31, 1953

N. B. It is the purpose of this form to provide for a complete return of all data relating to each mine operated during the calendar year 1953. However, if such a return is made, it must not be assumed by operator that all the costs and other data herein reported will be considered or allowed in determining the amount of occupation tax due upon the mining operations of this property.

It is important that this form be followed closely, that is, distribution of costs must be made in keeping with headings shown herein.

Explanatory notes have been inserted at various places, a thorough understanding of which will aid in completing the report properly.

Dept. of Taxation No. 37—
Legal description of property operated during the calendar year 1953.

Lots 1,2,3 & 4	Section 1 - 57 - 21
Lots 1,2,3 & 4	Section 2 - 57 - 21
SWSE ¼	Section 35-58-21
NWSE	Section 2 - 57 - 21
N ½ SW ¼ SE ¼	Section 2 - 57 - 21

Insert Legal Description: Twp., Range and Sec. and Mark with X each forty in Mining Unit.

Twp. No.				Rge. No.			
x	x	x	x	x	x	x	x
	Sec.	2			Sec.	1	
		x					
		x					
	Sec.	35			Sec.		
	58	21					
		x					

1. Extent and cost of all development work on said property at close of calendar year 1953, in following details:

NOTE: Please read and observe carefully: Costs under Item 1 or any subdivision thereof, must not include "taxes," "interest," "purchase of fee," "inspection costs," or any other expenses incurred upon acquisition of property or otherwise which are not directly attributable to the development of same.

OPEN PIT OPERATIONS

A. Extent and cost of open pit development.—Conditions as of January 1, 1921:

NOTE: Information requested under Subdivision A is for the purpose of determining "unamortized expenditures" for open pit development as of January 1, 1921. Therefore, all information should be based on the earliest data available subsequent to this date. Subdivision A need not be answered if development work was begun subsequent to January 1, 1921.

1.	Total expenditures for stripping or other open pit development to December 31, 1920 (C-1, P. 3)	$
2.	Total cubic yards of all materials removed by stripping, applicable to above expenditures	
3.	Estimated cubic yards of all materials remaining to be removed	
4.	Grand total cubic yards of stripping (A-2 + A-3)	
5.	Per cent of total yards moved to total stripping (A-2 ÷ A-4)	
6.	Total tonnage shipped prior to January 1, 1921	
7.	Estimated tonnage of open pit ore remaining in property as of January 1, 1921	
8.	Grand total tonnage in property at the beginning of operations (A-6 + A-7)	
9.	Estimated tonnage of ore developed by stripping removed prior to January 1, 1921 (A-8 × A-5)	
10.	Estimated tonnage of ore developed by stripping removed prior to January 1, 1921 and remaining unmined as of that date (A-9 — A-6)	
11.	The average development cost per ton of ore developed by stripping removed prior to January 1, 1921 (A-1 ÷ A-9)	$
12.	Balance of expenditures unamortized as of January 1, 1921 (A-10 × A-11)	$

B. Extent and cost of open pit development.—Conditions under law effective January 1, 1921:

NOTE: Subdivision B relates wholly to the status of open pit development and to expenditures therefor, applicable to all open pit ore produced subsequent to January 1, 1921. Under Item B-1 should be shown only the balance, if any, carried forward from Subdivision A-12. Item B-2 comprehends expenditures for all open pit development subsequent to January 1, 1921. Expenditures for open pit development other than for development actually done by present operator may be included under this item, but where included should be so indicated and the nature of such expense must be fully explained under remarks.

1.	Balance of expenditures unamortized January 1, 1921 (A-12)	$ 1,419,989
2.	Expenditures for open pit development subsequent to January 1, 1921; C-2+3, P. 3) (19..... to 1953 inclusive) (See Note)	$ 2,682,652
3.	Total expenditures (B-1 + B-2)	$ 4,102,641
4.	Amortization allowed by commission years 19..... to 1952, inclusive	$ 4,040,088
5.	Total expenditures unamortized (B-3 — B-4)	$ 62,553
6.	Estimated future expenditures (Full details under subdivision C-4, P. 3)	$ 849,569
7.	Total costs unamortized, plus estimated future expenditures (B-5 + B-6)	$ 912,122
8.	Estimated tonnage of ore in or at property, January 1, 1953, applicable to expenditures shown under B-7. (This estimate should include any ore mined, applicable to these expenditures, which may be in stockpile or otherwise not shipped)	8,961,876
9.	Average cost per ton (B-7 ÷ B-8)	$ .1018
10.	Total tonnage produced in year 1953	852,514
11.	Proportionate amount of development costs unamortized, applicable to tons produced in 1953 (B-10 X B-9)	$ 62,553
12.	Balance of actual expenditures unamortized December 31, 1953 (B-5 — B-11)	$

C. Supplementary to and in support of subdivisions A and B, a subdivision of the total stripping removed and the cost thereof as of December 31, 1953 is required in the following detail:

	Surface	Rock Solid	Rock Broken	Other Materials	Grand Total
1. Stripping prior to January 1, 1921:					
1. Total yards moved					13,428,820
2. Total expenditures to January 1, 1921	$	$	$	$	$ 3,281,112
3. Average cost per cu. yd.	$	$	$	$	$ .2443
2. Stripping for period of 1921 to 1952, inclusive:					
1. Total yards moved					8,392,792
2. Total cost, 1-1-21-12-31-52	$	$	$	$	$ 2,620,099
3. Average cost per cu. yd.	$	$	$	$	$ .3122
3. Stripping during year ending December 31, 1953.					
1. Total yards moved					169,164
2. Total cost to 12-31-53	$	$	$	$	$ 62,553
3. Average cost per cu. yd.	$	$	$	$	$ .3698
Grand Total, Items 1, 2 and 3					
1. Total yards moved					21,990,776
2. Total cost of stripping	$	$	$	$	$ .2712
3. Average cost per cu. yd.	$	$	$	$	$
4. Estimated cu. yds. of stripping remaining, and cost of removing same as of December 31, 1953.					
a. Est. total yds. remaining	1,347,164	310,703			1,657,867
b. Estimated cost of removal	$ 538,866	$ 310,703	$	$	$ 849,569
c. Average cost per cu. yd.	$ .40	$ 1.00	$	$	$ .5124
5. Grand total expenditures for stripping incurred and to be incurred as of 12-31-53 (C-1 to C-4, incl.)					
a. Total yards of stripping					23,648,643
b. Total costs for same	$	$	$	$	$ 6,813,333
c. Average cost per cu. yd.	$	$	$	$	$ .2881

6. Total initial tonnage of ore available for open pit mining within the proposed stripping area - - - - 108,318,209
7. Average stripping cost per ton (5-b ÷ 6) - - - - - - - - - - - - - - - - - - - $ .0629
8. Total tonnage produced, open pit operations, subsequent to January 1, 1921, to year 1952, inclusive - - 65,573,566

UNDERGROUND OPERATIONS

D. **Extent and cost of underground development.—Conditions as of January 1, 1921:**

NOTE: Notes which appear under the general heading of Item 1, Subdivision A and B of open pit development, are equally applicable to underground development. Please read and observe carefully.

1. Total expenditures to December 31, 1920:
   a. Shafts - - - - - - - - - - - - - - - - - - $______
   b. Drifts (Main levels) or other development where capitalized - - - - - - $______
   Total - $______
2. Total tonnage produced prior to January 1, 1921 - - - - - - - - - - - - - - - ______
3. Estimated tonnage of ore available for mining January 1, 1921 with facilities existing at that time - - ______
4. Total tonnage applicable to above expenditures (D-2 + D-3) - - - - - - - - - - - - ______
5. Average cost per ton (D-1 ÷ D-4) - - - - - - - - - - - - - - - - - - $______
6. Balance of expenditures unamortized as of January 1, 1921 (D-3 × D-5) - - - - - - - - $______

E. **Extent and cost of underground development.—Conditions under law effective January 1, 1921:**

1. Balance of expenditures unamortized January 1, 1921 (D-6) - - - - - - - - - - - - $______
2. Expenditures incurred subsequent to January 1, 1921, (19......to 1952, inclusive):
   a. Shafts - - - - - - - - - - - - - - - - - - $______
   b. Drifts (Main levels) where capitalized - - - - - - - - - - - $______
   c. Other development where capitalized - - - - - - - - - - - $______
   Total January 1, 1921 to December 31, 1952 - - - - - - - - - - - - - - $______
3. Expenditures actually incurred in 1953 only:
   a. Shafts - - - - - - - - - - - - - - - - - - $______
   b. Drifts (Main levels) where capitalized - - - - - - - - - - - $______
   c. Other development where capitalized - - - - - - - - - - - $______
   Total for year 1953 - $______

E. **Underground Development (Contd.)**

4. Grand total expenditures above (E-1, E-2 and E-3) - - - - - - - - - - - - - - $______
5. Estimated tonnage of ore available for mining, applicable to total expenditures under E-4
   a. Total underground tonnage produced, subsequent to January 1, 1921 to year 1952, inclusive - - - - - - - - - - - - - - - - ______tons.
   b. Estimated tonnage available for mining as of January 1, 1953 - - - - - ______tons.
   Total tonnage - ______
6. Average cost per ton (E-4 ÷ E-5) - - - - - - - - - - - - - - - - - - $______
7. Amortization allowed by Commission 19 to year 1952, inclusive - - - - - - - - - - $______
8. Total expenditures unamortized (E-4 — E-7) - - - - - - - - - - - - - - - $______
9. Estimated tonnage of ore available for mining January 1, 1953, applicable to development costs unamortized as shown under E-8 - ______
10. Average cost per ton (E-8 ÷ E-9) - - - - - - - - - - - - - - - - - - $______
11. Tons of ore produced from underground during year 1953 - - - - - - - - - - - - ______
12. Proportionate amount of development costs unamortized, applicable to underground ore produced in the year 1953 (E-11 X E-10) - $______
13. Balance of costs unamortized December 31, 1953 (E-8 — E-12) - - - - - - - - - - $______
14. Memoranda:
    a. Total depth of shaft in feet up to December 31, 1953 - - - - - - - - - ______feet.
    b. Average cost per foot of sinking shaft up to December 31, 1953 - - - - - - - - - - $______
    c. Average cost per foot of sinking shaft in 1953 or the last preceding year in which development was done $______

2. Total tonnage of ore mined or produced from the property above described, during the calendar year 1953, in detail as indicated below:

NOTE: This statute contemplates that all ores mined or produced in any calendar year are subject to tax. Tonnages reported hereunder, when shipped in the year mined, must be based upon railroad shipping weights (long tons) wherever possible. Where through failure to ship the ore in the year mined, it is necessary to apply factors other than railroad weights in determining these tonnages, any differences in tonnages disclosed through subsequent shipping of the ore so mined, should be reported.

METHOD OF OPERATION AND GROSS TONS MINED BY EACH METHOD

Legal Descriptions from which the ore was mined	OPEN PIT		UNDERGROUND		TOTAL TONNAGE MINED	
	Direct Ore Tons	Concentrate Ore Tons	Direct Ore Tons	Concentrate Ore Tons	Direct Ore Tons	Concentrate Ore Tons
Lots 1,2,3 & 4 Sec. 1-57-21						
Lots 1, 3 & 4 Sec. 2-57-21						
NW ¼ SE ¼) Sec. 2-57-21						
N ½ SW¼ SE¼)						
GRAND TOTAL						

3. Gross tons, grade and average analysis of ore mined or produced in 1953.

	Gross Tons	Nat. Iron %	Dry Phos. %	Nat. Mn. %	Dry Silica %	Dry Alum. %	Moist %
A. Bessemer	385,126	57.04	.038	.32	4.18		10.29
Total Tonnage and Average Analysis							
B. Non-Bessemer	467,388	52.90	.069	.41	7.70		11.19
Total Tonnage and Average Analysis							
C. Manganiferous							
Total Tonnage and Average Analysis							
GRAND TOTAL TONNAGE AND AVERAGE ANALYSIS	852,514						

4. Market value at Lake Erie Ports of ore mined or produced in 1953 as follows:

	Gross Tons	Per Ton Market Value at L. E. Ports	Total Market Value Lake Erie Ports	Remarks
A. Bessemer	198,994	$10.7734	$2,143,842	*4-1 to 6-30
	186,132	10.9426	2,036,768	* After 6-30
Total	385,126			
B. Non-Bessemer	175,345	9.7661	1,712,437	* 4-1 to 6-30
	292,043	9.9193	2,896,862	* After 6-30
Total	467,388			
C. Manganiferous				
Total				
GRAND TOTAL	852,514	$10.3106	$8,789,909	

NOTE: Screen analyses of season's shipment for Bessemer, Non-Bessemer and Manganiferous grades of ore are required as part of this report. The screen analyses should be complete and must show at least the percentage of material passing through a 40-mesh screen.

All tonnages of ores and iron-bearing materials, either (1) not shown under Item 3 which were removed from the mine in 1953 and for which separate analyses were kept, or (2) shown under Item 3 which were placed in stockpile in 1953 and not shipped from the range in 1953, must be listed below, showing gross tons and analyses. Report (1) and (2) separately. Give information on any concentration tests which may have been made on any such material. Report open pit and underground tonnages separately. Give legal description of land on which any such stockpiles are located.

Type of Material	Stockpiled on	Gross Tons	Nat. Iron %	Dry Phos %	Nat. Mn. %	Dry Silica %	Dry Alum. %	Moist %

* The market value of these ores is less than the market value of Standard Mesabi Ores due to the necessary structure penalties. The fineness of these ores should be given consideration in arriving at their value.

Detailed Information With Reference to the Cost of Mining and Producing Ore During the Calendar Year 1953

	Open Pit	Underground	Grand Total Gross Tons
5. Total mined, gross tons	852,514		
6. Loss due to beneficiation, gross tons	-0-		
7. Production, gross tons	852,514		

8. Cost of Development. (Under this item should be shown development costs applicable only to the tonnage mined during the calendar year. Costs per ton of Item 8 and subsequent items are based on Item 7.)

OPEN PIT		UNDERGROUND		TOTAL	
Average cost per ton	Total Cost	Average cost per ton	Total Cost	Average cost per ton	Total Cost
$ .0733	$ 62,553	$	$	$ .0733	$ 62,553

9. Cost of supplies used and labor performed at the mine in separating the ore from the ore body, including hoisting or conveying same to the surface of the earth.

OPEN PIT

	LABOR Per Ton	LABOR Total	SUPPLIES Per Ton	SUPPLIES Total	TOTAL Per Ton	TOTAL Total
A. Operating Costs:						
1. Power Shovels a. Operating	$ .0399	$ 34,014	$ .0262	$ 22,337	$ .0661	$ 56,351
b. Mtce & Repairs						
2. Locomotive & Cars a. Operating	.1396	118,979	.0494	42,160	.1890	161,139
b. Mtce & Repairs						
3. Trucks a. Operating	.0086	7,370	.0074	6,289	.0160	13,659
b. Mtce & Repairs						
4. Conveyors a. Operating						
b. Mtce & Repairs						
5. Track Expense	.0571	48,677	.0129	11,028	.0700	59,705
6. Roadways	.0137	11,628	.0105	8,969	.0242	20,597
7. Drilling & Blasting	.0197	16,777	.0138	11,764	.0335	28,541
8. Pumping & Drainage	.0048	4,053	.0038	3,253	.0086	7,306
9. Water Supply						
10. Scramming	.1750	149,214	.0666	56,746	.2416	205,960
11. Open Pit Supervision						
12. General Pit Expense	.0926	79,010	.1246	106,197	.2172	185,207
13. Mine Employees Bonus or Vacation Pay						
14. Lean Matl & Waste Pile Exp. (Tons or Yds. (Material	.0003	219			.0003	219
15. Stocking Merchantable Ore						
16. Contract Mining						
17. Misc. (Detail fully) a. $						
b.						
c.						
d.						
e.						
TOTAL (A-1 thru A-17)	$ .5513	$ 469,941	$ .3152	$ 268,743	$ .8665	$ 738,684

B. Administration and Miscellaneous Costs:

(Note: Report only costs incurred within Minnesota and directly attributable to mining operations. Report other administrative items under 10-A and B.)

OPEN PIT

	LABOR Per Ton	LABOR Total	SUPPLIES Per Ton	SUPPLIES Total	TOTAL Per Ton	TOTAL Total
1. Mine Office—Mine supervision and clerical	$ .0701	$ 59,755	$ .0211	$ 17,968	$ .0912	$ 77,723
2. Range Office—Mine supervision and clerical	.0079	6,779	.0205	427	.0284	7,206
3. Duluth or other central office in Minnesota — Mine supervision and clerical	.0119	10,186	.0044	3,745	.0163	13,931
4. Engineering	.0312	26,575	.0033	2,832	.0345	29,407
5. Laboratory (Assaying, Sampling, Etc.)	.0168	14,299	.0194	16,560	.0362	30,859
6. Experimental Expense						
7. Miscellaneous (detail fully)						
a.	$					
b.	$					
c.	$					
Total administrative expense	$ .1379	$ 117,594	$ .0487	$ 41,532	$ .1866	$ 159,126
TOTAL OPEN PIT OPERATING COSTS (A + B)	$ .6892	$ 587,535	$ .3639	$ 310,275	$ 1.0531	$ 897,810

UNDERGROUND

C. Operating Costs:	LABOR Per Ton	LABOR Total	SUPPLIES Per Ton	SUPPLIES Total	TOTAL Per Ton	TOTAL Total
1. Mining	$	$	$	$	$	$
2. Timbering						
3. Trimming						
4. Conveying						
5. Pumping						
6. Hoisting						
7. Repairs						
8. U. G. Supervision						
9. Genl U. G. Expense						
10. Genl Surface Exp.						
11. Misc. (Detail fully)						
a.	$					
b.	$					
c.	$					
d.	$					
TOTAL (C-1 thru C-11)	$	$	$	$	$	$

D. Administration and Miscellaneous Costs: (See note above)

1. Mine Office—Mine supervision and clerical						
2. Range Office—Mine supervision and clerical						
3. Duluth or other central office in Minnesota — Mine supervision and clerical						
4. Engineering						
5. Laboratory (Assaying, Sampling, Etc.)						
6. Experimental Expense						
7. Misc. (detail fully)						
a.	$					
b.	$					
c.	$					
d.	$					
Total administrative expense	$	$	$	$	$	$
TOTAL UNDERGROUND OPERATING COSTS (C + D)	$	$	$	$	$	$

10 Miscellaneous items of expense not included under items 9-B and D:

	OPEN PIT Average cost per ton	OPEN PIT Total Cost	UNDERGROUND Average cost per ton	UNDERGROUND Total Cost	TOTAL Average cost per ton	TOTAL Total Cost
A.	$ .0024	$ 2,014	$	$	$	$
1. Insurance on buildings and equipment used in operations						
2. Personal injury expense actually paid:						
a. Premiums for compensation and liability insurance $						
b. Medical and hospital expenses $						
c. Settlement of injury or death claims $						
d. Safety or other miscellaneous expenses (give details) $						
Total, a to d	$ .0383	$ 32,627	$	$	$	$
3. Total personal property taxes (Levied in the year 1953 and payable in 1954) 3a+3b. $						
a. Personal property taxes levied in 1953 on mining equipment and other personal property actually used in or attributable to mining operations:						
Total taxable valuation $						
Total taxes levied	.0215	18,637				
b. Total stock pile tax:						
1. Total tons						
2. Total tax $						
c. Ore in stockpile May 1, 1953, placed therein subsequent to May 1, 1952. Tons						
d. Proportion of total stockpile taxes levied in 1953 applicable to tonnage under 3-c						
4. Social Security taxes paid in 1953	.0137	11,677				
5. Pensions	.0260	22,157				
6 Group Insurance	.0112	9,565				
Total, Item 10-A	$ .1131	$ 96,407	$	$	$	$
B.						
1. Administration, offices outside of Minnesota	$	$	$	$	$	$
2. Contributions, donations, entertainment, etc.	.0001	75				
3. Association dues, assessments, advertising, discounts, exchange, etc.						
4. Contingent expenses, such as clubhouse, garden prizes, examinations, etc.						
5. Legal expenses	.0016	1,354				
6. Maintenance and upkeep of misc. real estate and dwellings	.0047	3,971	Labor Material	11,165 (7,194)		
7. Depletion, interest, charges, etc.						
8. Idle mine expense (mines idle during year 1953)	.0098	8,405				
9. Costs not included above			Miscellaneous Cleveland Expense			
Total, Item 10-B	$ .0162	$ 13,805	$	$	$	$
Total, Misc. Expense, (10-A and B)	$ .1293	$ 110,212	$	$	$	$

	OPEN PIT		UNDERGROUND		TOTAL	
	Average cost per ton	Total cost	Average cost per ton	Total cost	Average cost per ton	Total cost
11. Total Royalty accruing on tonnage mined in 1953	$ .1250	$ 106,564	$	$	$	$
SUBDIVIDE ABOVE TOTAL ROYALTY INTO:						
A. Portion represented by advance royalty credits, applied on 1953 tonnage $						
B. Portion represented by liquidated royalties applied on 1953 tonnage $						
C. Balance (Item 11 — A + B) currently paid or accrued upon ore produced during year 1953 $						
12. Total Amount of Realty Taxes, exclusive of Special Assessments, levied in 1953 (payable in 1954), upon the legal descriptions shown on page 2 $ 186,972						
Amount of Ad Valorem Taxes levied in 1953 applicable to the tonnage mined in 1953	$ .0458	$ 39,055	$	$	$	$
13. Mine Plant and Equipment (Exclusive of Beneficiating Plants)						
A. Standard Mine Plant and Equipment — Additions and betterments in 1953. $ 10,632						
1. Gross capital investment Dec. 31, 1953. $		(6% of 2,847,946.98 x 26.16%)				
2. Depreciation for 1953	$ .0525	$ 44,701	$	$	$	$
3. Total charged off at close of 1953 $						
B. Motorized Equipment — Additions and betterments in 1953. $ 537,293						
1. Gross capital investment Dec. 31, 1953. $		(25% of 1,986,532.19 x 26.16%)				
2. Depreciation for 1953	$ .1524	$ 129,919	$	$	$	$
3. Total charged off at close of 1953 $						

STOCKPILE LOADING, BENEFICIATION, TRANSPORTATION AND MARKETING EXPENSE

14. Stockpile Loading:						
A. Shipments from stockpile, 1953						
1. Tons Shipped						
2. Cost of Loading $						
3. Cost per ton $						
B. Tonnage Stockpiled in 1953						
1. Total Tons Stockpiled						
2. Cost per ton (A-3) $						
3. Cost Applicable to tons Stockpiled, B-1 × B-2	$	$	$	$	$	$
15. Beneficiation (Detail on Page 10)	Tons conc. produced					
A. Washing						
B. Drying						
C. Crushing & Screening						
D. Sintering						
E. Jigging						
F. Heavy medium						
G. Pelletizing						
H. Flotation						
Total cost of beneficiation	$	$	$	$	$	$

	OPEN PIT		UNDERGROUND		TOTAL	
	Average cost per ton	Total cost	Average cost per ton	Total cost	Average cost per ton	Total cost
16. Transportation.						
A. Rail freight (Based on rates in effect year 1953)						
tons $ per ton						
tons $ per ton						
tons $ per ton	$	$	$	$	$	$
B. Vessel freight (Based on rates in effect year 1953)						
tons $ per ton						
tons $ per ton						
tons $ per ton						
C. Vessel unloading (Based on rates in effect year 1953)						
tons $ per ton						
tons $ per ton						
tons $ per ton						
D. Federal Transportation tax	3.0908	2,634,927				
Total Transportation Expense	$	$	$	$	$	$
17. Other costs incidental to transportation and marketing	.0109	9,323		Cleveland Expense		
A. Marketing expense	$ .0500	$ 46,626	$	$ Commission	$	$
B. Marine Insurance	.0020	1,705				
C. Cargo analysis expense						
D. Miscellaneous items not expressly enumerated. (Detail fully under remarks)	.0150	12,788	(A)			
Total Item 17	$ .0779	$ 66,442	$	$	$	$
Total Cost of Transportation and Marketing (Items 16 & 17)	$ 3.1687	$ 2,701,369	$	$	$	$
GRAND TOTAL COSTS, YEAR 1953 (Items 8 to 17)	$ 4.8001	$ 4,092,183	$	$	$	$

DETAILED INFORMATION WITH REFERENCE TO BENEFICIATING ORES MINED FROM THE _____ MINE, DURING THE CALENDAR YEAR 1953

	Washing Plants	Drying Plants	Sintering Plants	Crushing and Screening Plants
1. Government description of tract upon which plant is located				
2. Plant and Equipment:				
A. Additions and betterments in 1953	$	$	$	$
(Detail of these items must accompany report.)				
3. Gross capital investment for depreciation as shown by your books at close of year 1953				
4. Amount charged off to depreciation year 1953				
5. Total amount charged off to depreciation at close of year 1953				
6. Net investment outstanding in plant and equipment at close of year 1953	$	$	$	$

DETAILED COSTS OF BENEFICIATION AS SUMMARIZED UNDER ITEM 15, PAGE 9:

7. A. Transportation expense, mine to plant	$	$	$	$
B. Labor:				
1. Beneficiation				
2. Maintenance				
3. Superintendence and clerical at plant				
4. Miscellaneous (Detail fully under remarks.)				
Total Labor	$	$	$	$
C. Supplies				
1. Plant	$	$	$	$
2 Maintenance				
3. Electric power				
4. Miscellaneous (Detail fully under remarks.)				
Total Supplies	$	$	$	$

(A) This is royalty tax required to be paid under the terms of these leases to permit shipment of ore from the mine.

	Washing Plants	Drying Plants	Sintering Plants	Crushing and Screening Plants
D. Miscellaneous other than labor and supplies:				
1. Workmen's compensation (Actual costs only, no reserve funds.)	$	$	$	$
2. Fire and other insurance necessary to plant				
3. Other items, Social Sec., etc. (Detail under remarks.)				
E. Taxes:				
1. Levied in the year 1953 (payable in 1954) on real estate connected with plant				
2. Levied in the year 1953 (payable in 1954) on personal property connected with plant				
F. Depreciation as per item 4, page 10				
G. Interest on beneficiating plant investment				
GRAND TOTAL COST	$	$	$	$

SUMMARY OF OCCUPATION TAX TOTALS

Item		Per Ton	Total	Total
4. Gross Tons 852,514	L. E. Value	$ 10.3106		$ 8,789,909
Non-Statutory Deductions:				
14. Stockpile Loading		$	$	
15. Beneficiation				
16. Transportation		3.0908	2,634,927	
17-A. Marketing Expense		.0609	51,949	
17-B, C, D. Miscellaneous		.0170	14,493	
Total Non-Statutory Deductions		$ 3.1687		$ 2,701,369
Value of Ore at Mouth of Mine		$ 7.1419		$ 6,088,540
Statutory Deductions:				
8. Development		$ .0733	$ 62,553	
9-A&C. Labor		.5513	469,941	
9-A&C. Supplies		.3152	268,743	
9-B&D. Administrative (Subd. 1&2)		.0996	84,929	
9-B&D. Administrative (Subd. 3)		.0163	13,931	
13. Depreciation		.2049	174,620	
9-B&D. (4, 5, 6, & 7) and 10-A. Miscellaneous		.1838	156,673	
11. Royalty		.1250 (A)	106,564	
12. Ad Valorem Taxes		.0458	39,055	
Total Statutory Deductions		$ 1.6152		$ 1,377,009
Taxable Value		$ 5.5267		$ 4,711,531

REMARKS (See footnote (A) on page 10)

State of ..... } ss.
County of .....

I, ... do solemnly swear that I am the ..... (Official title) of ..... (Operating company); that the foregoing report was made by me, or under my supervision, and that the matters therein set forth have been transcribed from the records of this Company and are true and correct to the best of my knowledge and belief.

Subscribed and sworn to before me this ..... day of ....., 1954.

Notary public .....
My commission expires .....

Form No. 37-A

DEPARTMENT OF TAXATION
STATE OF MINNESOTA

TENTATIVE DETERMINATION UNDER MINNESOTA STATUTES 1949, SECTION 298, AS AMENDED, OF THE AMOUNT OF OCCUPATION TAX DUE FROM ..... ON MINING OPERATIONS OF "A" MINE, DURING THE CALENDAR YEAR 1953.

1. Character of operation: Open Pit X Underground .....
2. Total tonnage mined during the calendar year 1953 852,514 tons.
3. Loss by beneficiation ..... tons.
4. Marketable tonnage mined 852,514 tons.
5. Market value of Item 4 ..... Per Ton $ ..... Total Value $ 8,789,914.41

NON STATUTORY DEDUCTIONS: COSTS BEYOND MOUTH OF MINE

6. Cost of loading ore from stockpile, ore mined in 1953 ..... tons Per Ton $ ..... Total Cost $ .....
7. Cost of beneficiation ..... Per Ton $ ..... Total Cost $ .....
8. Transportation cost ..... Per Ton $ ..... Total Cost $2,634,927.25
9. Marketing Expense ..... Per Ton $0.0975 Total Cost $ 42,412.57
10. Misc. (See detail on reverse side) ..... Per Ton $ ..... Total Cost $ 1,705.00
    Total - Items 6 to 10 ..... Per Ton $ ..... Total Cost $ 2,679,044.82
    Value of Ore At Mouth of Mine ..... Per Ton $ ..... Total Value $ 6,110,869.59

STATUTORY DEDUCTIONS

11. Cost of Development ..... Per Ton $ ..... Total Cost $ 62,553.00
12. Cost of Mining
    a. Labor ..... Per Ton $ ..... Total Cost $469,941.00
    b. Supplies ..... Per Ton $ ..... Total Cost $268,743.00
    c. Administrative Expense—Mine and District Offices ..... Per Ton $ ..... Total Cost $ 84,929.00
    d. Administrative Expense—Duluth or other central office in Minnesota ..... Per Ton $ ..... Total Cost $ 13,931.00
    e. Deprec. of Mine Plant & Equipm't ..... Per Ton $ ..... Total Cost $158,318.00
    f. Misc. (See detail on reverse side) ..... Per Ton $ ..... Total Cost $156,673.00
13. Royalty ..... Per Ton $ ..... Total Cost $106,564.00
14. Ad valorem taxes on ore mined ..... % Per Ton $ ..... Total Cost $ 39,055.15
    Total - Items 11 to 14 ..... Per Ton $ ..... Total Cost $ 1,360,707.15
15. Value of ore for purpose of tax $ 4,750,162.44
16. Gross Tax upon such value at 11% $ 522,517.87
17. Special Tax for Veterans Adjusted Compensation (Sec. 298.011) (1% of No. 15) $ 47,501.62
18. Total Gross Tax (16+17) $ 570,019.49
19. Credit for Labor as per Sec. 298.02 $ .....
20. Net Amount of Tax Due and Payable (18-19) $ 570,019.49

Item 7. Cost of Beneficiation

Transportation		$
Labor		
Supplies		
Miscellaneous		
Taxes		
Depreciation* (See detail below)		
Interest** (See detail below)		
Total		$
*1. Plant Investment—12/31/52		$
2. Additions—Year 1953	$	
3. Retirements—Year 1953		
4. Net Additions		
5. Amount to Depreciate at 12/31/53		
6. Depreciation allowed to 12/31/52	$	
7. Less Depreciation retired in 1953		
8. Net Depreciation Allowance		
9. Depreciation @ 6% on Item 5		
10. Total Depreciation to 12/31/53		
11. Undepreciated Balance—12/31/53		
Depreciation Allowance for 1953		
Depreciation as above—Item 9		
Add Loss—Deduct profit on equipment and rentals Depreciation Allowance for 1953		
**Undepreciated Balance as at 12/31/52		$
Interest @ 6% on 12/31/52 Undepreciated Balance		

Item 10. Miscellaneous

Marine Insurance	$
Cargo Analysis	
Other Items	
Total	$

Item 12f. Cost of Mining — Miscellaneous

Engineering	$
Laboratory	
Item 10-A	
Item	
Total	$

Item 12e. Depreciation

	Standard Plant		Motorized Equipment	
1. Investment — 12/31/52		$ 2,858,579		$ 1,449,240
2. Additions — Year 1953	$		$ 537,293	
3. Retirements — Year 1953	(10,632)			
4. Net Additions		(10,632)		537,293
5. Amount to Depreciate at 12/31/53		2,847,947		1,986,533
6. Depreciation allowed to 12/31/52	$ 2,464,164		$1,174,475	
7. Less Depreciation retired in 1953	9,569			
8. Net Depreciation Allowance	$ 2,454,595		$	
9. Depreciation @ 6% on Item 5	108,557		496,633	
10. Total Depreciation to 12/31/53		2,563,152		1,671,108
11. Undepreciated Balance—12/31/53		284,795		315,425
Depreciation Allowance for 1953				
Depreciation as above — Item 9		$ 108,557		$ 496,633
Add Loss—Deduct profit on equipt. sold and rentals		80,158		366,714
Depreciation Allowance for 1953		28,399		129,919
			158,318	

SUPPLEMENTAL WORKSHEET "A" MINE.

ITEM 5. Lake Erie Value

Grade of Ore	Tons	Nat Fe		Phos	Silica	% Thru 40M	Value/ton	Total
Bessemer								
4-1 to 7-1	198,994	57.04		.038	4.18	46.04	$ 10.7761	2,144,379.24
7-1 to 12-31	186,132	57.04		.038	4.18	46.04	10.9976	2,047,005.28
Non-Bessemer								
4-1 to 7-1	175,345	52.90		.069	7.70	39.34	9.7637	1,712,015.98
7-1 to 12-31	292,043	52.90		.069	7.70	39.34	9.9691	2,911,405.87
Buyer's Account	374,339						.0515	19,278.46

Gross value	8,834,084.83
Less 1% shrinkage	44,170.42
Lake Erie value	8,789,914.41

ITEM 8. Transportation

	Tons		Cost/ton	Total
4-1 to 12-31	852,514		$ 3.090773	$2,634,927.25
				2,634,927.25

ITEM 14. Ad Valorem Tax Allowance

Description	District	SD	Reserve(tons)	Assessed Value	Mill Rate	Tax (mineral)

Production _____ = % Total tax
Reserve Allow _____ % $ 39,055.15

ITEM 19. Credit For Labor

Total labor cost			
Tons produced			
Labor cost per ton			
Excess of 60¢ & not more than 78¢		x .10	
Excess of 78¢		x .15	
Labor credit earned _____ tons x			
Excess of 96¢		x .10	
Labor credit earned _____ tons x			
Total labor credit earned			
Maximum credit allowable (exclusive of effect of 298.02 sec. 1-c) _____% x gross tax @ 11% _____			
Credit not used under limitation			

DEPARTMENT OF TAXATION
STATE OF MINNESOTA

FINAL DETERMINATION UNDER MINNESOTA STATUTES 1949, SECTION 298, AS AMENDED, OF THE AMOUNT OF OCCUPATION TAX DUE FROM _____ ON MINING OPERATIONS OF "A" MINE, DURING THE CALENDAR YEAR 1953.

1. Character of operation: Open Pit X Underground _____
2. *Total tonnage mined during the calendar year 1953* _____ *tons.*
3. Loss by beneficiation _____ tons.
4. Marketable tonnage mined _____ tons.
5. Market value of Item 4 _____ Per Ton $_____ Total Value $_____

NON STATUTORY DEDUCTIONS: COSTS BEYOND MOUTH OF MINE

6. Cost of loading ore from stockpile, ore mined in 1953 _____ tons Per Ton $_____ Total Cost $_____
7. Cost of beneficiation _____ Per Ton $_____ Total Cost $_____
8. Transportation cost _____ Per Ton $_____ Total Cost $_____
9. Marketing Expense _____ Per Ton $_____ Total Cost $_____
10. Misc. (See detail on reverse side) _____ Per Ton $_____ Total Cost $_____
    Total - Items 6 to 10 _____ Per Ton $_____ Total Cost $_____
    Value of Ore At Mouth of Mine _____ Per Ton $_____ Total Value $_____

STATUTORY DEDUCTIONS

11. Cost of Development _____ Per Ton $_____ Total Cost $_____
12. Cost of Mining
    a. Labor _____ Per Ton $_____ Total Cost $_____
    b. Supplies _____ Per Ton $_____ Total Cost $_____
    c. Administrative Expense—Mine and District Offices _____ Per Ton $_____ Total Cost $_____
    d. Administrative Expense—Duluth or other central office in Minnesota _____ Per Ton $_____ Total Cost $_____
    e. Deprec. of Mine Plant & Equipm't _____ Per Ton $_____ Total Cost $_____
    f. Misc. (See detail on reverse side) _____ Per Ton $_____ Total Cost $_____
13. Royalty _____ Per Ton $_____ Total Cost $_____
14. Ad valorem taxes on ore mined _____ % Per Ton $_____ Total Cost $_____
    Total - Items 11 to 14 _____ Per Ton $_____ Total Cost $_____
15. Value of ore for purpose of tax $4,750,162.44
16. Gross Tax upon such value at 11% $ 522,517.87
17. Special Tax for Veterans Adjusted Compensation (Sec. 298.011) (1% of No. 15) $ 47,501.62
18. Total Gross Tax (16+17) $ 570,019.49
19. Credit for Labor as per Sec. 298.02 $_____
20. Net Amount of Tax Due and Payable (18-19) $ 570,019.49

FORM NO. 37

STATE OF MINNESOTA
DEPARTMENT OF TAXATION

OCCUPATION TAX REPORT

OF

"B"

(OPERATING COMPANY)

(POST OFFICE ADDRESS)

Made pursuant to the provisions of Section 298.05, Minnesota Statutes 1949, as Amended

COVERING OPERATIONS OF THE

_____ MINE

During the calendar year ending December 31, 1953

N. B. It is the purpose of this form to provide for a complete return of all data relating to each mine operated during the calendar year 1953. However, if such a return is made, it must not be assumed by operator that all the costs and other data herein reported will be considered or allowed in determining the amount of occupation tax due upon the mining operations of this property.

It is important that this form be followed closely, that is, distribution of costs must be made in keeping with headings shown herein.

Explanatory notes have been inserted at various places, a thorough understanding of which will aid in completing the report properly.

Dept. of Taxation No. 87—

Legal description of property operated during the calendar year 1953.

SW ¼ NE ¼ Sec. 36-59-18

NW ¼ SE ¼ Sec. 36-59-18

SW¼ SE ¼ Sac. 36-59-18

Insert Legal Description: Twp., Range and Sec. and Mark with X each forty in Mining Unit.

Twp. No.				Rge. No.			
	Sec.	x			Sec.		
	36	x					
		x					
	Sec.				Sec.		

1. Extent and cost of all development work on said property at close of calendar year 1953, in following details:

NOTE: Please read and observe carefully: Costs under Item 1 or any subdivision thereof, must not include "taxes," "interest," "purchase of fee," "inspection costs," or any other expenses incurred upon acquisition of property or otherwise which are not directly attributable to the development of same.

OPEN PIT OPERATIONS

A. Extent and cost of open pit development.—Conditions as of January 1, 1921:

NOTE: Information requested under Subdivision A is for the purpose of determining "unamortized expenditures" for open pit development as of January 1, 1921. Therefore, all information should be based on the earliest data available subsequent to this date. Subdivision A need not be answered if development work was begun subsequent to January 1, 1921.

1. Total expenditures for stripping or other open pit development to December 31, 1920 (C-1, P. 3) - - - $
2. Total cubic yards of all materials removed by stripping, applicable to above expenditures - - - - - -
3. Estimated cubic yards of all materials remaining to be removed - - - - - - - - - - -
4. Grand total cubic yards of stripping (A-2 + A-3) - - - - - - - - - - - - - - -
5. Per cent of total yards moved to total stripping (A-2 ÷ A-4) - - - - - - - - - - - -
6. Total tonnage shipped prior to January 1, 1921 - - - - - - - - - - - - -
7. Estimated tonnage of open pit ore remaining in property as of January 1, 1921 - - - - - - - -
8. Grand total tonnage in property at the beginning of operations (A-6 + A-7) - - - - - - - -
9. Estimated tonnage of ore developed by stripping removed prior to January 1, 1921 (A-8 × A-5) - - -
10. Estimated tonnage of ore developed by stripping removed prior to January 1, 1921 and remaining unmined as of that date (A-9 — A-6) -
11. The average development cost per ton of ore developed by stripping removed prior to January 1, 1921 (A-1 ÷ A-9) - $
12. Balance of expenditures unamortized as of January 1, 1921 (A-10 × A-11) - - - - - - - - $

B. Extent and cost of open pit development.—Conditions under law effective January 1, 1921:

NOTE: Subdivision B relates wholly to the status of open pit development and to expenditures therefor, applicable to all open pit ore produced subsequent to January 1, 1921. Under Item B-1 should be shown only the balance, if any, carried forward from Subdivision A-12. Item B-2 comprehends expenditures for all open pit development subsequent to January 1, 1921. Expenditures for open pit development other than for development actually done by present operator may be included under this item, but where included should be so indicated and the nature of such expense must be fully explained under remarks.

1. Balance of expenditures unamortized January 1, 1921 (A-12) - - - - - - - - - - - - $
2. Expenditures for open pit development subsequent to January 1, 1921; C-2+3, P. 3) (19...... to 1953 inclusive) (See Note) - $1,206,940.53
3. Total expenditures (B-1 + B-2) - - - - - - - - - - - - - - - - - - $1,206,940.53
4. Amortization allowed by commission years 19...... to 1952, inclusive - - - - - - - - - $1,060,891.81
5. Total expenditures unamortized (B-3 — B-4) - - - - - - - - - - - - - - - $ 146,048.72
6. Estimated future expenditures (Full details under subdivision C-4, P. 3) - - - - - - - - - $ 105,415.70
7. Total costs unamortized, plus estimated future expenditures (B-5 + B-6) - - - - - - - - - $ 251,464.42
8. Estimated tonnage of ore in or at property, January 1, 1953, applicable to expenditures shown under B-7. (This estimate should include any ore mined, applicable to these expenditures, which may be in stockpile or otherwise not shipped) - - - - - - - - - - - - - - - - - - - 262,177.48
9. Average cost per ton (B-7 ÷ B-8) - - - - - - - - - - - - - - - - - - $ .9591
10. Total tonnage produced in year 1953 - - - - - - - - - - - - - - - - - 126,363.48
11. Proportionate amount of development costs unamortized, applicable to tons produced in 1953 (B-10 X B-9) $ 121,195.21
12. Balance of actual expenditures unamortized December 31, 1953 (B-5 — B-11) - - - - - - - - $ 24,853.51

C. Supplementary to and in support of subdivisions A and B, a subdivision of the total stripping removed and the cost thereof as of December 31, 1953 is required in the following detail:

	Surface	Rock Solid	Rock Broken	Other Materials	Grand Total
1. Stripping prior to January 1, 1921:					
1. Total yards moved					
2. Total expenditures to January 1, 1921	$	$	$	$	$
3. Average cost per cu. yd.	$	$	$	$	$
2. Stripping for period of 1921 to 1952, inclusive:					
1. Total yards moved	1,042,343		507,227	15,047	1,564,617
2. Total cost, 1-1-21-12-31-52	$ 627,554	$	$ 437,568.73	$ 1,766.57	$ 1,066,889.30
3. Average cost per cu. yd.	$ .6021	$	$ .8627	$ .1174	$ .6819
3. Stripping during year ending December 31, 1953.					
1. Total yards moved	81,373		86,517		167,890
2. Total cost to 12-31-53	$ 47,861.71	$	$ 92,189.52	$	$ 140,051.23
3. Average cost per cu. yd.	$ .5882	$	$ 1.0655	$	$ .8342
Grand Total, Items 1, 2 and 3					
1. Total yards moved	1,123,716		593,744	15,047	1,732,507.
2. Total cost of stripping	$ 675,415.71	$	$ 529,758.25	$ 1,766.57	$ 1,206,940.53
3. Average cost per cu. yd.	$ .6011	$	$ .8922	$ .1174	$ .6824
4. Estimated cu. yds. of stripping remaining, and cost of removing same as of December 31, 1953.					
a. Est. total yds. remaining	10,830		75,674		86,504
b. Estimated cost of removal	$ 7,039.50	$	$ 98,376.20	$	$ 105,415.70
c. Average cost per cu. yd.	$ .65	$	$ 1.30	$	$ 1.2186
5. Grand total expenditures for stripping incurred and to be incurred as of 12-31-53 (C-1 to C-4, incl.)					
a. Total yards of stripping	1,134,546		669,418	15,047	1,819,011
b. Total costs for same	$ 682,455.21	$	$ 628,134.45	$ 1,766.57	$ 1,312,356.23
c. Average cost per cu. yd.	$ .6015	$	$ .9383	$ .1174	$ .7215

6. Total initial tonnage of ore available for open pit mining within the proposed stripping area - - - - 1,260,035.48
7. Average stripping cost per ton (5-b ÷ 6) - - - - - - - - - - - - - - - - - - $ 1.0415
8. Total tonnage produced, open pit operations, subsequent to January 1, 1921, to year 1952, inclusive - - 997,858

UNDERGROUND OPERATIONS

D. Extent and cost of underground development.—Conditions as of January 1, 1921:

NOTE: Notes which appear under the general heading of Item 1, Subdivision A and B of open pit development, are equally applicable to underground development. Please read and observe carefully.

1. Total expenditures to December 31, 1920:
   - a. Shafts - - - - - - - - - - - - - - - - - - $
   - b. Drifts (Main levels) or other development where capitalized - - - - - - $
   - Total - $
2. Total tonnage produced prior to January 1, 1921 - - - - - - - - - - - - - - -
3. Estimated tonnage of ore available for mining January 1, 1921 with facilities existing at that time - -
4. Total tonnage applicable to above expenditures (D-2 + D-3) - - - - - - - - - - - - - $
5. Average cost per ton (D-1 ÷ D-4) - - - - - - - - - - - - - - - - - - $
6. Balance of expenditures unamortized as of January 1, 1921 (D-3 × D-5) - - - - - - - - - - $

E. Extent and cost of underground development.—Conditions under law effective January 1, 1921:

1. Balance of expenditures unamortized January 1, 1921 (D-6) - - - - - - - - - - - -
2. Expenditures incurred subsequent to January 1, 1921, (19......to 1952, inclusive):
   - a. Shafts - - - - - - - - - - - - - - - - - $
   - b. Drifts (Main levels) where capitalized - - - - - - - - - - - - $
   - c. Other development where capitalized - - - - - - - - - - - - $
   - Total January 1, 1921 to December 31, 1952 - - - - - - - - - - - - - - - $
3. Expenditures actually incurred in 1953 only:
   - a. Shafts - - - - - - - - - - - - - - - - - $
   - b. Drifts (Main levels) where capitalized - - - - - - - - - - - - $
   - c. Other development where capitalized - - - - - - - - - - - - $
   - Total for year 1953 - $

E. Underground Development (Contd.)

4. Grand total expenditures above (E-1, E-2 and E-3) - - - - - - - - - - - - - - $
5. Estimated tonnage of ore available for mining, applicable to total expenditures under E-4
   a. Total underground tonnage produced, subsequent to January 1, 1921 to year 1952, inclusive - - - - - - - - - - - - - - - tons.
   b. Estimated tonnage available for mining as of January 1, 1953 - - - - - tons.
   Total tonnage - - - - - - - - - - - - - - - - - - -
6. Average cost per ton (E-4 ÷ E-5) - - - - - - - - - - - - - - - - $
7. Amortization allowed by Commission 19...... to year 1952, inclusive - - - - - - - - - $
8. Total expenditures unamortized (E-4 — E-7) - - - - - - - - - - - - - $
9. Estimated tonnage of ore available for mining January 1, 1953, applicable to development costs unamortized as shown under E-8 - - - - - - - - - - - - - - - - -
10. Average cost per ton (E-8 ÷ E-9) - - - - - - - - - - - - - - - - $
11. Tons of ore produced from underground during year 1953 - - - - - - - - - - -
12. Proportionate amount of development costs unamortized, applicable to underground ore produced in the year 1953 (E-11 X E-10) - - - - - - - - - - - - - - - - - $
13. Balance of costs unamortized December 31, 1953 (E-8 — E-12) - - - - - - - - - - - $
14. Memoranda:
   a. Total depth of shaft in feet up to December 31, 1953 - - - - - - - - - feet.
   b. Average cost per foot of sinking shaft up to December 31, 1953 - - - - - - - - - - - $
   c. Average cost per foot of sinking shaft in 1953 or the last preceding year in which development was done $

2. Total tonnage of ore mined or produced from the property above described, during the calendar year 1953, in detail as indicated below:

NOTE: This statute contemplates that all ores mined or produced in any calendar year are subject to tax. Tonnages reported hereunder, when shipped in the year mined, must be based upon railroad shipping weights (long tons) wherever possible. Where through failure to ship the ore in the year mined, it is necessary to apply factors other than railroad weights in determining these tonnages, any differences in tonnages disclosed through subsequent shipping of the ore so mined, should be reported.

METHOD OF OPERATION AND GROSS TONS MINED BY EACH METHOD

Legal Descriptions from which the ore was mined	OPEN PIT		UNDERGROUND		TOTAL TONNAGE MINED	
	Direct Ore Tons	Concentrate Ore Tons	Direct Ore Tons	Concentrate Ore Tons	Direct Ore Tons	Concentrate Ore Tons
SW-NE Sec. 36-59-18	5,155.97	12,985.63			5,155.97	12,985.63
NW-SE Sec. 36-59-18	6,109.40	101,924.48			6,109.40	101,924.48
GRAND TOTAL	11,265.37	114,910.11			11,265.37	114,910.11

3. Gross tons, grade and average analysis of ore mined or produced in 1953.

	Gross Tons	Nat. Iron %	Dry Phos. %	Nat. Mn. %	Dry Silica %	Dry Alum. %	Moist %
A. Bessemer — Before 7-1-53	26,859.29	52.86	.029	.59	13.16	.77	8.08
A. Bessemer — After 6-30-53	13,340.17	53.62	.031	.52	12.77	.66	7.67
Total Tonnage and Average Analysis	40,199.46	53.11	.030	.57	13.03	.73	7.95
B. Non-Bessemer — Before 7-1-53	38,438.40	46.62	.056	1.13	16.25	1.63	12.19
B. Non-Bessemer — After 6-30-53	47,537.62	49.87	.054	1.17	14.14	1.21	9.79
Total Tonnage and Average Analysis	85,976.02	48.40	.055	1.15	15.08	1.40	10.86
C. Manganiferous							
Total Tonnage and Average Analysis							
GRAND TOTAL TONNAGE AND AVERAGE ANALYSIS	126,175.48	49.88	.047	.97	14.43	1.18	9.93

4. Market value at Lake Erie Ports of ore mined or produced in 1953 as follows:

	Gross Tons	Per Ton Market Value at L. E. Ports	Total Market Value Lake Erie Ports	Remarks
A. Bessemer — Before 7-1-53	26,859.29	$	$	
A. Bessemer — After 6-30-53	13,340.17	9.99952	401,975.20	
Total	40,199.46	9.99952	401,975.20	
B. Non-Bessemer — Before 7-1-53	38,438.40			
B. Non-Bessemer — After 6-30-53	47,537.62	8.60117	739,494.79	
Total	85,976.02	8.60117	739,494.79	
C. Manganiferous				
Total				
GRAND TOTAL	126,175.48	$ 9.04668	$1,141,469.99	

NOTE: Screen analyses of season's shipment for Bessemer, Non-Bessemer and Manganiferous grades of ore are required as part of this report. The screen analyses should be complete and must show at least the percentage of material passing through a 40-mesh screen.

All tonnages of ores and iron-bearing materials, either (1) not shown under Item 3 which were removed from the mine in 1953 and for which separate analyses were kept, or (2) shown under Item 3 which were placed in stockpile in 1953 and not shipped from the range in 1953, must be listed below, showing gross tons and analyses. Report (1) and (2) separately. Give information on any concentration tests which may have been made on any such material. Report open pit and underground tonnages separately. Give legal description of land on which any such stockpiles are located.

Type of Material	Stockpiled on	Gross Tons	Nat. Iron %	Dry Phos. %	Nat. Mn. %	Dry Silica %	Dry Alum. %	Moist %
Concentrates		504	42.96	.052	.61	23.63	1.08	9.69

Detailed Information With Reference to the Cost of Mining and Producing Ore During the Calendar Year 1953

	Open Pit	Underground	Grand Total Gross Tons
5. Total mined, gross tons	254,455.37		254,455.37
6. Loss due to beneficiation, gross tons	128,279.89		128,279.89
7. Production, gross tons	126,175.48		126,175.48

8. Cost of Development. (Under this item should be shown development costs applicable only to the tonnage mined during the calendar year. Costs per ton of Item 8 and subsequent items are based on Item 7.)

OPEN PIT		UNDERGROUND		TOTAL	
Average cost per ton	Total Cost	Average cost per ton	Total Cost	Average cost per ton	Total Cost
$ .9605	$ 121,195.21	$	$	$ .9605	$ 121,195.21

9. Cost of supplies used and labor performed at the mine in separating the ore from the ore body, including hoisting or conveying same to the surface of the earth.

OPEN PIT

	LABOR Per Ton	LABOR Total	SUPPLIES Per Ton	SUPPLIES Total	TOTAL Per Ton	TOTAL Total
A. Operating Costs:						
1. Power Shovels & trucks a. Operating	$ .4225	$ 53,309.58	$ .5024	$ 63,394.70	$ .9249	$ 116,704.28
b. Mtce & Repairs						
2. Locomotive & Cars a. Operating						
b. Mtce & Repairs						
3. Trucks a. Operating						
b. Mtce & Repairs						
4. Conveyors a. Operating						
b. Mtce & Repairs						
5. Track Expense			.0529	6,676.19	.0529	6,676.19
6. Roadways						
7. Drilling & Blasting			.0241	3,041.53	.0241	3,041.53
8. Pumping & Drainage	.0279	3,527.26	.0486	6,122.51	.0765	9,649.77
9. Water Supply						
10. Scramming						
11. Open Pit Supervision						
12. General Pit Expense	.0883	11,142.65	.1027	12,955.16	.1910	24,097.81
13. Mine Employees Bonus or Vacation Pay						
14. Lean Matl & Waste Pile Exp. (Tons or Yds. (Material						
15. Stocking Merchantable Ore						
16. Contract Mining						
17. Misc. (Detail fully) a. b. c. d. e.						
TOTAL (A-1 thru A-17)	$ .5387	$ 67,979.49	$ .7307	$ 92,190.09	$ 1.2694	$ 160,169.58

B. Administration and Miscellaneous Costs:

OPEN PIT

(Note: Report only costs incurred within Minnesota and directly attributable to mining operations. Report other administrative items under 10-A and B.)	LABOR Per Ton	LABOR Total	SUPPLIES Per Ton	SUPPLIES Total	TOTAL Per Ton	TOTAL Total
1. Mine Office—Mine supervision and clerical	$	$	$	$	$	$
2. Range Office—Mine supervision and clerical	.4018	50,700.70	.0477	6,015.58	.4495	56,716.28
3. Duluth or other central office in Minnesota — Mine supervision and clerical						
4. Engineering	.0702	8,851.47	.0040	513.55	.0742	9,365.02
5. Laboratory (Assaying, Sampling, Etc.)		*				
6. Experimental Expense			.0432	5,443.85	.0432	5,443.85
7. Miscellaneous (detail fully) a. Geological $2,779.47	.0131	1,650.54	.0089	1,128.93	.0220	2,779.47
b. $						
c. $						
Total administrative expense	$ .4851	$ 61,202.71	$ .1038	$ 13,101.91	$ .5889	$ 74,304.62
TOTAL OPEN PIT OPERATING COSTS (A + B)	$ 1.0238	$ 129,182.20	$ .8345	$ 105,292.00	$ 1.8583	$ 234,474.20

UNDERGROUND

	LABOR Per Ton	LABOR Total	SUPPLIES Per Ton	SUPPLIES Total	TOTAL Per Ton	TOTAL Total
C. Operating Costs:						
1. Mining	$	$	$	$	$	$
2. Timbering						
3. Tramming						
4. Conveyors						
5. Pumping						
6. Hoisting						
7. Repairs						
8. U. G. Supervision						
9. Gen'l U. G. Expense						
10. Gen'l Surface Exp.						
11. Misc. (Detail fully) a. b. c. d.						
TOTAL (C-1 thru C-11)	$	$	$	$	$	$
D. Administration and Miscellaneous Costs: (See note above)						
1. Mine Office—Mine supervision and clerical						
2. Range Office—Mine supervision and clerical						
3. Duluth or other central office in Minnesota — Mine supervision and clerical						
4. Engineering						
5. Laboratory (Assaying, Sampling, Etc.)						
6. Experimental Expense						
7. Miscl. (detail fully) a. b. c. d.						
Tol administrative expense	$	$	$	$	$	$
TOAL UNDERGROUND OERATING COSTS (C+D)	$	$	$	$	$	$

*See Lerch Bros. affidavit.

10 Miscellaneous items of expense not included under items 9-B and D:	OPEN PIT Average cost per ton	OPEN PIT Total Cost	UNDERGROUND Average cost per ton	UNDERGROUND Total Cost	TOTAL Average cost per ton	TOTAL Total Cost
A.	$	$	$	$	$	$
1. Insurance on buildings and equipment used in operations						
2. Personal injury expense actually paid:						
a. Premiums for compensation and liability insurance $3,824.15						
b. Medical and hospital expenses $						
c. Settlement of injury or death claims $						
d. Safety or other miscellaneous expenses (give details) $						
Total, a to d	$ .0303	$ 3,824.15	$	$	$ .0303	$ 3,824.15
3. Total personal property taxes (Levied in the year 1953 and payable in 1954) 3a+3b. $						
a. Personal property taxes levied in 1953 on mining equipment and other personal property actually used in or attributable to mining operations:						
Total taxable valuation $						
Total taxes levied						
b. Total stock pile tax:						
1. Total tons						
2. Total tax $						
c. Ore in stockpile May 1, 1953, placed therein subsequent to May 1, 1952. Tons						
d. Proportion of total stockpile taxes levied in 1953 applicable to tonnage under 3-c						
4. Social Security taxes paid in 1953	.0510	6,429.90			.0510	6,429.90
5. Pensions	.0515	6,509.48			.0515	6,509.48
6 Group Insurance	.0135	1,698.60			.0135	1,698.60
Total, Item 10-A	$ .1463	$18,462.13	$	$	$ .1463	$18,462.13
B.						
1. Administration, offices outside of Minnesota	$	$	$	$	$	$
2. Contributions, donations, entertainment, etc.						
3. Association dues, assessments, advertising, discounts, exchange, etc.						
4. Contingent expenses, such as clubhouse, garden prizes, examinations, etc.						
5. Legal expenses						
6. Maintenance and upkeep of misc. real estate and dwellings						
7. Depletion, interest, charges, etc.						
8. Idle mine expense (mines idle during year 1953)						
9. Costs not included above						
Total, Item 10-B	$	$	$	$	$	$
Total, Misc. Expense, (10-A and B)	$ .1463	$18,462.13	$	$	$ .1463	$18,462.13

	OPEN PIT Average cost per ton	OPEN PIT Total cost	UNDERGROUND Average cost per ton	UNDERGROUND Total cost	TOTAL Average cost per ton	TOTAL Total cost
11. Total Royalty accruing on tonnage mined in 1953	$ .5800	$ 73,181.97	$	$	$ .5800	$ 73,181.97
SUBDIVIDE ABOVE TOTAL ROYALTY INTO:						
A. Portion represented by advance royalty credits, applied on 1953 tonnage $						
B. Portion represented by liquidated royalties applied on 1953 tonnage $						
C. Balance (Item 11 — A + B) currently paid or accrued upon ore produced during year 1953 $						
12. Total Amount of Realty Taxes, exclusive of Special Assessments, levied in 1953 (payable in 1954), upon the legal descriptions shown on page 2 $4,752.98						
Amount of Ad Valorem Taxes levied in 1953 applicable to the tonnage mined in 1953	$ .0182	$ 2,290.79	$	$	$ .0182	$ 2,290.79
13. Mine Plant and Equipment (Exclusive of Beneficiating Plants)						
A. Standard Mine Plant and Equipment — Additions and betterments in 1953. $						
1. Gross capital investment Dec. 31, 1953. $ 36,201.39*	$ .0717	$ 9,050.35*	$	$	$ .0717	$ 9,050.35*
2. Depreciation for 1953						
3. Total charged off at close of 1953 $33,232.18						
B. Motorized Equipment — Additions and betterments in 1953. $						
1. Gross capital investment Dec. 31, 1953. $						
2. Depreciation for 1953	$	$	$	$	$	$
3. Total charged off at close of 1953 $						

* Represents plant erection costs written off on basis of life of mine.

STOCKPILE LOADING, BENEFICIATION, TRANSPORTATION AND MARKETING EXPENSE

14. Stockpile Loading:						
A. Shipments from stockpile, 1953						
1. Tons Shipped						
2. Cost of Loading $						
3. Cost per ton $						
B. Tonnage Stockpiled in 1953						
1. Total Tons Stockpiled 504						
2. Cost per ton (A-3) $ .15						
3. Cost Applicable to tons Stockpiled, B-1 × B-2	$ .0006	$ 75.60	$	$	$ .0006	$ 75.60
15. Beneficiation (Detail on Page 10) Tons conc. produced						
A. Washing	.1967	24,825.47			.1967	24,825.47
B. Drying						
C. Crushing & Screening						
D. Sintering						
E. Jigging					.6319	79,724.92
F. Heavy medium	.6319	79,724.92				
G. Pelletizing						
H. Flotation						
Total cost of beneficiation	$ .8286	$104,550.39	$	$	$ .8286	$104,550.39

	OPEN PIT		UNDERGROUND		TOTAL	
	Average cost per ton	Total cost	Average cost per ton	Total cost	Average cost per ton	Total cost
16. Transportation.						
A. Rail freight (Based on rates in effect year 1953)	$ 3.0908	$ 389,979.77	$	$	$ 3.0908	$ 389,979.77
126,175.48 tons $ 3.090773 per ton						
____ tons $ ____ per ton						
____ tons $ ____ per ton						
B. Vessel freight (Based on rates in effect year 1953)						
____ tons $ ____ per ton						
____ tons $ ____ per ton						
____ tons $ ____ per ton						
C. Vessel unloading (Based on rates in effect year 1953)						
____ tons $ ____ per ton						
____ tons $ ____ per ton						
____ tons $ ____ per ton						
D. Federal Transportation tax						
Total Transportation Expense	$ 3.0908	$ 389,979.77	$	$	$ 3.0908	$ 389,979.77
17. Other costs incidental to transportation and marketing						
A. Marketing expense .04975	$ .0497	$ 6,277.23	$	$	$ .0497	$ 6,277.23
B. Marine Insurance						
C. Cargo analysis expense						
D. Miscellaneous items not expressly enumerated. (Detail fully under remarks)						
Total Item 17	$ .0497	$ 6,277.23	$	$	$ .0497	$ 6,277.23
Total Cost of Transportation and Marketing (Items 16 & 17)	$ 3.1405	$ 396,257.00	$	$	$ 3.1405	$ 396,257.00
GRAND TOTAL COSTS, YEAR 1953 (Items 8 to 17)	$ 7.6047	$ 959,537.64	$	$	$ 7.6047	$ 959,537.64

DETAILED INFORMATION WITH REFERENCE TO BENEFICIATING ORES MINED FROM THE _____ MINE, DURING THE CALENDAR YEAR 1953

	Washing Plants	Drying Plants	Sintering Plants	Crushing and Screening Plants
1. Government description of tract upon which plant is located	SW-SE 36-59-18			
2. Plant and Equipment:				
A. Additions and betterments in 1953	$	$	$	$
(Detail of these items must accompany report.)				
3. Gross capital investment for depreciation as shown by your books at close of year 1953	186,418.39			
4. Amount charged off to depreciation year 1953	20,769.94			
5. Total amount charged off to depreciation at close of year 1953	70,654.08			
6. Net investment outstanding in plant and equipment at close of year 1953	$ 115,764.31	$	$	$

DETAILED COSTS OF BENEFICIATION AS SUMMARIZED UNDER ITEM 15, PAGE 9:

7. A. Transportation expense, mine to plant	$	$	$	$
B. Labor:				
1. Beneficiation	3,695.80	19,063.99		
2. Maintenance				
3. Superintendence and clerical at plant				
4. Miscellaneous (Detail fully under remarks.)				
Total Labor	$ 3,695.80	$ 19,063.99	$	$
C. Supplies				
1. Plant	$ 12,937.61	$ 60,660.93	$	$
2 Maintenance				
3. Electric power				
4. Miscellaneous (Detail fully under remarks.)				
Total Supplies	$ 12,937.61	$ 60,660.93	$	$

	Washing Plants	Heavy Medium ~~Drying~~ Plants	Sintering Plants	Crushing and Screening Plants
D. Miscellaneous other than labor and supplies:				
1. Workmen's compensation (Actual costs only, no reserve funds.)	$	$	$	$
2. Fire and other insurance necessary to plant				
3. Other items, Social Sec., etc. (Detail under remarks.)				
E. Taxes:				
1. Levied in the year 1953 (payable in 1954) on real estate connected with plant				
2. Levied in the year 1953 (payable in 1954) on personal property connected with plant				
F. Depreciation as per item 4, page 10				
G. Interest on beneficiating plant investment	8,192.06			
GRAND TOTAL COST	$ 24,825.47	$ 79,724.92	$	$

SUMMARY OF OCCUPATION TAX TOTALS

Item		Per Ton	Total	Total
4.	Gross Tons 126,175.48 L. E. Value	$ 9.0467		$ 1,141,469.99
	Non-Statutory Deductions:			
14.	Stockpile Loading	$ .0006	$ 75.60	
15.	Beneficiation	.8286	104,550.39	
16.	Transportation	3.0908	389,979.77	
17-A.	Marketing Expense	.0497	6,277.23	
17-B, C, D.	Miscellaneous			
	Total Non-Statutory Deductions	$ 3.9697		$ 500,882.99
	Value of Ore at Mouth of Mine	$ 5.0770		$ 640,587.00
	Statutory Deductions:			
8.	Development	$ .9605	$ 121,195.21	
9-A&C.	Labor	.5387	67,979.49	
9-A&C.	Supplies	.7307	92,190.09	
9-B&D.	Administrative (Subd. 1&2)	.4495	56,716.28	
9-B&D.	Administrative (Subd. 3)			
13.	Depreciation	.0717	9,050.35	
9-B&D.	(4, 5, 6, & 7) and 10-A. Miscellaneous	.2857	36,050.47	
11.	Royalty	.5800	73,181.27	
12.	Ad Valorem Taxes	.0182	2,290.79	
	Total Statutory Deductions	$ 3.6350		$ 458,654.65
	Taxable Value	$ 1.4420		$ 181,932.35

REMARKS _____

State of _____ }
County of _____ } ss.

I, _____ do solemnly swear that I am the _____ (Official title) of _____ (Operating company); that the foregoing report was made by me, or under my supervision, and that the matters therein set forth have been transcribed from the records of this Company and are true and correct to the best of my knowledge and belief.

Subscribed and sworn to before me this _____ day of _____, 1954.

Notary public _____

My commission expires _____

STATE OF MINNESOTA
DEPARTMENT OF TAXATION

APPENDIX A TO 1953 OCCUPATION TAX REPORT:_____MINE

For the purpose of arriving at the allowable credits against occupation taxes, resulting from the application of the labor credit provisions as found in Minnesota Statutes 1949, Chapter 298, as amended, the following items of labor costs shall be considered in computing said credits as they relate to mining operations in the calendar year 1953, to-wit:

Nature of Labor	Reference Occupation Tax Report	Wages Paid	Total labor subject to credit
1. Development:	Item 8		
a. Direct payroll		$ 41,412.43	
b. Contract labor		$	
Total			$ 41,412.43
2. Mining:	Item 9		
a. Direct payroll		$ 68,291.41	
b. Contract labor		$	
Total			$ 68,291.41
3. Beneficiation:	Item 15		
a. Direct payroll		$ 22,759.79	
b. Contract labor		$	
Total			$ 22,759.79
4. New construction and installation of machinery pertaining wholly to mining or beneficiating operations:	Item		
a. Direct payroll		$	
b. Contract labor		$	
Total			$
5. Engineering and clerical personnel at Mine Office immediately adjacent to the mine, the duties of whom are devoted wholly to mining or beneficiating operations:	Item 9B		$ 10,502.01
6. Engineering and clerical personnel at a District Office on the Iron Ranges, the duties of whom are devoted wholly to mining or beneficiating operations, and are in all respects comparable to the duties performed by employees included under Item 5: Labor included in Inter-company Rentals	Item 9B		$ 3,948.17 49,454.53
7. Ore grading and analytical personnel:	Item 9B		
a. Direct payroll		$	
b. Contract labor		$ 2,950.97	
Total			$ 2,950.97
8. Costs of social security, unemployment and compensation insurance applying to the foregoing items: $6429.90; Pension 6,509.48; Group Insurance 1,698.60	Item		$ 14,637.98
GRAND TOTAL LABOR (Items 1 through 8)			$ 213,957.29
Total marketable production, tons			126,175.48
Average labor cost per ton: A. In excess of 60c and not more than 78c			$ .18
B. In excess of 78c per ton			$ .91571
C. In excess of 96c per ton			$ .73571

(NOTE. None of the items enumerated above should include the salaries of general superintendents, their assistants, or mine superintendents.)

(See Over)

Form No. 37A

DEPARTMENT OF TAXATION
STATE OF MINNESOTA

TENTATIVE DETERMINATION UNDER MINNESOTA STATUTES 1949, SECTION 298, AS AMENDED, OF THE AMOUNT OF OCCUPATION TAX DUE FROM "B" ON MINING OPERATIONS OF_____MINE, DURING THE CALENDAR YEAR 1953.

1. Character of operation: Open Pit X Underground_____
2. Total tonnage mined during the calendar year 1953 254,455.37 tons.
3. Loss by beneficiation 128,279.89 tons.
4. Marketable tonnage mined 126,175.48 tons.
5. Market value of Item 4 Per Ton $_____ Total Value $1,148,563.87

NON STATUTORY DEDUCTIONS: COSTS BEYOND MOUTH OF MINE

6. Cost of loading ore from stockpile, ore mined in 1953 _____ tons Per Ton $_____ Total Cost $ 75.60
7. Cost of beneficiation _____ Per Ton $_____ Total Cost $125,320.33
8. Transportation cost _____ Per Ton $_____ Total Cost $389,979.77
9. Marketing Expense _____ Per Ton $_____ Total Cost $ 6,277.23
10. Misc. (See detail on reverse side) _____ Per Ton $_____ Total Cost $_____
    Total - Items 6 to 10 _____ Per Ton $_____ Total Cost $ 521,652.93
    Value of Ore At Mouth of Mine _____ Per Ton $_____ Total Value $ 626,910.94

STATUTORY DEDUCTIONS

11. Cost of Development _____ Per Ton $_____ Total Cost $121,014.90
12. Cost of Mining
    a. Labor _____ Per Ton $_____ Total Cost $ 67,979.49
    b. Supplies _____ Per Ton $_____ Total Cost $ 92,190.09
    c. Administrative Expense—Mine and District Offices _____ Per Ton $_____ Total Cost $ 56,716.28
    d. Administrative Expense—Duluth or other central office in Minnesota _____ Per Ton $_____ Total Cost $_____
    e. Deprec. of Mine Plant & Equipm't _____ Per Ton $_____ Total Cost $ 9,050.35
    f. Misc. (See detail on reverse side) _____ Per Ton $_____ Total Cost $ 36,050.47
13. Royalty _____ Per Ton $_____ Total Cost $ 73,181.97
14. Ad valorem taxes on ore mined _____ % Per Ton $_____ Total Cost $ 1,629.82
    Total - Items 11 to 14 _____ Per Ton $_____ Total Cost $ 457,813.37
15. Value of ore for purpose of tax $ 169,097.57
16. Gross Tax upon such value at 11% $ 18,600.73
17. Special Tax for Veterans Adjusted Compensation (Sec. 298.011) (1% of No. 15) $ 1,690.98
18. Total Gross Tax (16+17) $ 20,291.71
19. Credit for Labor as per Sec. 298.02 ($11,160.44) Limitation $ 9,934.76
20. Net Amount of Tax Due and Payable (18-19) $ 10,956.95

Item 7. Cost of Beneficiation

Transportation	$ 22,759.79
Labor	22,759.79
Supplies	73,598.54
Miscellaneous	
Taxes	
Depreciation* (See detail below)	20,769.94
Interest** (See detail below)	8,192.06
Total	$125,320.33
*1. Plant Investment—12/31/52	$186,418.39
2. Additions—Year 1953	$
3. Retirements—Year 1953	
4. Net Additions	
5. Amount to Depreciate at 12/31/53	
6. Depreciation allowed to 12/31/52	$ 49,884.14
7. Less Depreciation retired in 1953	
8. Net Depreciation Allowance	
9. Depreciation @ 6% on Item 5	20,769.94
10. Total Depreciation to 12/31/53	70,654.08
11. Undepreciated Balance—12/31/53	115,764.31
Depreciation Allowance for 1953	
Depreciation as above—Item 9	
Add Loss—Deduct profit on equipment and rentals	
Depreciation Allowance for 1953	
**Undepreciated Balance as at 12/31/52	$136,534.25
Interest @ 6% on 12/31/52 Undepreciated Balance	8,192.06

Item 10. Miscellaneous

Marine Insurance	$
Cargo Analysis	
Other Items	
Total	$

Item 12f. Cost of Mining — Miscellaneous

Engineering	$ 9,365.02
Laboratory	5,443.85
Item 10-A	18,462.13
Item	2,779.47
Total	$ 36,050.47

Item 12e. Depreciation

	Standard Plant		Motorized Equipment
1. Investment — 12/31/52		$ 36,201.39	$
2. Additions — Year 1953	$	$	
3. Retirements — Year 1953			
4. Net Additions			
5. Amount to Depreciate at 12/31/53			
6. Depreciation allowed to 12/31/52	$ 24,181.85	$	
7. Less Depreciation retired in 1953			
8. Net Depreciation Allowance	$	$	
9. Depreciation @ 6% on Item 5	9,050.35		
10. Total Depreciation to 12/31/53		33,232.18	
11. Undepreciated Balance—12/31/53		2,969.21	
Depreciation Allowance for 1953			
Depreciation as above — Item 9		$ 9,050.35	$
Add Loss—Deduct profit on equipt. sold and rentals			
Depreciation Allowance for 1953			

SUPPLEMENTAL WORKSHEET "B" MINE.

ITEM 5. Lake Erie Value

Grade of Ore	Tons	Nat Fe		Phos	Silica	Thru 40M	Value/ton	Total
Bessemer								
4-1 to 7-1	26,859.29	52.86		.029	13.16		$10.0769	270,658.38
7-1 to 12-31	13,340.17	53.62		.031	12.77		10.4273	139,101.95
Non-Bessemer								
4-1 to 7-1	38,438.40	46.62		.056	16.25		7.8009	299,854.11
7-1 to 12-31	47,537.62	49.87		.054	14.14		9.2844	441,358.28
Buyer's Account								
4-1 to 7-1	65,297.69						.0515	3,362.83

Gross value	1,154,335.55
Less ½% shrinkage	5,771.68
Lake Erie value	1,148,563.87

ITEM 8. Transportation

	Tons		Cost/ton	Total
4-1 to 12-31	126,175.48		3.090773	389,979.77
				389,979.77

ITEM 14. Ad Valorem Tax Allowance

Description	District	SD	Reserve(tons)	Assessed Value	Mill Rate	Tax (mineral)
SE-NE-NW-SE &						
SW-SE	Nichols T.	21	262,177	17.592	192.49	3,386.28
36-59-18						

Production 126,175.48	= 48.13% Total tax		3,386.28
Reserve 262,177	Allow 48.13 %		1,629.82

ITEM 19. Credit For Labor

Total labor cost	213,957.29			
Tons produced	126,175.48			
Labor cost per ton	1.6957			
Excess of 60¢ & not more than 78¢	.18	x .10	.0180	
Excess of 78¢	.9157	x .15	.1374	
Labor credit earned 100,000 tons x			.1554	15,440.00
Excess of 90¢	.7357	x .10	.0736	
Labor credit earned 26,175.48 tons x			.0736	1,926.52
Total labor credit earned				17,366.52
Maximum credit allowable (exclusive of effect of 298.02 sec. 1-c) 60 % x gross tax @ 11% 18,600.73				11,160.44
Credit not used under limitation				6,306.08

DEPARTMENT OF TAXATION
STATE OF MINNESOTA

FINAL DETERMINATION UNDER MINNESOTA STATUTES 1949, SECTION 298, AS AMENDED, OF THE AMOUNT OF OCCUPATION TAX DUE FROM "B" ON MINING OPERATIONS OF MINE, DURING THE CALENDAR YEAR 1953.

1. Character of operation: Open Pit x Underground
2. Total tonnage mined during the calendar year 1953 tons.
3. Loss by beneficiation tons.
4. Marketable tonnage mined tons.
5. Market value of Item 4 Per Ton $ Total Value $

NON STATUTORY DEDUCTIONS: COSTS BEYOND MOUTH OF MINE

6. Cost of loading ore from stockpile, ore mined in 1953 tons Per Ton $ Total Cost $
7. Cost of beneficiation Per Ton $ Total Cost $
8. Transportation cost Per Ton $ Total Cost $
9. Marketing Expense Per Ton $ Total Cost $
10. Misc. (See detail on reverse side) Per Ton $ Total Cost $
    Total - Items 6 to 10 Per Ton $ Total Cost $
    Value of Ore At Mouth of Mine Per Ton $ Total Value $

STATUTORY DEDUCTIONS

11. Cost of Development Per Ton $ Total Cost $
12. Cost of Mining
    a. Labor Per Ton $ Total Cost $
    b. Supplies Per Ton $ Total Cost $
    c. Administrative Expense—Mine and District Offices Per Ton $ Total Cost $
    d. Administrative Expense—Duluth or other central office in Minnesota Per Ton $ Total Cost $
    e. Deprec. of Mine Plant & Equipm't Per Ton $ Total Cost $
    f. Misc. (See detail on reverse side) Per Ton $ Total Cost $
13. Royalty Per Ton $ Total Cost $
14. Ad valorem taxes on ore mined % Per Ton $ Total Cost $
    Total - Items 11 to 14 Per Ton $ Total Cost $
15. Value of ore for purpose of tax $ 169,097.57
16. Gross Tax upon such value at 11% $ 18,600.73
17. Special Tax for Veterans Adjusted Compensation (Sec. 298.011) (1% of No. 15) $ 1,690.98
18. Total Gross Tax (16+17) $ 20,291.71
19. Credit for Labor as per Sec. 298.02 Limitation $ 9,273.25
20. Net Amount of Tax Due and Payable (18-19) $ 11,018.46

ROYALTY TAX

The computation and administration of the royalty tax is very simple. Royalty is the amount in money or value of property received by any person having any right, title or interest in or to any tract of land in this state for permission to mine and remove ore therefrom. (Minnesota Statutes 1953, Section 299.02). Assume that "A" owns some land containing iron ore and he leases it to "B" for the purpose of mining the ore; "B" to pay to "A" fifty cents a ton royalty for each ton removed, and assume that 100,000 tons of ore is removed during the calendar year.

"A" would then receive from "B" the sum of $50,000 in royalty upon which "A" would pay a tax of 12% or $6,000.

The law requires each recipient of royalty to file a report with the Commissioner of Taxation on or before February 1 of each year showing the amount of royalty received during the preceding calendar year.

The Commissioner of Taxation determines from the report the amount of the royalty tax due and certifies the amount to the State Treasurer and State Auditor on or before May 1 of each year.

As a practical matter the mining companies usually pay the royalty taxes, regardless of who receives the royalty. This is done to prevent any liens for failure to pay the tax.

The royalty tax is 12%. The proceeds of the tax of 11% is credited to the State General Revenue Fund and the proceeds of the tax of 1% goes to the Veterans' Compensation Fund.

TACONITE TAX

The tax on taconite concentrate that is actually produced is as follows: Five cents per gross ton, plus one-tenth of one cent per ton for each 1% that the iron content of such product exceeds 55% dried iron.

The collection and payment of this part of the tax is handled as follows: A report form is sent to the companies producing taconite concentrate. In this report is contained the data needed by the Commissioner to determine the amount of tax. After the tentative determination of the tax, and after hearings provided under the statute, he makes the final determination of the amount of the tax, and certifies this amount to the State Auditor, who draws a warrant to the Treasurer to be paid.

The tax collected under Section 298.26, on unmined taconite or

iron sulphides, is handled by the local officials in their districts, the limit of the tax being $1.00 per acre.

Distribution of the tax collected under Section 298.24, as explained in the section entitled "Digest of Minnesota Laws," is as follows:

one-fourth to the city, village or town;
one-fourth to the school district;
one-fourth to the county; and
one-fourth to the State.

TAXES IN OTHER STATES

ALABAMA

Alabama imposes a tax on mined iron ore of 3 cents per gross ton. Real estate and personal property is assessed at 60% of its **fair market value** and iron ore in the ground is assessed on this basis. Alabama does not use any particular formula for assessing unmined iron ore and investigation at Birmingham disclosed the fact that the iron ore reserves of U. S. Steel and Republic Steel were valued at about $2500.00 per acre **fair market value,** and assessed at 60% or about $1500.00 per acre. The constitution limits the millage on the ad valorem tax for state and local purposes.

Alabama has a corporate income tax of 3% of net income and also a corporate capital stock tax. Domestic corporations pay $2.00 per thousand on paid up capital stock and foreign corporations pay $2.00 per thousand on all capital employed in the state.

CALIFORNIA

California assesses real and tangible personal property at 50% of its **full cash value.** There is no severance tax on mined ore and unmined iron ore is taxed on the basis of **present worth of estimated future profits** under the Hoskold formula the same as Minnesota and this tax is for local purposes only. California imposes a corporate income tax of 4% of net income on all corporations.

MICHIGAN

Michigan has no special tax on iron ore. Real and tangible personal property is assessed at its **true cash value.** Michigan has an appraiser of mines who computes the true cash value of unmined iron ore and certifies the valuation to the state and local taxing districts. In arriving at the true cash value, the appraiser of mines uses the "Finlay" method, based on the present worth of estimated future profits. Michigan has a nominal corporation tax of 4 mills on the value of capital stock, which as applied to mining companies, yields the equivalent of about 1 cent per ton on iron ore produced. Sec. 7.24, M. S. A. provides that metallic ore newly discovered or proved in the ground and not part of the property of an operating mine shall be exempt from the general property tax for 10 years, or until such time as it becomes part of the property of an operating mine or in itself becomes an operating mine.

NEW JERSEY

New Jersey has no special taxes on iron ore and has no income tax. Iron ore, whether mined or unmined, is taxed the same as other property for state and local purposes.

TAXES IMPOSED

NEW YORK

There are no special taxes in New York on iron ore. Real estate and personal property is taxed on the basis of **full value** for state and local purposes. The mine assessments are determined by local assessors and there is no uniformity. We have been advised by the State Board of Equalization and Assessment that New York is considering the use of the Hoskold formula. New York has a corporate income tax of 5½% of net income.

PENNSYLVANIA

Pennsylvania has no special taxes on iron ore. Iron ore is taxed on the same basis as other property. There is a corporate income tax of 5% of the net income. The ad valorem tax is for local purposes only.

TEXAS

Texas has no special taxes on iron ore. Real and personal property are taxed on their **full cash value** for local purposes only. Texas has a severance tax on oil, natural gas and sulphur.

UTAH

In Utah, for state and local purposes, metalliferous mines are valued at $5.00 per acre, plus value of machinery and real estate, plus twice the average of net annual proceeds for preceding 3 years. There is a corporate income tax of 3% of net income and a tax of 1% of the gross amount received for metalliferous ore sold.

WISCONSIN

Wisconsin has no special taxes on iron ore. Real and personal property is taxed on the **full value at private sale** for state and local purposes. The value of iron ore is determined by the State Geologist and his computations are certified to the state and local taxing districts. The State Geologist uses the Hoskold formula to fix the value of iron ore. Wisconsin has a graduated corporate income tax starting with 2% on the first $1,000.00 of net taxable income and ending with 6% on net taxable income over $7,000.00.

WYOMING

Wyoming assesses real and personal property at its **true value in money at private sale** for state and local purposes. The gross product of operating mines, including oil and gas is taxed in lieu of taxation of the land, but in addition to the surface improvements, an annual return is made to the State Board of Equalization which assesses the

Note: All state tax references taken from Tax Systems C.C.H. 1952 and Supplement.

gross value at the mouth of the mine and returns the valuations to the several counties for taxation. Wyoming has no income tax.

The language used in these various state statutes, **full and true value** (Minn.); **fair market value** (Ala.); **full cash value** (Cal. & Tex.); **true cash value** (Michigan); **full value** (N.Y.); **full value at private sale** (Wisc.); **a true value in money at private sale** (Wyo.); all mean **market value.** However, these statutes do not set up any standard by which the market value can be determined, hence there is no uniform method by which the market value is ascertained and each state uses its own theory in fixing the valuation.

In Minnesota, the value of the iron ore in the ground is computed by the Commissioner of Taxation and certified to the county auditors. In Michigan, the Appraiser of Mines computes the value and certifies the appraisal to the state and various taxing units. In Wisconsin, the State Geologist computes the value and certifies the appraisal to the state and local taxing districts. In Minnesota, Michigan, Wisconsin and California, the Hoskold or Finlay formula is used, with certain modifications, to fit particular situations. In other states the systems vary in each taxing district.

TAXES IN CANADA AND PROVINCES

CANADA

The Dominion government does not impose any royalty or ad valorem tax. There is a corporate income tax (Laws 1948, C.52) of 17% on first $10,000 of taxable net income and 47.6% on excess over $10,000.*

LABRADOR AND NEWFOUNDLAND

Labrador is now under the jurisdiction of Newfoundland and Newfoundland is a full-fledged Province of Canada. The laws of Newfoundland apply to Labrador.

There is no provincial ad valorem tax, but municipalities tax real and personal property for local revenue, on the assessed value, at various rates. Under the Mining Tax Act of June 22, 1951, Iron Mining companies pay 20% of net income obtained from iron ore recovered in the year or 10 cents for each ton of iron ore recovered up to 1,500,000 tons and 8 cents for each additional ton.

We were advised by the Department of Natural Resources, St. Johns, Newfoundland, on May 19, 1952, that the Iron Ore Company of Canada, operators of the Labrador field, under special agreement, will pay only 5% of their net profits.

* Tax Systems C.C.H. 1952.

ONTARIO

The province of Ontario does not levy an ad valorem tax, but the local taxing districts do (Laws 1948, Chapt. 272). There is a special mine tax of 10 cents per acre and the mining companies pay on their annual profits as follows:

$10,000 to $1,000,000 – 6%
$1,000,000 to $5,000,000 – 8%
Over $5,000,000 – 9%

QUEBEC

There is no provincial ad valorem tax, but real and personal property is assessed at its **real value** by the local taxing districts. The Quebec Mining Act. R. S. 1941, Chapt. 196, Sec. 226, exempts Mining companies from Municipal taxation for 5 years. Quebec imposes an income tax but mining companies are exempt. Stat. 1947, Chapt. 33, Sec. 6. Mining companies, however, pay duties on their net profits as follows: $10,000 to $1,000,000 4%; over $1,000,000 to $2,000,000 5%; over $2,000,000 to $3,000,000 6%; and over $3,000,000 7%. The Hollinger North Shore Exploration Company, Ltd. by the provisions of the act 4/17/1946 will pay in addition to the above, $100,000.00 annually.

TAXES IN OTHER FOREIGN COUNTRIES

BRAZIL, SOUTH AMERICA

To mine metal of any kind in Brazil, a permit is required from the federal government. Under the mining code, taxes under the union, state and municipalities to which holders of permits may be subject, to 8% of the value of the total output of the mine at the point of exploitation. (Source – Martindale-Hubbell Law Directory, 1954.)

CHILE, SOUTH AMERICA

In Chile the title to all mineral deposits is in the government and the right to explore or extract the ore is granted by concessions from the government. Iron mines (operating) pay an annual 50 centavos (about 2 cents) per hectare (about 2½ acres). Chile also imposes an income tax on iron mining of 19½%. (Source – Martindale-Hubbell Law Directory, 1954.)

PERU, SOUTH AMERICA

The ownership of all minerals belongs to the state which grants concessions for their exploitation. There is a mining tax (surface) of 20 soles (about 90 cents) per hectare (about 2½ acres); also an income tax with varying rates. Mining concessionaires paying the surface

tax and income tax are exempt from all other taxes for 25 years. (Source – Martindale-Hubbell Law Directory, 1954.)

VENEZUELA

In Venezuela there is no tax on property as such; that is, there is no tax corresponding to what we call the general property or ad valorem tax. The Government gets its revenues from income taxes and from a very large number of excise taxes on the sale of goods, stamp taxes on various transactions, licenses, and customs duties. The local governments (states, local municipalities and school districts) get their money by grants from the Federal Government and by local license taxes, stamp taxes, and excise taxes on sales. There is one exception to this: if an industry is conducting its operations more than two and one-half miles from an incorporated local municipality it must provide school and hospital facilities for its employees; this, however, is an expense of operation rather than a tax.

To understand the taxes paid by mining companies it is, therefore, necessary to consider only the Federal taxes. These Federal taxes are the following:

FEDERAL GOVERNMENT TAXES

A. Special Taxes:

The Federal Government owns all the minerals in Venezuela. The companies get the right to mine them by concessions or leases from the Federal Government. Instead of charging royalty, the Government collects an "Exploitation Tax." This tax is at the rate of 1% of the gross value of the ore at the mouth of the mine after being mined. Assuming a gross value of $4.50 a ton, this tax would be 4½ cents a ton.

There is a Stamp Tax on export bills of lading, which, however, is not substantial. There is no export tax at the present time, but the Federal executive has power to impose such a tax when the interest of the nation requires it.

B. Income Taxes:

Aside from the special taxes above set forth, the Government imposes Income Taxes in three steps, (1) the basic tax; (2) the complementary tax; and (3) the additional tax. Essentially, these taxes correspond to what we in America would call the Federal Normal Income Tax; the Federal Surtax; and the Federal Excess Profits Tax.

1. **The basic tax** is at the rate of 2½% of net income. In arriving at net income the taxpayer is allowed deductions of the same general character as we are familiar with in the United States in

computing net income for Federal income tax purposes, including such items as interest, depreciation and depletion, losses not compensated for by insurance, and all labor costs and expenses of every kind.

2. **The complementary tax** is a graduated surtax on net income. It does not apply until net income amounts to about $2,700.00 in American money; the rate between $2,700.00 and $3,000.00 is 1½%; the rate is then graduated upward until it reaches 26% of net incomes in excess of about $8,000,000. In addition to the ordinary deductions there are certain additional deductions allowed for investment within the taxable year for expansion of production in Venezuela.

3. **The additional tax** would correspond roughly to the former Federal Excess Profits Tax. It is applicable only in the event the taxpayer's net income before income taxes amounts to more than 15% profit on his invested capital (there is an intermediate bracket where half of the tax is effective if net profit is more than 10% on invested capital but not 15%). The method of computation of the tax is somewhat technical. It can be best explained by showing how it works. In effect, it is intended to impose enough additional tax so that the total of all taxes paid by a taxpayer in Venezuela will be equal to one-half of his net profits before taxes. To accomplish this a formula is set up by which an additional tax is imposed, which, when added to all the other taxes, would equal 50% of the net income before taxes.

   Thus, if we assume that a company made $2,100,000 profit before taxes, and that this exceeded 15% of its invested capital; assume that its total special taxes in Venezuela were $100,000, and its total basic income and complementary tax or surtax were $280,000; with those assumptions the additional tax would be $670,000, which, when added to the $100,000 special taxes and $280,000 income taxes, would make a total of $1,050,000, or exactly one-half of the $2,100,000 profit before taxes. The company and the Government would each realize net $1,050,000 out of the $2,100,000 profit before taxes.

   It is not nearly as heavy a tax as the combined Federal and State taxes in the United States, since the Federal income tax alone (without the excess profits tax) takes 52% of net profits.

Under the United States laws applicable to companies doing business outside the United States but in the Western Hemisphere, the net profits made in Venezuela would not be subject to any Federal income tax in the United States.

A mining company operating in Venezuela, therefore, pays, at the

most, 50% of its net profits, which covers (a) royalty on the ore taken under the Government concession; (b) all local and state taxes; (c) all Venezuelan Federal taxes; and (d) all United States income taxes on Venezuelan properties.

NOTE – PROFIT SHARING – the provision for sharing 10% of net profits of mining companies with the workers at the end of each year, is explained in this report.

Determination of Tax Base

Since the computation and determination of the ad valorem and occupation taxes is based on value, the law requires that the taxing authorities determine the value of iron ore for tax purposes. Value is a matter of judgment upon which different minds may differ. However, a good measure of value is the market price of the product in question. In construing the Minnesota Statutes for determining the full and true value of iron ore for tax purposes, the Supreme Court has stated that the market value is what a willing buyer will pay a willing seller for the product. For over forty years, the State Department of Taxation has used as a measure of the value of a ton of iron ore the market price, or what a willing buyer will pay a willing seller, and, having determined what that market price is at the beginning of each year, that price or value is used in determining the amount of tax.

Occupation Tax Ad Valorem Tax

This market price or value of a ton of iron ore is the price at various Lake Erie ports for the ore delivered to these ports, and since for occupation tax purposes the law requires the value of iron ore to be determined at the surface of the mine, or, as it is commonly called, at the "mouth" of the mine, the State Department of Taxation deducts from the value or market price at the Lake Erie ports, pursuant to the statute, the allowable deductions of freight charges, handling, insurance, etc., to determine the value or market price of a ton of iron ore at the mouth of the mine. This value is then multiplied by the number of gross tons (2,240 pounds) produced during the year by each mine, and from this total are deducted the various items allowable under sections 298.02 and 298.03, M.S.A. 1953. Having found this total value, the tax is then computed by multiplying this value by 11% (the present tax rate) to get the occupation tax, and the same total, before deducting the labor credits, is multiplied by 1% to get the amount due the Veterans' Compensation Fund.

Ad Valorem Tax

In computing the ad valorem tax on iron ore, which is assessed on the basis of 50% of the full and true value as of May 1 of each year, the State Department of Taxation takes the average of the value or market price for the last five years including current year, as a base to arrive at the value of the ore in the ground.

The law and method used in computing the ad valorem and occupation tax is explained fully in this report under the heading "Administration of Tax" and for this reason is not repeated in discussing this subject.

In view of the fact that the tax proceeds due the State of Minnesota from the occupation and ad valorem taxes are based on the value of

the iron ore at the mouth of the mine or in the ground, the Commission has investigated thoroughly the market price established at the Lake Erie ports to determine whether or not this market price is the real and actual value, or whether it is a fictitious and artificial price as some people have contended. In other words, the crucial answer underlying our entire tax proceeds from the various taxes on the mining companies originates from the value which is found by using the market price at the Lake Erie ports. Over the years, this market price has become known as the Lake Erie price, and there has been contention that large producers of steel or iron ore have conspired to set the market price, and thus, in truth and in fact, it is not a competitive price arrived at by a willing buyer and a willing seller.

The Commission heard substantial evidence from numerous owners of mining properties, producers of iron ore, and also invited any evidence from any source which would establish that the market price at the Lake Erie ports, or so-called Lake Erie price, was fictitious or unreal. Those appearing in opposition to the Lake Erie price produced no evidence disputing the reliability of the market price. Several committees of the United States Congress have held extensive hearings on this matter; notably the O.P.A. in 1942, the National Temporary Economics Commission in 1939; and more recently the subcommittee of the Judiciary Committee of the House of Representatives in December, 1950.

Producers of steel must know a year, or possibly longer, in advance of their production year, where they will get their iron ore; and producers of iron ore, in order to determine their activities for a mining season must be certain to have a market for the ore at a price sufficiently high which they believe will produce a profit for the iron ore producing company.

Accordingly, before each mining season, usually in the winter, the producers of iron ore or the mining companies are seeking a market for the ore during the following shipping season, and thus these mining companies approach users of iron ore in an endeavor to enter into a contract to supply the steel manufacturer with the needed tonnage of ore. When a mining company or producer of iron ore has reached an agreement with the purchaser or steel manufacturer for the sale during the shipping season of a substantial tonnage of ore and the price therefor has been agreed upon by the seller and the purchaser, this fact is made known and the price is published in various trade journals, and for the year 1953 was published on June 24, 1953. The 1953 price is still in effect.

The price of the ore in this first contract for a substantial tonnage is the price of a gross ton of iron ore containing 51.50% natural iron delivered at ports of Lake Erie. (See Table No. 1) The price is ad-

justed up or down, according to the iron units in the ore, using the market price of 51.50% natural iron. There are also adjustments because of phosphorus, silica and other materials in the ore. The market price so established is then used by all mining companies as the market price or value of iron ore for that season and is the value used by the State Department of Taxation in determining the various taxes on the mining industry in Minnesota.

It appears that for the year 1951 the market price or value was established by contract entered into between the Cleveland-Cliffs Iron Company,* a large producer of ore and a purchaser of ore. The Cleveland-Cliffs Iron Company has established the market price in other years as well, although the testimony indicated that different companies established the market price or value in different years. It appeared from the testimony that all mining companies accept this market price as the price of ore which is produced and sold during the season, and it appears that once the market price has been established, other mining companies recognize that price as one sufficient to produce a profit and thus be an incentive for the production of iron ore for that season.

The Cleveland-Cliffs Iron Company is engaged largely in mining of ores requiring beneficiation, and since the combination of mining and beneficiation is high cost, it appears to the Commission that the price established by the Cleveland-Cliffs Company would be relatively high because of the high cost of their mining, plus beneficiation; and furthermore, since the company mines ore primarily for sale to others, not being manufacturers of steel, it might logically follow that other mining companies could produce and sell ore profitably at that price. Of course, it is an advantage to the State of Minnesota from a tax standpoint to have the market price or value high since it would follow that tax proceeds would be higher.

Owners of some of the numerous small independent mining companies which are producers of iron ore for sale only, and not tied in with any steel manufacturer or processor, appeared before the Commission; and included Mr. Harrison of Pacific Isles Mining Company and Mr. Moore of the W. S. Moore Company. They stated that their great interest was in having the market price of ore as high as possible since they are selling ore, and they unequivocally asserted that in their opinion the price at the Lake Erie ports upon which the value of the ore is based for tax purposes is a real and competitive price and not an artificial or fixed price which resulted from a conspiracy or combination of large steel manufacturers.

It was pointed out that the Oliver Mining Company, a subsidiary of the United States Steel, in 1951, sold nine million tons of ore to

* An independent seller.

competing steel companies. It is obvious that United States Steel, which owns Oliver Mining Company, would be interested in getting as high a price from this ore as possible since, of course, steel manufactured by that company would compete with other steel companies in the sale of steel. In other words, Oliver Mining Company, in such case, would be interested in having a high price, which is also the interest of the State of Minnesota, viewed from a tax standpoint. Cleveland-Cliffs Iron Company, represented by Mr. Bubb, the assistant controller of that company, was also present. He testified as to the technique and procedure used in establishing the market price for the year. He pointed out that Cleveland-Cliffs Iron Company produced and sold approximately 6,500,000 tons of ore yearly at the price established by the first substantial sale made each year. He also pointed out that the sales made to Ford Motor Company had in some years established the market price.

The contracts that are entered into are, in many instances, of a duration running up as high as five or more years, the reason for the length of term being that steel companies must know their source of ore over a substantial period of time. The price of ore in those contracts is agreed to be the price that will be established each year, so that it might be said that even in long-term contracts the price is a negotiable one for each year, the contract simply being an agreement to furnish ore.

The mining companies have consistently objected to the use of the current market price in computing the occupation tax, which would be unnecessary if the price were controlled because in such case it could be depressed. In 1941, they protested vigorously before the State Tax Commissioner and produced testimony that ore could be sold for only $4.05 per ton, whereas the current market price was $4.45 per ton, which was used by the State Tax Commissioner in computing the iron ore taxes.

The Oliver Mining Company claimed that the use of the current market price for that year increased the ore tonnage value in excess of $10,000,000 with a corresponding excess in the ore tax of over a million dollars. The State Tax Commissioner refused their plea and used the ore market price which was established at the beginning of the year in any event, all of which indicates that the market price is not a controlled or fixed price in view of the foregoing.

The foregoing statement covers years in which there was no governmental control in prices. However, we desire to point out that during the years 1942, '43, '44, '45 and '46, the Office of Price Administration froze the price of iron ore at the then Lake Erie price. During the years 1947, '48, '49 and '50, the price was not regulated by the O.P.A. However, on December 2, 1950, the Office of Price Stabilization again

exercised control over the price of iron ore until 1953, when controls were abolished.

The use of the Lake Erie price does not affect the ad valorem tax with the force that it does the occupation tax.

The ad valorem tax per ton based on the tonnage of ore in the ground in 1941 was $.012 and the Lake Erie price was $4.45, whereas in 1953 the average ad valorem tax per ton was $.023 and the Lake Erie price was $9.90.

In 1941, with the Lake Erie price at $4.45, the average occupation tax per ton produced was $.132, whereas in 1953, with the Lake Erie price at $9.90, the average occupation tax per ton produced was $.380. This comparison shows that under the occupation tax law, with its restricted deductible costs, the tax per ton increased even more than did the market value.

The Supreme Court of Minnesota has sustained the use of the Lake Erie price in determining the tax base. The increases in the Lake Erie price have been in about the same ratio as those of wages and pig iron.

Witnesses who appeared before the Commission and vigorously attacked the use of the Lake Erie price were unable to suggest to the Commission a better method of determining the tax base.

In view of the foregoing it has been concluded that the use of the Lake Erie price has not been detrimental to the State of Minnesota.

TABLE NO. 1

ORE PRICES FOR VARYING IRON CONTENT CALCULATION OF LAKE ERIE SELLING VALUES

(According to Formula adopted in 1925, and still in use)

Standard Lake Erie selling values for iron ore, as quoted in trade journals and ore sales contracts, are per gross ton of 2,240 pounds, delivered at rail of vessel at Lower Lake Ports and are based on the following classification and guaranteed base analyses:

Old Range Bessemer	51.50% Iron Natural	.045% Phosphorus
Old Range Non-Bessemer,	51.50% Iron Natural	
Mesabi Bessemer,	51.50% Iron Natural	.045% Phosphorus
Mesabi Non-Bessemer,	51.50% Iron Natural	
High Phosphorus,	51.50% Iron Natural	+.180% Phosphorus

Price Adjustments for Iron Content Above or Below the Guarantee; All Grades:

Selling values of ores of different iron content than the base ores are determined as follows: The base price is divided by 51.50, the number of units in the base ore. The resulting quotient is the base unit value, used to determine additions to or subtractions from the base price, for iron contents above or below the base analysis, as follows:

When less than 51.50% and not less than 50.00% Iron: from the base price deduct, for each unit or fraction of a unit of iron less than 51.50% iron, at the rate of the base unit value.

When less than 50.00% and not less than 49.00% Iron: from the price computed for 50.00% iron deduct, for the unit or fraction of a unit of iron less than 50.00% iron, at the rate of one and one-half times the base unit value.

When less than 49.00% Iron: from the price computed for 49.00% iron deduct, for each unit or fraction of a unit of iron less than 49.00% iron, at the rate of two times the base unit value.

When over 51.50% Iron: to the base price add, for each unit or fraction of a unit of iron more than 51.50% iron, at the rate of the base unit value.

Price Adjustment for Phosphorus:

All ores containing .045% phosphorus, or less, are classed as Bessemer. Phosphorus content lower than .045% commands a premium, determined in accordance with the standard table of phosphorus values. All ores containing more than .045% phosphorus are classed as Non-Bessemer. Ores containing more than .180% phosphorus are classed as High Phosphorus.

Penalties:

In addition to the standard deductions applied for iron contents of less than 50%, which are computed as above, arbitrary penalties are also exacted for high silica and for fine structure.

Premiums for Lump Structure and High Manganese Content:

Hard ores of high iron, low silica contents are often sold as lump grade, generally being priced as Old Range Non-Bessemer plus premiums for lump structure.

Ores containing in excess of 5% natural manganese are recognized as standard manganiferous iron ores and are generally priced as Old Range Non-Bessemer on the combined natural iron and manganese content, plus a premium for the natural manganese in excess of 5%. Ores containing between 2% and 5% of natural manganese are also sometimes marketed as manganiferous at prices which recognize some small value for the manganese content.

Premiums for lump structure and high manganese content vary and are determined by negotiation between buyer and seller.

Source—Minnesota Mining Directory 1954.

RESERVES

The term "RESERVES" means the iron ore in the ground, other than taconite, which can be mined and is either merchantable iron ore in its natural state, or by present methods of beneficiation can be made into merchantable iron ore, suitable for use in the manufacture of pig iron and steel; and mined ore in stockpiles.

On May 1, 1921, the estimated iron ore reserves in Minnesota were 1,311,410,779 gross tons. Since then and up to May 1, 1953, 1,402,292,000 gross tons have been shipped. In other words, the shipments exceeded the 1921 estimated reserves and yet on May 1, 1953, we still had estimated reserves of 915,183,000 gross tons. These facts have caused many people to believe that the mining companies have been concealing deposits of iron ore, which if disclosed would become taxable. This Commission has conducted hearings and made a thorough investigation of the matter in an effort to determine whether this belief has foundation in fact.

In Minnesota, prior to 1908, the local assessors estimated the tonnage of ore in the ground and made the assessments. Under the local assessor system there was no uniformity of method used to determine the estimated tonnage or the value of iron ore; and because of this, many assessments had to be reviewed by the State Board of Equalization. So, in 1907, after a joint Legislative Commission, appointed to investigate the best methods of taxing iron ore, had reported on this matter, a joint resolution was introduced in which it was stated: "That the ore lands did not bear their just share of taxation and were grossly undervalued for that purpose."[1]

In 1907, the Legislature abolished the State Board of Equalization and transferred all the duties and powers thereof to the Minnesota Tax Commission. The problem of valuing iron ore properties was studied by the Minnesota Tax Commission; and in 1908 it devised a classification rate schedule of values on iron ore for operating (active) mines and prospects. The values were determined by the quantity and quality of the ore in the ground based upon the reports of explorations furnished by the owners, lessees or operators of the property. The Tax Commission thought that these estimates based upon the reports so furnished, should be verified by disinterested and competent engineers before being accepted as substantially correct.

On December 20, 1909, arrangements were made to have these estimates, furnished by the mining companies, checked by the staff of the University School of Mines. Although the Legislature has never

(1) Report of Minnesota Tax Commission, 1908, p. 110.

enacted a law requiring the use of this system, it has been followed ever since.[2] The system works in the following manner: —

About November 15 each year, the Mining Division of the Department of Taxation makes a preliminary study of active mines, which the Department wants the School of Mines to review. These lists are discussed with the engineers of the School of Mines and mining companies. After these discussions a list of the mines of each of the major operating companies is submitted to the School of Mines with the request that those properties be reviewed by them as of the next assessment date (May 1). At the same time a letter is sent to the mining companies requesting that they submit to the School of Mines their own estimates on the selected mines operated by them, together with all computations, drill records, maps and cross sections. The mining companies are requested to send in this information during the first half year, and as far as we can ascertain, they have always complied with the request as promptly as possible.

It should be noted that the open pit mines do not remove iron ore during the winter months, hence the estimates made in the winter generally reflect the tonnage in the ground when the next operating season begins about May 1. Allowance is made for any shipments made in early spring prior to May 1.

Underground mines operate all year, and for this reason the Pioneer, Sibley, Zenith and Soudan underground mines on the Vermilion Range are checked every year.

On inactive mines, or on so-called reserve properties, there is no necessity for checking each year because the estimated tonnage remains the same, unless some additional drilling has been done, in which event the new drill records are checked and the property re-estimated.

The mining companies furnish the School of Mines with cross-sections of the ore bodies based upon the exploratory drilling and other information which is disclosed by operations, either on the property itself or adjacent properties. These cross-sections are vertical sections through the deposit from the surface down to the bottom of the exploratory drilling, and in some cases beyond, based upon the interpretation of the engineers and geologists as to how the formations lie and how the different layers conform with each other. In these cross sections are placed the drill holes, in most cases with the analyses generally in the ore body itself, at 5 foot intervals. From these analyses the engineers, to the best of their judgment, outline the layers of the different materials constituting the ore formation. These areas are then run, to determine the total area in the section for the

(2) Interim Commission on Iron Ore Tax Report, 1941, pp. 40-52.

different layers. The engineers at the School of Mines sometimes increase the volume of material in the estimate made by the mining companies and these situations are adjusted by conferences between the engineers of the School of Mines and the mining companies.

From these cross-sections the number of cubic feet of ore formation is figured and on the Mesabi and Cuyuna Ranges the total cubic footage is divided by 14 to determine the tonnage. The mining companies, in computing their estimates on the Mesabi and Cuyuna Ranges also use 14 cubic feet per ton. This formula does not apply to the Vermilion Range, for in the Soudan Mine on the Vermilion Range, 10 cubic feet per ton is used; and in the Pioneer, Sibley and Zenith, 11 cubic feet per ton is used. This is due to the difference in specific gravity of these various ores as found by experience. The estimates are all based on ore "in place" in the ground and undisturbed. Heaviest of all is the Soudan ore, very dense and hard, and high in iron. Next comes the ore at the Ely mines, part of which is hard ore. The last, and by far the largest group, is made up of the Mesabi and Cuyuna ores, which average out about 14 cubic feet per ton.

The gross tonnages computed in the foregoing manner are then classified as to quantity and quality according to the constituents in the analyses, as to dried iron content, phosphorus, silica, alumina, manganese, moisture and natural iron and then computed as to the tonnages of Bessemer or non-Bessemer ore. Bessemer ore is that containing .045% or less in phosphorus. In case the phosphorus exceeds .045%, the ore is non-Bessemer.

With the limited personnel available to the School of Mines, it is making an inspection of each active mine about every two to four years, except the underground mines which are checked every year.

The present system for estimating reserves is the best that has been devised, and our investigation leads to the conclusion that the present Tax Commissioner is placing all known iron ore in Minnesota on the tax rolls.

The fact that reserve estimates do not diminish in the same ratio as the shipments made, can be accounted for by several factors: — No one can accurately determine the amount of iron ore in the ground unless extensive drilling has been done in the ore body to be estimated, and even then an accurate estimate cannot be made because the areas between the drill holes may, when actually mined, show more or less ore than shown by the drilling estimate. New methods of beneficiation have enabled the mining companies to produce merchantable iron ore from ore bearing bodies formerly considered worthless and not classified as reserves in the former estimates. For example,

the Mary Ellen Mine at Biwabik was abandoned in 1930, because the ore body remaining could not be processed commercially by any known method at that time. However, because of the development of the heavy media concentration process, it was reopened in 1948, and has been producing 300,000 to 400,000 gross tons per season, and has a sufficient reserve to last several years. This is just one instance of many on the range where millions of tons of iron ore have been added to the reserves and placed on the tax rolls because of new mining techniques.

It also appears that after preliminary drilling has been done and years later when the companies prepare to open up the reserve, additional extensive drilling is done to determine more closely the operating limits of the open pit. These additional drillings, in most instances, disclose more tonnages which are added to the reserve estimates. As an example of this situation, we have the estimates of the Auburn-Great Western Mine. For many years prior to and up to May 1, 1949, the estimated tonnage was 8,389,000 tons. In the year 1949 the Oliver Mining Company drilled 33 new holes to an average depth of 200 feet, and from the new drill record the School of Mines increased the tonnage to 11,604,000 tons, or an increase in the prior estimates of 3,215,000 tons. This is just another instance of many that have happened on the range. It should be noted that since May 1, 1921, the estimated tonnages on the Cuyuna Range, have, by drilling and new beneficiation processes, increased from 25 million to 42 million tons in spite of shipments made from that range.

These factors; new beneficiation techniques, additional drilling and the reserves on the Cuyuna Range, account, at least in part, for the fact that the reserve estimates do not diminish in the same ratio as the shipments made.

The Commission's investigation discloses that during the past 30 years, because of the new techniques and additional drilling, there have been two tons of ore added to the reserves for each three tons shipped. Professor John W. Gruner, Geologist at the University of Minnesota, claims that this ratio of two tons added to the reserves, for each three tons shipped will not be maintained and that we can expect this ratio to diminish very rapidly, due to the increasing depth of mining, the decline in average grade of ore and in the size of the remaining ore bodies.

It should be noted, however, that the tonnage of concentrates shipped is increasing and that of high grade direct shipping ore is decreasing. The records show that in 1920, only 12% of the iron ore shipments from Minnesota were concentrates, whereas in 1953, they were 33%; while in 1920, the shipments of direct shipping ore were 88%, and in 1953 were 67%.

The reserves of merchantable iron ore in the State of Minnesota, as of May 1, 1953, are shown in the following table prepared by the Commissioner of Taxation.

TABLE NO. 2

CLASSIFICATION OF IRON ORE RESERVES OF MINNESOTA AS OF MAY 1, 1953

Classification	Mesabi Range	Vermilion Range	Cuyuna Range	Total
Direct Ore:				
Open Pit	469,656,000		10,614,000	480,270,000
Underground ...	199,550,000	12,989,000	24,559,000	237,098,000
Total.....	669,206,000	12,989,000	35,173,000	717,368,000
Concentrate:				
Open Pit	128,807,000		8,370,000	137,785,000*
Underground ...	41,837,000		1,290,000	43,127,000
Total.....	170,644,000		9,660,000	180,912,000*
Total Ore:				
In Ground	839,850,000	12,989,000	44,833,000	898,280,000*
In Stock-pile	15,648,000	297,000	918,000	16,903,000†
Total.....	855,498,000	13,286,000	45,751,000	915,183,000*†

Note: The above figures represent the total estimated iron ore reserves in gross tons as of May 1, 1953, and include the reserve tonnages shown in Table No. 3 as of that date, together with the tonnage of ore on State lands that were not under lease as of May 1, 1953.
* Includes 608,000 tons in Fillmore County District.
† Includes 40,000 tons in Fillmore County District.
Authority: Compiled by the Mines Experiment Station from the records of the Minnesota Department of Taxation.

TABLE NO. 3

IRON ORE RESERVES OF MINNESOTA

(May 1, 1920 to May 1, 1953, inclusive)

Estimated Reserve Tonnage (Including Stockpiles) in Gross Tons

Year May 1	Mesabi Range	Vermilion Range	Cuyuna Range	Fillmore County	Total
1920	1,305,926,735	10,927,844	24,819,959		1,341,674,538
1930	1,154,434,031	14,250,540	66,542,939		1,235,227,510
1940	1,139,314,272	13,841,272	65,431,104		1,218,586,648
1945	973,129,581	12,715,183	59,787,900		1,045,632,664
1950	923,769,792	13,183,901	43,415,199	589,000	980,957,892
1951	906,225,928	12,110,218	41,869,807	913,165	961,119,118
1952	869,104,825	12,965,994	44,808,481	574,908	927,454,208
1953	855,380,607	13,286,060	45,751,154	647,500	915,065,321

Source: Department of Taxation.

All of the foregoing reserves refer to the so-called standard merchantable ore and do not include taconite. For taconite reserves, see the section on taconite.

The reserves of iron ore in the other states of the union and those in foreign countries, some of which may be competitive with Minnesota iron ore, are as follows:

UNITED STATES

ALABAMA

Red ore 1,000,000,000 gross tons running from 31% to 37% dried iron.[1] There is also some low grade brown and grey ore. The bulk of the Alabama ore is located in Jefferson County at or near Birmingham. The mines are all underground and production is about 8 million tons annually. U. S. Steel and Republic Steel are the big producers. The Birmingham area also has large deposits of coking coal and of limestone, the fluxing material used in making iron. This is the reason why the U. S. Steel Co. has a large steel plant at Birmingham where this low grade ore is utilized.[2] It is doubtful whether or not this ore would be usable without these materials being near at hand. At present, the entire output of these mills is used in the southeastern area of this country.

(1) State Department of Revenue, Montgomery, Alabama, 9/21/51.
(2) Sub-committee inspection, April, 1952.

CALIFORNIA

122,658,000 gross tons running 50% to 60% dried iron.[1] These deposits consist of HEMATITE AND MAGNETITE, in small shallow deposits in about ten different areas in the state. Production is around 500,000 tons annually and most of it goes to the Kaiser Plant at Fontana.

(1) Iron Resources of California, Bulletin No. 129, Part N., p. 217, April, 1948, issued by State Division of Mines.

MICHIGAN

This is the second largest iron ore producing district in the United States, with an annual production of about 12,000,000 tons. On January 1, 1954, the iron ore reserve was estimated at 154,057,254 gross tons (running 50% to 60% dried iron).[1] Most of the iron ore in Michigan is deeply imbedded and is mined by underground methods. Michigan also has an abundant supply of iron bearing rock called "Jasper" which is somewhat similar to our Minnesota "Taconite." The Cleveland-Cliffs Company and the Ford Motor Co. have erected a plant at Humboldt, Michigan to process Jasper from an open pit and are in production.[2] It is doubtful that Michigan will ever, because of the depth of ore bodies, be able to increase its production to

(1) Minnesota Mining Directory, 1954.
(2) Skillings Mining Review, Oct. 30, 1954.

any great extent, beyond the increase due to future concentrates made from Jasper.

NEW YORK, PENNSYLVANIA, NEW JERSEY

1,600,000,000 gross tons of crude low grade ore requiring concentration. Production of these three states averages about 3,000,000 tons of concentrates annually,[1] which requires sintering before blast furnace use. The concentrate produced is about one-third of the crude ore mined.[2] Most of the mining is underground, but there are a few open pits. Moderate expansion may be expected.

(1) U. S. Bureau of Mines Minerals Year Book, 1949.
(2) The Mineral Industries of New York State, 1950, Department of Commerce.

TEXAS

139,000,000 gross tons of crude low grade ore requiring beneficiation.[1] This is a brown ore and the Lone Star Steel Co. in the Daingerfield area, Morris County, is producing from open pits around 500,000 tons annually. This ore is beneficiated by washing, calcining and sintering.[2] Ore occurs in thin seams, and is of low iron content.

(1) U. S. Department of Interior Geological Survey Map 3-212-1947, Iron Ore Deposits of Western United States by Carl E. Denton and Martha D. Carr.
(2) U. S. Bureau of Mines Minerals Yearbook, 1949, page 15.

UTAH

150,000,000 to 175,000,000 gross tons direct shipping ore running from 45% to 50% natural iron.[1] Utah produces from open pit mines about 2,500,000 gross tons annually. This ore is used in iron and steel centers located at Provo and Geneva, Utah; Fontana, California; and Pueblo, Colorado.[2] Some expansion of Utah iron mining is to be expected in future years.

(1) Utah Tax Commission 9/21/51.
(2) U. S. Bureau of Mines Year Book 1949, p. 15.

WISCONSIN

On January 1, 1954, 6,500,000 gross tons direct shipping ore, running 50% to 60% dried iron.[1] This ore is all on the Gogebic Range and can only be mined by underground method.

(1) Minnesota Mining Directory, 1954.

WYOMING

54,000,000 gross tons running 50% natural iron.[1] This is a direct shipping hematite ore. The Sunrise Mine in Platte County is the principal producer, averaging about 500,000 tons annually from underground operations.[2] All of this is used at Pueblo, Colorado mills of the Colorado Fuel & Iron Company.

(1) Same reference as Texas.
(2) U. S. Bureau of Mines Minerals Yearbook, 1949.

CANADA

LABRADOR-QUEBEC

Proved reserves of 418,000,000 gross tons of iron ore running 54% natural iron. For full details of this field, see pages 124 to 130.

MICHIPICOTEN

(Mines of Algoma Ore Properties, Ltd., Ontario, Canada.)[1]

Algoma Ore Properties Ltd. is a Canadian company wholly owned by Algoma Steel Corp. Ltd., formerly using ore from the old Helen Mine. This mine, near Michipicoten Harbor, on the north shore of Lake Superior, was a producer of hematite ore, which was mined out by 1918. A large ore deposit had been found by drilling, 14 miles north of the Helen Mine, of a different type of ore, known as siderite, a carbonate of iron. This was called the New Helen Mine. Operations were suspended in 1921, due to inability to compete with Mesabi ore, and the mine was inactive until 1937. In that year the Ontario Government granted a subsidy of 2 cents per iron unit (or $1.00 per ton on ore having 50% iron) to producers of iron ore sinter within the Province of Ontario.

Mining operations were then resumed, and sintering machines were installed 3 miles from the mine, replacing the old revolving tubes formerly used for roasting. Drilling had resulted in finding an ore deposit 200 feet wide and 3,000 feet long; and as to depth, the holes extended to 2,000 feet, still in ore. Other important ore deposits in that area have also been found by drilling.

Ore is crushed to 4½ inch size at the mine, and is transported to the sinter plant by aerial tramway at the rate of 120 tons per hour. There the ore and coke are crushed to ¼ inch size or under, and mixed, the ratio of coke to iron ore depending on the sulphur content of the ore. Since the sulphur is not wanted in the sinter, and will aid in furnishing the heat needed for the sintering operation, its presence in the ore is thus turned to good advantage.

An important feature of this sinter lies in the fact that it is practically self-fluxing, that is, not requiring the addition of much further lime in the form of limestone in the blast furnace charge. This is shown by the 1953 analysis of the sinter, which is as follows:[2]

Iron	49.44%	Lime	2.62%
Manganese	2.80%	Magnesia	7.90%
Phosphorus	.024%	Gain on ignition	.80%
Silica	11.59%	Moisture	1.16%
Alumina	2.56%		

(1) Annual Report of Ontario Department of Mines—Vol. 60, Part II-1951.
(2) A Survey of the Iron Ore Industry in Canada, 1953, by W. Keith Buck, Mineral Resources Division.

In 1950, the sintering plant was operated at capacity most of the year, treating 4,800 tons of siderite ore per day and obtained a daily production of 3,300 tons of good sinter. The objective was one million tons for 1950 and that figure was exceeded. The 1953 production was 1,166,832 tons.

The sintering plant as expanded in 1952-53, has a capacity of 1.5 million tons annually. Of the 1953 ore shipment, 391,381 tons went by rail to the Algoma Steel Plant at the Soo and the rest was shipped by rail and boat to lower lake ports of the U. S.

Ore disposal charts indicate that much of the Helen Mine ore goes to U. S. furnaces while the Algoma Steel Plant uses a part of the sinter from Helen Mine ore and a greater amount of Minnesota and Michigan ore.

Current production rate gives 1.2 million tons of sinter from 1.8 million tons treated.

Reserves given in 1954 Canadian Mines Handbook published by Northern Miner Press, Ltd., Toronto, are as follows:

Crude ore:

Helen, Victoria and Alexander	50,000,000 tons
Bartlett	30,000,000 tons
Goulais	150,000,000 tons
Siderite Hill	100,000,000 tons
Total	330,000,000 tons

Assuming the same ratio of two tons of sinter to three tons of crude ore, as shown above, would indicate a total reserve of over 200,000,000 tons of sinter.

Further expansion is indicated in this field.

STEEP ROCK

This area was visited on June 10, 1952, by a group including several members of the Interim Commission, and a number of engineers and mining men.

The iron ore deposits of this region are 120 miles west of Port Arthur, and 60 miles north of Ely, Minnesota, near the line of the Canadian National Railway, just north of the Village of Atikokan.

Early in the 1900's, prospecting work was done near Steep Rock Lake, and iron ore was found by test-pitting. This area was inactive for many years. It was not until 1937 that active exploration and development work started in earnest. Since the major ore deposits were found by winter drilling through the ice on Steep Rock Lake, it was found that the first task was to provide a diversion channel

for the waters of the Seine River, which entered the lake from the northeast, to a parallel watercourse two miles west. Then came the task of pumping out part of Steep Rock Lake, to permit stripping the muck and clay from the Errington (or "B") ore body which had been outlined by drilling.

This part of the drainage was completed by 1943, and removal of lake-bottom mud and clay was carried out in time to permit a shipment of 500,000 tons of ore in 1945.

The pit area was enlarged, and in 1946 the production was increased to 830,000 tons; 1947, 1,200,000 tons; 1948, 680,000 tons; 1949, 1,130,000 tons; 1950, 1,215,000 tons; 1951, 1,325,000 tons; 1952, 1,274,666 tons; 1953, 1,301,377 tons. Production is expected to increase. Reserves have been variously estimated at widely diverse amounts. The figure of 132,000,000 tons, given by the company's engineers in June, 1952, is evidently a conservative estimate of the five known ore bodies in the Steep Rock group. The ore is high grade, direct shipping ore, averaging from 50% to 60% iron. At present this ore goes mainly to U. S. furnaces.

Stripping of the "A" ore body is under way, and another ore area is being explored by drilling. When these two ore bodies begin shipping, it is expected that production will be greatly increased; however, in view of the fact that the "B" ore body, which had, since 1944, produced nearly 7,000,000 tons from the open pit, will shortly be mined by underground methods; and that the other ore bodies will follow a similar routine as to ore below a depth of 400 feet below lake level; it does not appear that the yearly production rate will greatly exceed 3,000,000 tons.

As drilling progresses on the areas not yet fully explored, the foregoing total of 132,000,000 tons in reserve may be somewhat increased. In this connection it should be noted that the figure of 132,000,000 is made up of both "proved" ore and "probable" ore, thus making substantial allowance for future discovery ore.

SOUTH AMERICA

BRAZIL

Brazil has large reserves of iron ore located about 350 miles north of Rio de Janeiro. Estimates vary but those of the Brazilian Geologist, Dr. L. J. Moraes, give the following figures for ore reserves in the State of Minas Geraes, where the iron ore is located: 1.5 billion tons of compact hematite averaging 65% iron or over: 3.5 billion tons having 55% to 60% iron and 10 billion tons having 30% to 50% iron.

These large reserves have not been extensively developed mainly for two reasons, viz: political instability and long distances from the mines to the two seaports, Victoria and Rio de Janeiro. Also it is about 5,000 miles from Rio de Janeiro to Baltimore, or more than twice the distance from Venezuela to Baltimore.

Since the extensive ore developments in Venezuela were started there has been little in the news regarding Brazilian ore developments. Although some Brazilian ore has been shipped to the United States for years past, it has reached 1,000,000 tons in only two years, 1951 and 1952, and then dropped to 458,000 tons in 1953.

It now appears that the iron ore development of Brazil, beyond their own requirements, may be delayed for an indefinite period.

CHILE

Chile's 1951 reserve was reported at 72,000,000 gross tons – 60% iron open pit direct shipping ore.[1] Recent reports on the once large El Tofo iron mine of Bethlehem Steel indicate a rapidly declining reserve with greatly increasing costs. Some of the large ore boats formerly used for Chilean ore are now transporting Venezuelan ore and indications are that the El Tofo mine is rapidly nearing exhaustion.

(1) Iron Age, Jan. 4, 1951.

PERU

In 1952 and early 1953 Marcona Mining Co., a subsidiary of Cyprus Mines Corporation and Utah Construction Co., developed an ore deposit in a 12 by 18 mile area near San Juan Bay on the western coast of Southern Peru. Drilling proved about 100,000,000 tons of 60% iron ore. Early in 1954 it was reported that over 2,000,000 tons of Marcona mine ore were being delivered to U. S. Steel's Fairless plant at Morrisville, Pa., and their Tennessee Coal and Iron Co. plant at Birmingham, Ala.[1] Other eastern firms were also reportedly seeking contracts for this ore. Part of the Marcona ore is to go to a new electric furnace under construction at Chimbote in northern Peru.

Republic Steel Corporation took an exploration option on 60,000 acres of potential iron ore land also in the San Juan area of southern Peru.[2]

(1) Iron Age, May 20, 1954.
(2) Engineering & Mining Journal, February, 1954.

VENEZUELA

Orinoco Mining Company, Cerro Bolivar, 500,000,000 tons of iron ore proved, running 58% natural iron. Iron Mines Company of Vene-

zuela at El Pao, 60,000,000 tons of iron ore proved, running 58% natural iron. For full details of this field, see pages 132 to 143.

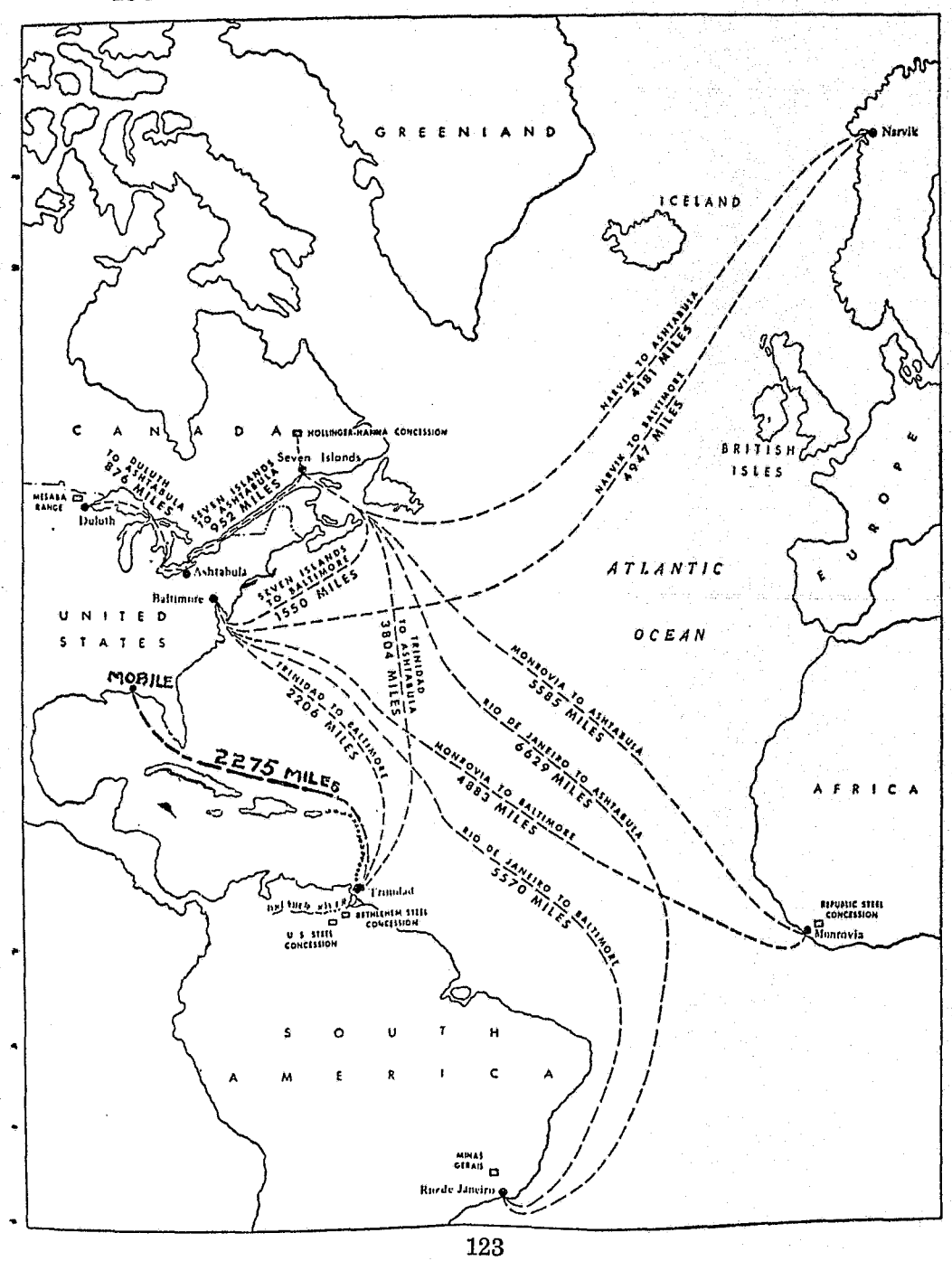
WEST AFRICA

LIBERIA

20,000,000 gross tons open pit, open hearth grade iron ore, running 68% to 70% dried iron.[1] The iron ore deposits are located at Bomi Hills about 40 miles from the Seaport of Monrovia. Republic Steel Co. has the concession and is shipping the ore to the United States.[2] In addition to the above reserve of high grade ore, there is also a substantial reserve of banded iron formation which may prove to be amenable to concentration.

(1) Legislative Research Publication 29, August, 1950.
(2) Scientific American, January, 1952, p. 52.

MAP NO. 1
LOCATIONS AND DISTANCES OF FOREIGN SOURCES OF IRON ORE



LABRADOR-QUEBEC, CANADA

In the hemisphere-wide search for areas containing major deposits of good iron ore, mainly within the last ten years, two such areas have been found. One is in Labrador-Quebec, and the other is in Venezuela, and both contain large reserves of high grade ore. Both areas have their advantages and disadvantages of development and transportation. The area discussed here is that in Labrador-Quebec.

Quebec Province covers a very large area, bounded on the west by Hudson's Bay, James' Bay and the Province of Ontario; on the north by Hudson's Strait and Ungava Bay; on the east by Labrador and the northeast arm of St. Lawrence Gulf; and on the south by Lake Ontario, the Northeastern States of United States, New Brunswick and the St. Lawrence Gulf.

Labrador, a part of Newfoundland, but separated from it by a narrow strait, is bounded on the west and south by Quebec and on the east and north by the Atlantic Ocean. For nearly 300 miles, the southern boundary follows the 52nd parallel and then follows a very irregular and winding path defined by the height of land or watershed, separating the flowage westward into Hudson's Bay and northward into Ungava Bay from that going eastward into the Atlantic and southward into St. Lawrence Gulf.

Concession Areas. Of the two principal concessions in the area here considered, the one in Labrador covers about 20,000 square miles, held by Labrador Mining and Exploration Company, Ltd.; and the other covers 3,900 square miles in Quebec and is held by Hollinger North Shore Exploration Company, Ltd. By agreement, the final Labrador grant must be confined to 1,000 square miles and the final Quebec grant to 300 square miles. About 213 square miles in the two grants have been subleased to Iron Ore Company of Canada, Ltd., by Labrador Mining and Exploration Company, Ltd., and Hollinger North Shore Exploration Company, as stated by W. Keith Buck, Mineral Resources Division, Canada, Department of Mines and Technical Surveys, Ottawa, in Skillings Mining Review, July 31, 1954. This is an area comparable with that of the Mesabi Range, Minnesota.

Recent History. In 1937, Dr. J. A. Retty, a Canadian geologist, visited the area now being developed for mining. In 1942 the Labrador Mining and Exploration Company, Ltd., and the Hollinger North Shore Exploration Company, Ltd., were acquired by the Hollinger Consolidated Gold Mines, Ltd., of Montreal. Also in 1942, the M. A. Hanna Company of Cleveland was offered an opportunity to participate with Hollinger, and became the operating arm of the Hollinger-Hanna Company.

The Iron Ore Company of Canada, Ltd., was formed in 1949 to get

the new iron ore area into production. Other U. S. Companies, including Republic Steel, National Steel, Wheeling Steel, Armco (American Rolling Mill Corp.) and Youngstown Sheet & Tube Corp., are all stockholders in the Iron Ore Company of Canada, Ltd. The remaining interest is held by the Hollinger Consolidated Gold Mines Company, Ltd.

Small portion of concession area is fully explored. Since the exploration in this area has all been done in the past few years, under most difficult conditions,[1] the portion of the concession areas that is fully tested is relatively small. Hence any statement or estimate of reserves means little without some description of the country itself, the companies interested in the venture, an account of the construction work and plans for future development.

Topography. The City of Sept Iles (Seven Islands) on the north shore of St. Lawrence Gulf is built on a delta of the Moisie River, which flows into the gulf a few miles farther east. Its name is taken from a group of seven small rocky islands outside the harbor.

About eight miles north of Sept Iles, the rugged rocky country begins, with rapid streams and deep canyons. This continues for about 100 miles. At 150 miles north of Sept Iles, is the height of land, which here is at 2050 feet elevation. There is a slight drop in elevation north of mile 150 and from mile 180 to mile 330 the lakes seem to cover more area than the land between them.

The height of land rises farther north, and northwest of the end of the railroad, it reaches an elevation of about 3000 feet.

Climate at 55 degrees north latitude and 2,000 to 3,000 feet above sea level ranges from cool in summer to minus 50 degrees F. in winter, with plenty of wind. There are said to be two months of the year without frost — July and August. The mining season is about six weeks shorter than in Minnesota.

Ore storage, Dock and Loading Facilities. The foregoing facts were explained to the five members of the Commission and their Engineer by the mining officials who accompanied the group on their visit to the iron ore area in September, 1952. They were: Mr. C. E. McManus, Manager of Open Pit Mines, Hollinger-Hanna Company; Mr. Richard Geren, Chief Engineer; and Mr. E. S. Mollard, Assistant to General Manager of Minnesota Mines, the M. A. Hanna Company, of Hibbing, Minnesota. The group went by plane from Montreal to Sept Iles and from there to Knob Lake.

These men also explained the following facts concerning the ore dock then under construction and now completed at Sept Iles. The

(1) To 1953 every man, every machine and all supplies had to be brought in from either Mon Joli or Seven Islands by air.

dock has a 1,600 foot section for belt loading of ore into ships and a section for ship mooring for other shipping. This dock is of the most modern design[2] and is equipped with all necessary facilities for efficient loading.

Operation. The loaded ore cars are sampled at the mines and the chemical analysis of ore in each car is known at the Seven Islands yard office before it arrives there. Cars hold from 90 to 100 tons as compared to the 75-ton ore cars used in Minnesota. Loaded cars from the storage yard[3] are pushed up an incline to the mechanical dumper. Two loaded cars at a time are held in heavy clamps, then rotated and dumped into a large bin or hopper, one of which was under construction. Under each hopper is a heavy apron type alloy steel feeder which moves the ore to a six-foot reversible conveyor belt. In one direction of the conveyor, the ore is discharged onto a belt system leading to the ship loading dock; or in the opposite direction to another belt system leading to stackers for placing the ore in stockpiles when no vessel is at the dock for loading.

The Mining season will be limited by weather conditions to between five and six months, but the harbor will probably be open for about nine months. The ore in stockpiles can be used to extend the season of shipping by ocean.

Ship Loading. The dock shiploader can be placed so as to load two widely spaced compartments of the ore vessel at the same time. By shifting the movable loader, all compartments can be filled evenly without moving the boat itself. Loading of ore is at the rate of 6,000 to 8,000 tons per hour.

Railroad Construction — Supply Sources. Company policy favors use of Canadian labor and supplies to the fullest possible extent. Steel rails from Sydney, Nova Scotia, are figured at about 100,000 tons[4] including yard tracks and the 22 passing tracks, which are spaced at intervals of from 10 to 20 miles along the line. 55 main line Diesel locomotives came from London, Ontario. Four of these are used per ore train load of 10,000 tons. Two thousand 98-ton ore cars were made by the Pullman Company. Ships brought railroad ties from distant places, many from Texas. Much of the large amount of cement used came from a plant in Newfoundland.

Construction. By October 1, 1952, steel had been laid to mile 64. Two rock tunnels had been completed; the first at mile 12, 2,200 feet long and the second farther north, 750 feet long. The longest steel bridge on the entire line, that over the Moisie River just above the first tunnel, 725 feet long, had been completed. Grading had been

(2) Steel piling for dock facing contains copper for resistance to corrosion.
(3) The storage yard for loaded ore cars is nearly a mile long, with provision for forty tracks.
(4) Rails are the heaviest rolled in Canada, weighing 132 lbs. per yard.

completed to mile 164. Grading was continued into November, and track laying into December, 1952.[5]

In the winter of 1952-53, a supply train, made up of tractor-trucks and heavy sleds, was used to move machines and equipment from end of steel, following the graded line to mile 164, then following along "tote-roads" the remaining distance to Knob Lake at mile 360. This speeded up the completion of the railroad building, and also the early development of the mine where the first ore is now being loaded into cars. By May 1954 all track had been laid and by July 1954 ballasting had been completed and the railroad was finished on schedule.

Communications. The pole line from end to end of the railroad was completed in 1953 and teletype is in service. Voice communication is in use in railway operation. Mine communication is in use at Knob Lake and vehicles in the mining area communicate by radio.

Water Power. A power plant has been built at Menihek Falls, 30 miles south of the end of the railroad. This plant will furnish current for the mines, shops and the town of Schefferville,[6] near Knob Lake and for upper end of the railway system.

A second power plant was built at Marguerite Falls, 18 miles west of Sept Iles, to furnish current for the operation of dock and ore yard facilities and for the town. The group flew over the Menihek plant site and also saw Grand Falls, about 70 miles east of Menihek River, where it is estimated that over 1,300,000 H.P. could be developed. Another possible future power source is at Eaton Canyon, 75 miles northwest of Schefferville, estimated to have a potential of 500,000 H.P. This source has been leased by the mining company.

The Airlift. With no roads or navigable streams, all travel during railroad construction was by air. This held through 1953, when the airlift made a new record as follows: Hollinger-Ungava Transport, 5,345,000 ton-miles; and chartered planes, 1,195,000 ton-miles. 69,590 passengers were transported by Hollinger-Ungava Planes in 1953 and about 40,000 tons of freight. 1952 air cargo included 60,000 bags of cement for the Menihek power project. Air transport for such cargo is costly. There was no other way to get the job done.

Proved Ore Reserves. It was explained that within an area of 5-mile radius, with the center at Burnt Creek (north end of railroad) over 200 million tons of high-grade open pit ore have been proved by drilling. When the camp was located at Burnt Creek, the existence of any important nearby ore deposits was not known.

Not far from this first area is a smaller ore area. Other proved

(5) Maximum grade going north, 1.4% for empty trains; going south, ore trains, 0.4%.
(6) Named for the Bishop of Labrador.

deposits within the concession bring the total estimate of proved reserve tonnage to 417.7 million tons as of 1950, averaging 55% to 60% dried iron. Within this total it is estimated that there are over 40 million tons of ore having about 50% iron and 7½% manganese.

Ore properties visited by the Commission members include the following rather widely separated ore exposures:

No. 1. An exposure in the Burnt Creek area, showing a yellowish (limonitic) type of ore at the outcrop, said to be of merchantable grade.

No. 2. The property called Ferriman No. 2 showed a large exposure of fine dark bluish hematite ore resembling the Mahoning[7] high-grade ore, both in appearance and analysis. This ore deposit was stated to be 3,300 feet long, with average width of 250 feet. The ore is of Bessemer grade, high in iron, with low phosphorus and very low silica.

No. 3. Ruth Lake No. 3 shows a high ridge of outcropping iron ore in the form of crystalline limonite or goethite. Much of this is hard ore and should provide some good lump ore for use in open hearth plants. It is of a type readily broken and should be minable at low cost.

South of No. 3 is another deposit called the Ruth Lake No. 1. This was said to extend about one mile in a north and south direction.

Another deposit called the Ruth Lake Extension, lies south of Ruth Lake No. 1.

The deposits seen by the Commission evidently contain ample tonnage for the first five years' production.

While some writers who have visited the Burnt Creek ore area several times, give a figure for total reserves in excess of one billion tons, the official company figure of 1950 still stands unchanged at 417,700,000 tons.

It was necessary to prove up a definite minimum tonnage by close drilling to justify the very heavy expenditure for railroad, dock and power plants. That objective was reached in 1950. Drilling done each year since then has been for the purpose of indicating areas within which substantial tonnages of ore are likely to be found by close drilling. This preliminary drilling aids in the selection of the tracts that will be included in the final grants from the Provincial Governments of Labrador and Quebec.

In addition to the high-grade ore deposits in the Burnt Creek area, there is another area some 150 miles to the southwest, having large

(7) Mesabi Range, Hibbing, Minnesota.

deposits of a lower grade ore which can be treated by crushing and ordinary washing to produce a high-grade concentrate.

The Oliver Iron Mining Division of U. S. Steel is reported to be carrying on extensive explorations in this area.[8]

Ore Shipments Started.

Ocean Shipments. The first cargo of 20,000 tons of Labrador-Quebec high-grade iron ore was loaded at the Sept Iles dock on July 31, 1954, into S.S. Hawaiian[9] for the port of Philadelphia. The cargo was divided among the five U. S. companies previously named.

The first Labrador-Quebec ore to reach the port of Baltimore was a cargo of 8,800 tons taken by S.S. Sirenes on August 20, 1954. The running time for the 1550 miles from Sept Iles to Baltimore was five days. This ore was trans-shipped by railroad 579 miles to the Armco Steel Corp. plant at Hamilton, in southwestern Ohio.[10]

River Shipments. A recent article[11] describes the loading of the first small cargo of Labrador ore into a canal-sized boat (Keydon), bound for Toledo. The boat left the dock at Sept Iles on August 2 with 2,170 tons of iron ore for account of Armco's Hamilton, Ohio works,[12] and arrived at Toledo, 1087 miles total distance, on August 9 after some delay en route.

From July 30 to October 14, 1954, total shipments were 1,250,000 gross tons. Canal-sized vessels averaging 2,300 tons each, transported 150,000 tons to Buffalo, Ashtabula and Toledo. The ore went to Republic Steel, Wheeling Steel, Youngstown Sheet & Tube and Armco. Ocean vessels transported 1,100,000 tons to Atlantic coast ports. Of this amount 800,000 tons went by railroad to inland U. S. furnaces.[13]

Comments. The Hanna Company pioneered open pit electric haulage at its Mesabi Chief Mine on the Mesabi Range many years ago when they electrified both the pit hauling system and the two-mile railway from pit to washing plant. With the abundant water power that is available, not too far from the mining operation, they may some day electrify the new railroad, reducing the freight cost.

On completion of the Seaway, Labrador-Quebec ore can be delivered at Lake Erie ports at a water freight cost but little more per ton than that from Duluth to Lake Erie ports. The small difference in distance will be offset by the higher average iron content of the Labrador-Quebec ore.

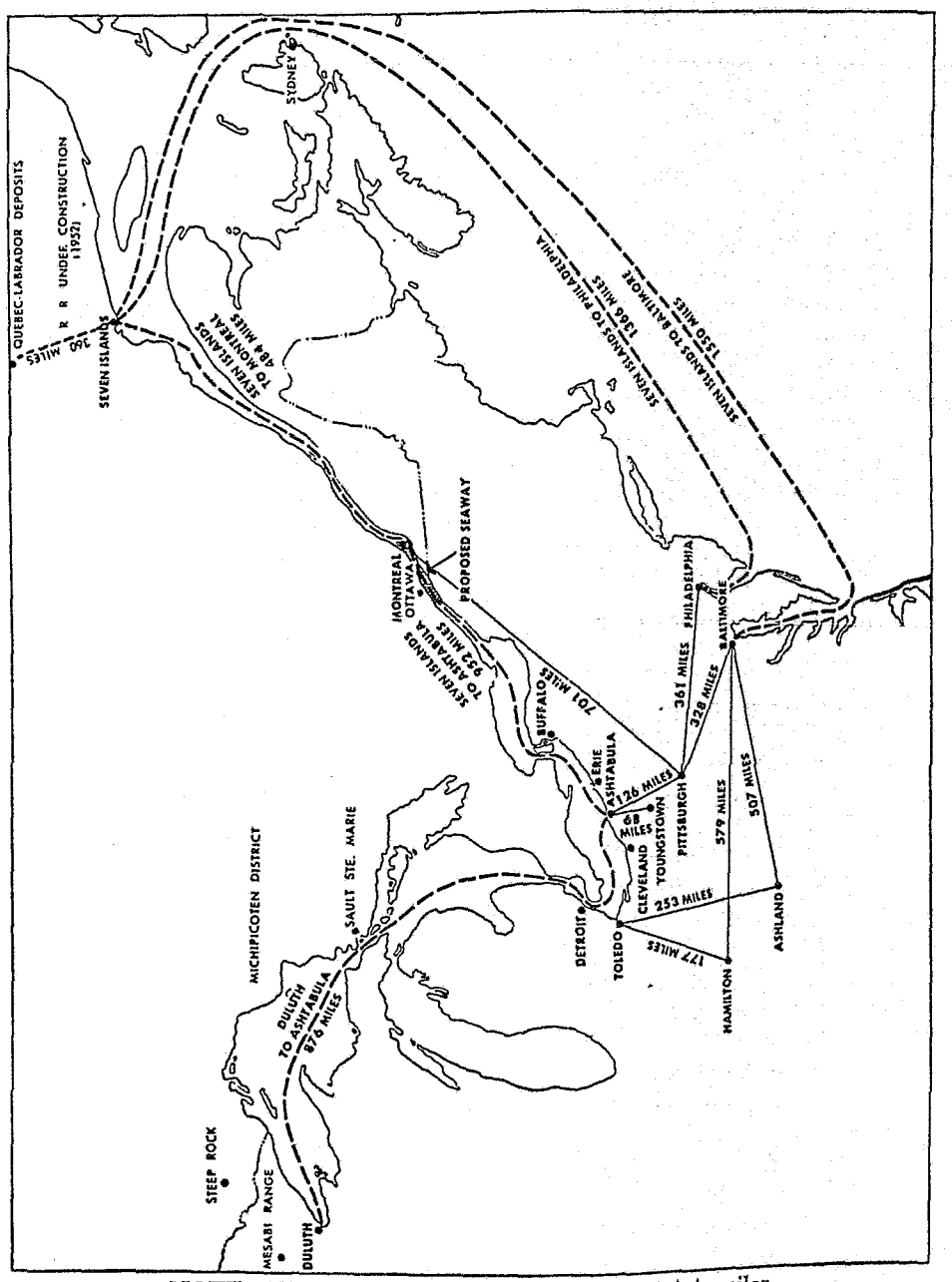
(8) Skillings Mining Review, July 31, 1954.
(9) Skillings Mining Review, August 14, 1954, p. 5.
(10) Skillings Mining Review, August 28, 1954, p. 7.
(11) Skillings Mining Review, September 4, 1954, p. 16.
(12) Distance by R.R., from Toledo to Hamilton, Ohio, is 177 miles.
(13) Skillings Mining Review, October 23, 1954.

RESERVES

The mine operating arm of the Iron Ore Company of Canada is the Hanna Company, whose Minnesota ore production for the past three years was second only to that of the Oliver Division of U. S. Steel. Their past mining record, together with their notable success in building the 360-mile Labrador railroad under most difficult conditions and on scheduled time, plus the great potential of the new ore fields, is proof of their ability to deliver a much larger annual tonnage than the 10,000,000 tons initially planned, whenever the need arises.

The following map shows the distances from the Labrador-Quebec iron ore field to the Central and Eastern consuming districts of the United States.

MAP NO. 2 — DISTANCES FOR LABRADOR ORE TO CENTRAL AND EASTERN ORE CONSUMING DISTRICTS



NOTE: All land and water distances are in statute miles, and all land distances are via shortest existing rail routes.

Courtesy of M. A. Hanna Company

VENEZUELA, SOUTH AMERICA

In February, 1954, 11 members of the Commission, the Director and Secretary made an inspection trip to the ore fields in Venezuela, namely: Orinoco Mining Company (United States Steel Corporation) and Iron Mines Company of Venezuela (Bethlehem Steel Company). The following facts, information and notes of interest were gathered.

Ownership and Procedure in Obtaining Concessions. All minerals and mineral rights in Venezuela are owned by the government. Lands lying within a National Reserve Zone require that concessions be obtained from the government and these have a time limitation of 40 years. As to lands lying outside of a Reserve Zone, after permission is obtained from the government, claims may be filed by denouncement, subject to a 50-year limitation, with option of renewal.

Topography and Rivers. The country is crossed by the Orinoco, one of the great rivers of the world, draining a tropical area of about 375,000 square miles. The Caroni River empties into the Orinoco near the site of the two ore transfer ports, described later herein. The known iron ore areas are south of the Orinoco and occur both east and west of the Caroni River. The area east of the Caroni River is mostly jungle country and west of the Caroni there is a marked change from jungle country to a great expanse of hills and plains, or savannas, with sparse vegetation.

About 50 miles down the Orinoco River from Puerto Ordaz the river divides and discharges to the north and northeast through several large channels called canos. The first is the Cano Macareo, and 11 miles farther down stream this again splits into two channels, the westerly one being the Cano Maname, which empties into the Gulf of Paria. The three-sided area through which these and many other branches flow to the sea is known as the Orinoco Delta. Its front on the Atlantic and the Gulf of Paria extends for some 200 miles, the whole area being subject to overflow during high stages of the river.

The periods of high and low river level occur with great regularity, following the seasons with the annual low in March and the high in August. The weather ranges in temperature from 65 degrees up to 90 degrees and the Trade Winds create a breeze almost constantly.

Early History. The first company to examine the iron ore areas of Venezuela was the M. A. Hanna Company, who sent engineers into the interior in the early 1930's. Important deposits were found, but the conditions at the time did not appear favorable and the concessions were not then developed.

Bethlehem Steel entered the field in the early 1940's and obtained concessions from the Venezuelan Government, including the iron ore deposits at El Pao, lying east of the Caroni River and south of the

Orinoco River. Their operating company is the Iron Mines Company of Venezuela.

United States Steel began investigations of Venezuelan ore fields in 1945 and obtained concessions in the area east of El Pao and later in the area west of the Caroni River. They formed the Orinoco Mining Company as their operating arm in Venezuela.

Operating Companies. The operating companies will be described separately herein, discussing Orinoco Mining Company first and Iron Mines Company of Venezuela second.

ORINOCO MINING COMPANY (U.S. STEEL)

In the area known as the Guayana region, Orinoco Mining Company holds the following concessions: (See Map No. 3.)

Cerro Bolivar Ore Body – 500,000,000 tons proven by drilling on area being developed.

Altamira and Rondon – unproven. Located to the northeast of Cerro Bolivar within a radius of 20 miles.

Monte Bello, Monte Romero, Monte Paraiso and Monte LaGrulla – tonnage unproven. Located to the northeast of Cerro Bolivar a distance of about 100 miles.

Piacoa – tonnage unproven. Located northeast of Cerro Bolivar a distance of about 120 miles.

It was pointed out that there is a belt of hills containing iron ore formations 50 to 80 miles wide south of the Orinoco River which extends 350 to 400 miles to the east and an unknown distance to the west.

Preliminary to obtaining the above concessions, an office was established at Ciudad Bolivar and permission of the Venezuelan Government was obtained to make a systematic survey of a region 80 by 200 miles in area, which is about the size of the states of New Hampshire and New Jersey combined. This survey was started by the company in 1945.

The country was unmapped and uninhabited, except along the river bank, or along the shores of small tributary streams flowing into the Orinoco. In 1946, field parties were sent out to examine the hills which were most accessible from the river along the belt extending from Ciudad Bolivar down to the low swampy area near the ocean. Many small deposits of high-grade ore were examined during the first year of investigation, but none was considered large enough to justify exploration by drilling. The geological parties traveled on foot and supplies were carried along on burros. Many square miles of dense jungle country were examined and mapped in a preliminary way. The com-

any was able to secure copies of three-dimensional aerial pictures
ı the possession of the Venezuelan Government, which were taken
ı the early 1940's by the U. S. Army in cooperation with that Gov-
ımment. These east-west flights spaced 20 to 30 miles apart, covered
ıuch of the area south of the Orinoco which was then being studied.
ıtensive study of these pictures, combined with the knowledge al-
eady gained from the ground survey, indicated that a complete aerial
ırvey would be valuable for furnishing accurate maps of the region
nd for providing a complete set of vertical aerial pictures for topo-
raphic and geological study with the aid of stereoscopic instruments.
contract was let to the Fairchild Aerial Surveys, Inc., of Los Angeles,
o take the pictures and submit accurate mosaic maps of the district.
he aerial photographic survey of an area of about 11,000 square
iles was accomplished in 1947.

Oliver Iron Mining Company obtained title to the Cerro Bolivar hill
y denouncement, and soon afterwards acquired additional ore bodies
n other hills in the vicinity known as Rondon and Arimagua. All of
ıe concessions of the district west of the Caroni River, being at that
me outside the limits of a National Reserve Zone, were obtained
y denouncement. After these discoveries, that part of the State of
olivar was also declared a part of the National Reserve, and further
oncessions had to be acquired by negotiations with the Government.

Cerro Bolivar. Cerro Bolivar is the only Orinoco Mining Company
oncession developed and operating. The ore forms the top and outer
ıell of the mountain which is about 1½ miles wide and 4½ miles
ng. The average grade of the ore (dry analysis) is about 63.5% iron,
106% phosphorus, 2% silica, 0.11% manganese, 1.90% alumina
ıd 5.20% loss on ignition. The moisture content probably averages
out 8%. The natural iron content is calculated to be about 58.40%
on. The ore is practically sulphur-free and does not contain any
ther objectionable element. It is a mixture of hematite, limonite and
small percentage of magnetite. The limonite has been formed by
ıe weathering of the other minerals of the original ore rock. The ore
generally porous and easily broken. It can be drilled easily with
ckhammers or churn drills. In places the weathering has broken
own the dense, hard, laminated hematite and magnetite into loose
nd-like grains, which, although very high in grade, will require
ntering or nodulizing to prepare a suitable product for blast furnace
nelting.

The highest point is 2,800 feet above sea level and the peak of the
ountain is 1,800 feet above the surrounding savanna. Samples of the
on ore picked at random by members of the Commission while on
ıe mountain were brought back to Minnesota and sent to the State

Laboratory at Hibbing for analysis. The returns showed the dried iron content of those samples to be 67.50%.

The first mining on Cerro Bolivar is being conducted on three benches 50 feet wide which are now being cut near the summit. The plan is to mine from the top downward along the slopes of the mountain. The operations will be the reverse of open-pit mining, where the iron ore is dug from excavations below ground level. There is no overburden and the ore deposits cover the surface of Cerro Bolivar down to an average depth of 250 feet. In some parts the deposit of ore has cemented itself into more or less a solid mass and must be drilled and blasted to break the mass into sufficiently small pieces for handling by mechanical shovels. For the actual mining of the ore, two electric shovels each having a dipper capacity of 8.0 cubic yards and one diesel shovel of 6.0 cubic yards dipper capacity are used.

Towns built. Orinoco Mining Company has built new modern towns at both the river port (Puerto Ordaz) and at the mine site of Cerro Bolivar (Ciudad Piar). The distance between the two towns, Puerto Ordaz and Ciudad Piar, is about 80 miles. The towns are complete with residences, schools, hospitals and other civic structures. The construction work is now largely completed. Electric power, water and sewer systems, maintenance and service facilities, office and warehouse space, a radio communication system and airports have been set up.

Ore Carrying Railroad. Orinoco Mining Company's new railroad extends 90 miles from the western crest of the mountain, Cerro Bolivar, to the river port, Puerto Ordaz. The track is standard gauge, with heavy steel. Creosoted ties are imported from southern United States. Crushed stone ballast is used to a depth of 12 inches below bottom of ties. There are four long passing tracks and the capacity of the system with high frequency radio control will practically equal that of a double track railroad. Two loaded trains per day will carry 5,000,000 tons annually. Empty trains take the nearest passing track when a loaded train is approaching. The line is always clear for loads.

Highway. A good highway has been built by the company, paralleling the railroad, connecting the mine and the river port. It was in the final stages of completion when the Commission was there and drove over it from Puerto Ordaz to Cerro Bolivar.

River Port. Puerto Ordaz, Orinoco Mining Company's port, at the northern end of the railroad, is on the south side of the Orinoco River just west of the mouth of the Caroni River. At this port Cerro Bolivar ore is crushed and transferred to large ore carriers for shipment to gulf or eastern United States ports.

Power Plants. A power plant with two 2,500 KW electric units has been built near the base of the mountain, Cerro Bolivar, to furnish

electric current for the town and the mine. At Puerto Ordaz there is a steam plant with two 6,000 KW units, with provision for a third unit. Boilers are oil fired.

Channel Dredging. In order to avoid a second transfer of ore and a second dock at seaboard, the Orinoco Mining Company decided to dredge a channel down the Orinoco River from Puerto Ordaz, then down the Cano Macareo to the ocean, at a cost of $18,000,000. By arrangement with the Venezuelan government the Company will be reimbursed by tolls charged for use of the channel or through its taxes. The dredging to 26 foot depth at low water was completed in August, 1953. Recently the channel was deepened to 35 foot depth. It is likely that some re-dredging will be required each year to maintain the full channel depth at low water.

Field Construction. Orinoco Mining Company began work of field construction in February, 1952. Early shipments of construction equipment to the port at Puerto Ordaz included that needed for railroad, camps, highway, etc. One year later, 7,000 men were employed on construction, 5,100 of whom were Venezuelans. All cement and petroleum products and most of the lumber, tools and minor supplies were Venezuelan products. Over 300,000 tons of equipment for use in construction of the whole project has been brought in by boat from the United States to Puerto Ordaz.

The following information taken from U. S. Steel News, January, 1954, touches on some interesting bits of data about the Orinoco Mining Company project, given to the Commission members while in Venezuela.

> "The creation of such a large industrial project in such a short time is attributable, in part at least, to a policy of using Venezuelan materials and manpower to the maximum extent possible. Contracts were awarded to some thirty Venezuelan firms which, in turn, placed sub-contracts with other Venezuelan companies.
>
> "*****Throughout the period of construction, nationals (Venezuelans) were put into skilled jobs as rapidly as they could be trained. (Schools were set up for training.) Venezuelans, for example, operated all twelve of the 2-cubic yard shovels that were used for excavation and grading.
>
> "In a similar manner, Venezuelans are being groomed for specialized mining company jobs. Typical of such tasks is the operation of the Diesel-electric locomotives which haul the ore cars from Cerro Bolivar to Puerto Ordaz. There are nine of these powerful 180-ton locomotives, and all of them will be manned by Venezuelans as soon as they have completed their training. Many nationals have been employed for the company's clerical

> positions, and an increasing number, with technical educations, are assuming engineering responsibilities."

Operations. Ore operations begin at the top of Cerro Bolivar mountain where the ore is right at the surface. The ore is loaded by power shovels into heavy trucks which travel down-grade to the railroad loading docks near the western summit of the mountain. Here the ore is transferred to the bins at the docks and from there is loaded into standard steel railroad cars for the 90-mile trip to the ocean shipping dock at Puerto Ordaz. Ore shipments are taken from the benches now being constructed for systematic future mining operations. Ore cars are of the 4-axle type, of 90 gross tons capacity, and are equipped with standard Westinghouse air brakes and an additional braking device for greater safety. Ore trains start from an assembly yard at the west end of the mountain top at an elevation of about 1,000 feet above its base. Trains move down a 3 percent grade for about 7 miles to the base of the mountain and continue mainly on down-grade to Puerto Ordaz. Locomotives are Diesel-electric, 180-ton 1,600 HP units. Three units are used to handle a train of 123 cars. The round trip running time from the assembly yard at mountain-top to Puerto Ordaz is about 8 hours.

Dock. The dock at the railroad terminal is located just west of the mouth of the Caroni River on the south bank of the Orinoco. Because of the 40-ft. variation in river level between wet and dry seasons, a floating type dock is used, being fully efficient and more quickly built. The dock is made up of three huge barges which carried their own equipment for setting up as a dock. The first barge came in during the month of May 1953, and within a week it had been set up and was being used for unloading supplies. The other two barges came in between May and September and were assembled, making a very modern, sturdy and permanent loading dock, 1,000 feet long, designed to carry a ship-loader weighing 750 tons, plus a dock load of 300 lbs. per square foot.

The ore handling and storage system is designed to receive the run-of-pit ore in cars which are dumped in pairs by a rotary dumper into a reducing crusher from which it is moved to a stockpile by bridge conveyor. The ore is automatically weighed while moving on the conveyor on its way to ship loading.

Some of the outstanding features of the ore-handling system are:

1. Capacity of 1.67 tons of ore per second.
2. Size and speed of car dumper probably one of the most rugged ever built.
3. Massive gyratory primary crusher installed in a pit over 100 feet deep.

4. Reclaiming tunnels under the ore stockpile and the rotary plows for feeding ore to conveyor belt.
5. Continuous automatic sampling system which takes ore from the traveling belt.
6. Use of apron feeders with transfer belts for more uniform belt loading.
7. Use of a direct current variable voltage system from reclaiming tunnels to ship-loader.

Total investment to ship first cargo of ore by Orinoco Mining Company was reported as being about $160,000,000. Orinoco Mining Company feels it must produce iron ore which it can deliver at Pittsburgh at a cost competitive with Minnesota ore and that any of the Venezuelan product in excess of 3 to 5 million tons per year would have to get into the Pittsburgh area where it would be directly competitive with Minnesota ores. Early in 1954 the Company publicly offered the ore for sale F.O.B. vessel at Puerto Ordaz at $5.80 per ton for 58% natural iron.

IRON MINES COMPANY OF VENEZUELA (BETHLEHEM STEEL COMPANY)

About 38 miles south of the junction of the Orinoco and Caroni Rivers, the Iron Mines Company of Venezuela have a deposit of iron ore of about 60 million tons proven, on a mountain called Boccardo Hill. They also have some other concessions where the tonnage of iron ore has not been proven. (See Map No. 3.)

The ore is hard massive hematite, 63% to 66% iron, as shipped, though on average drill hole samples it is expected that the whole deposit will average 63% dry or 58% natural. Samples picked up at random by members of the Commission were brought back to Minnesota and sent to the State laboratory at Hibbing for analysis. The reports showed the ore to be 68.50% dried iron. The hard ore is of a type that may be used either in blast furnaces or open hearths. The main deposit now being mined is a bowl-shaped formation about 2,600 feet long and 1,700 feet wide on top of a hill rising several hundred feet above the surrounding country. The center of the bowl-like formation is filled with an overburden consisting mainly of clay, with some igneous material, up to 425 feet thick, but averages 225 to 250 feet, and must be stripped before all the ore can be mined. The ore body itself varies from a few feet to approximately 400 feet in thickness. The mining method adopted is one of slicing off the top of the hill in benches about 42 feet high by standard open pit methods.

Construction work. Actual construction work of the Iron Mines Company of Venezuela was started in February, 1941 but was brought

to a virtual standstill during and immediately following the war years. In February, 1947 the company acquired two properties on the Gulf of Paria, known as the Valley of Jamaica and the Valley of Carenero for use as a transfer station named Puerto de Hierro, or "Iron Port." Construction was started here in May, 1947 and completed in July, 1950. $50 million was invested by the Company before the first cargo of iron ore was moved.

Towns Built. The Company has built three towns or villages: El Pao at the mine site, Boccardo Hill; Palua, the port 38 miles from El Pao; and Puerto de Hierro which is the terminus for the river craft. Two-family houses are provided for workmen and single dwellings for foremen, office workers and the staff. Practically all houses are of one-story construction adapted to the tropical climate – cool, fully screened and termite proof. All have electric lighting, modern plumbing and sewer connections. The villages are laid out with wide, well-lighted hard surfaced streets. All water passes through modern treatment plants before use. El Pao gets its supply from the Caroni River pumped through a 23-mile, 8" pipe line to a reservoir of 11,000,000 gallon capacity. Palua draws water from the Orinoco and Puerto de Hierro draws water from a dammed-up mountain stream three miles away.

Attractive schools have been built in all villages. The company pays all expenses of maintaining the schools, including teachers' salaries, books and supplies. However, appointment of teachers and all school administration are functions of the Venezuelan government.

Clean sanitary commissaries are operated in all communities. These have walk-in refrigerated storage boxes for meat, fruit and vegetables and are well stocked with groceries, shoes and dry goods. Space is also made available for native merchants in the village.

Many of the workers who were employed by the company during the construction period have cleared tracts in the jungle along the railroad and highway. Here they have settled down on small farms where they raise corn, bananas, yams, beans and other fruits and vegetables for which they find a ready market in the villages.

The three villages maintain medical service and hospitalization which is free to all employees and their families. Two doctors, with a staff of nurses, are in attendance at each place. The Government allows only Venezuelan doctors and dentists to practice in Venezuela. Use of DDT and other precautionary measures have proved very successful in combating malaria.

In February, 1954 the company was running two shifts a day at the mine in El Pao, – 7:00 A.M. to 3:00 P.M. and 3:00 P.M. to 11:00 P.M. They have 67 employees from the States and about 1,200

Venezuelan nationals. They work six eight-hour days and get paid for 7 days a week. For overtime, over 8 hours a day, or over 44 hours per week, they are paid time and a half and have 15 days a year vacation. Electric shovel operators are paid 38 Bolivars (about 30 cents to a Bolivar) a day; truck drivers – 29 to 35 Bolivars a day; bull dozer operators are paid 24 Bolivars a day. In addition the worker is entitled to certain "fringe benefits." If the company dismisses one who has worked for them for 10 years, he is entitled to advance notice and one month's pay; 5 months' compensation (15 days for each year worked), which is job insurance, giving him time to look for a job.

Operations — Railroad, Docks, River and Ocean Transport. At El Pao the ore is hauled down-grade by truck to a large crusher and goes into 70-ton railroad cars for shipment over the 38-mile railroad to the docks at Palua, about a two hour trip. Four trains daily of 36 cars each are estimated to carry enough ore for the desired ultimate production of 3,000,000 tons annually. The Company's port at Palua is on the south bank of the Orinoco River, but is on the east side of the Caroni, near its mouth. Here the ore cars are unloaded into a large long storage pocket cut out of solid rock. A tunnel running lengthwise underneath the pocket has a 48-inch belt conveyor, onto which the ore is delivered by roll-type feeders that take the ore from air-operated chute gates in the tunnel roof. The tunnel conveyor discharges the ore to a second 48-inch belt 537 feet long, placed at right angles to the ore pocket. No. 2 conveyor, moving at 450 feet per minute, extends onto a 416 ft. steel ship-loader which projects out beyond the dock over the river.

Five 4,500-ton barges with 14 ft. loaded draft and one twin screw river vessel of 8,500 ton capacity at maximum draft are used to transport the ore from Palua to tidewater (Puerto de Hierro). Commission members saw the twin screw river vessel being loaded the day they were at Palua. The barges are towed by 1,300 HP ocean-going tugs to Puerto de Hierro, where the ore is transferred to ocean steamers. They travel via Cano Manamo past Pedernales and across the Gulf of Paria to Puerto de Hierro, a distance of 230 miles. Due to their greater draft, larger ships must travel the 395 mile route through the main channel of the Orinoco – the Boca Grande – and up the coast. During the season of highwater they may return empty to Palua by the shorter Pedernales route. Normally the barges will make the round trip from Palua to Puerto de Hierro in three days, as will the larger vessels when they can use the shorter route back to Palua.

Communication with the outside world is mainly by airplane. The company has built an airfield at San Felix, 2½ miles from Palua, which it maintains for daily use by commercial airlines. Puerto de

Hierro has daily connections by means of company launches, free to all, with nearby Guiria and its adjoining airfield.

One of the major maintenance problems encountered is that of keeping the jungle from encroaching upon the highway and the railroad. A gang of workers with machetes is kept busy cutting the growth. Experiments are now being conducted with chemical eradicators and weed killers.

SUMMARY OF VENEZUELA, SOUTH AMERICA.

Potential Reserves and Shipments

While any present estimate of Venezuelan iron ore reserves within a distance of 400 miles from the coast would be conjectural, recent developments strongly indicate a potential reserve at least comparable in tonnage to that of the Mesabi Range in 1900 with an average grade of ore higher than the Mesabi average.

In any estimate of probable future shipments, the length of shipping season has to be considered. In Minnesota the season is about eight months. Venezuela has conditions favorable for year-round mining and transportation.

Orinoco Mining Company plans to ship 3 million tons of ore this year. Two million tons will go to the Fairless Works at Morrisville, Pa., and one million tons to Mobile, Alabama. By 1956 they plan shipping five million tons a year. The distance down the Orinoco River and Cano Macareo from Puerto Ordaz to the Atlantic Ocean is about 175 miles. Approximately seven days are required to make the trip from Puerto Ordaz to Morrisville, Pa. Based on operating only one eight-hour shift per day at the known rate of 6,000 tons per hour, Orinoco Mining Company can mine, move by rail to port and load into ocean vessels, 48,000 tons per day. Counting fifty five-day weeks, or 250 working days per year, the present facilities could then produce 12 million tons annually. Doubling the port capacity would mean single daily shift production of 24 million tons per year without reaching the capacity of either the mine or the railroad.

Iron Mines Company of Venezuela ship about 2 to 3 million tons of iron ore to Sparrows Point, Maryland each year. Through this substitution Bethlehem Steel is supplementing the declining Chilean supply. The Chilean ore was all open pit mining and achieved three million tons per annum. The Sparrows Point plants were built and intended to use foreign ore entirely. None of this ore being mined by Iron Mines Company of Venezuela in this development will be sent to Pittsburgh or to plants now supplied by Lake Port shipments.

Notes of Interest. The Venezuelan law requires that at least 75% of the labor be Venezuelan. Their government has authority to waive

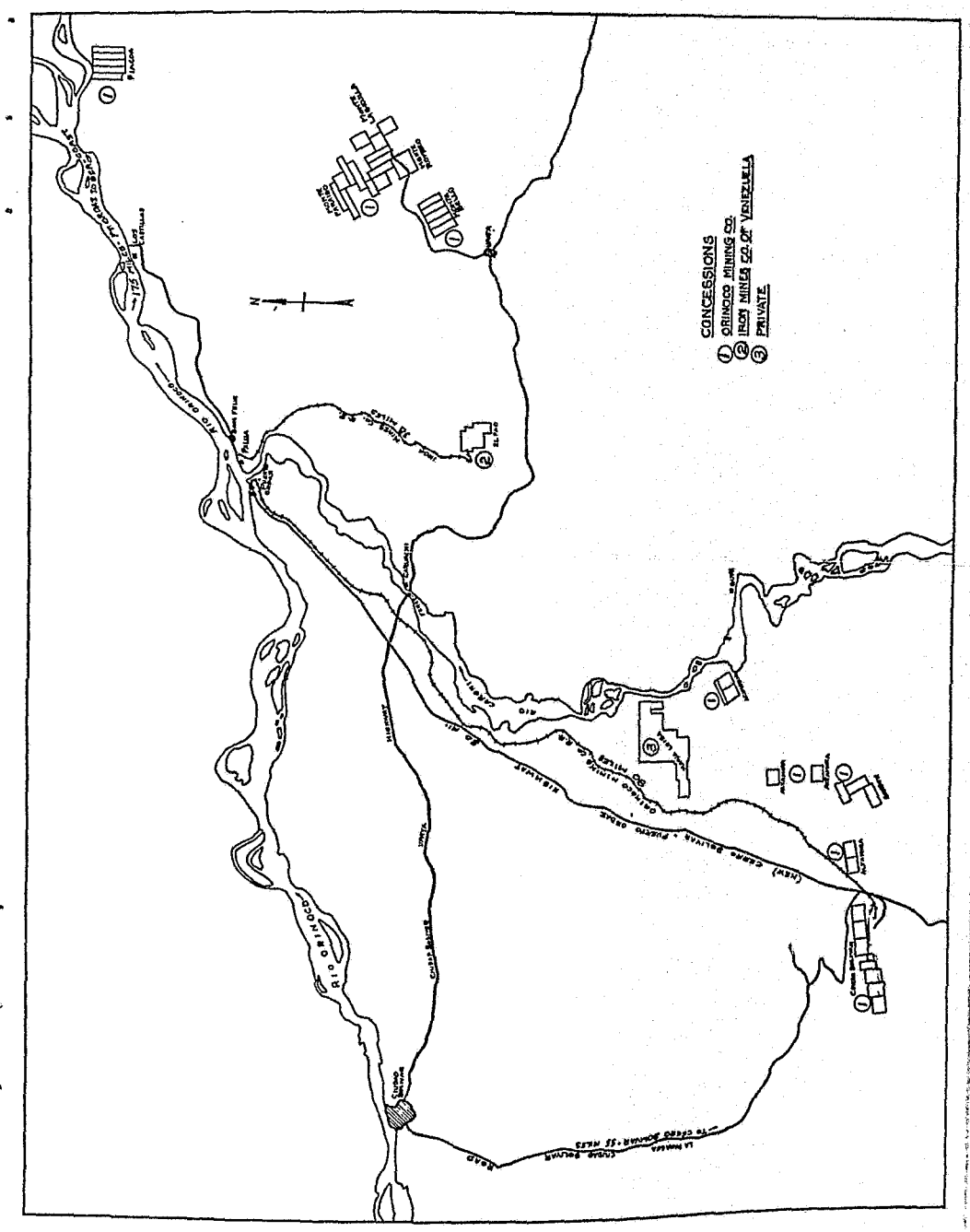
that requirement during the construction and break-in periods. This applies up through clerical staff, through engineering staff, etc. The policy of the companies is to train the Venezuelans as far as possible and exceed the government requirements wherever possible. The mining and oil companies operating in Venezuela have found the Venezuelans after being properly trained, are very efficient. The basic wage rates probably average about half those obtaining on the Mesabi Range, fringe benefits are more liberal and together closely approximate our labor costs.

Under the Venezuelan law there is provision for Profit Sharing, which is as follows: Article 76 of the Labor Law (Nov. 3, 1947), provides that each enterprise is obliged to distribute among all its workers at least ten per cent of the net profits obtained by it during the fiscal year. This is a fringe benefit. But Article 78, which does not purport to limit Article 76, provides that the individual participation of each worker may in no case exceed two months' salary or wages.

The maximum profit-sharing by any company is two months' salary per worker and if a company makes such distribution to its workers it has satisfied all its obligations under the profit-sharing provisions of the Labor Law even though such distribution is less than 10% of the company's net profits for such year.

If the mining company pays two months' additional salary per worker in a given year when 10% of its net profits exceeds such payment, it does not have to retain the excess for distribution in future years when it fails to earn profits to permit a distribution of two months' salary per worker.

MAP NO. 3
CONCESSIONS IN VENEZUELA



No report on the iron ores of Minnesota would be complete without a chapter on taconite. Many years of research by the Minnesota Mines Experiment Station, the Battelle Institute and the mining companies are showing good results in the manufacture of high grade concentrate from the iron-bearing rock. Several excellent reports have been written on the geology of the area and on the processes that have been developed for doing in a few hours the work of many centuries by natural forces.

WHAT IS TACONITE?

Briefly, it is a fine-grained hard iron-bearing rock; the Mesabi Range formation within which are found the deposits of iron ore.

OCCURRENCE OF THE TWO MAJOR TYPES

There are several different types of taconite. The two most important classes are the magnetic and the non-magnetic taconite.

The taconite of the eastern third of the Mesabi Range is described as being mainly of the magnetic variety. The middle third has areas containing both magnetic and non-magnetic taconite. The western third of the range has little magnetic taconite.

MAIN LAYERS OF IRON FORMATION

As traced from records of drill-holes in both ore and taconite, the iron-bearing rocks occur in four main layers or horizons:

1. Upper slaty formation, high in alumina content;
2. Upper cherty formation, high in silica content;
3. Lower slaty formation; and
4. Lower cherty formation.

MAIN SOURCES OF MAGNETIC TACONITE

On the eastern Mesabi Range, the upper cherty formation is that described by geologists as the main source of magnetic taconite in that area. In the middle area of the Mesabi Range, magnetic taconite is found in both the upper and the lower cherty formation. It is now considered that the magnetic type of taconite is the one that is commercially important.

PRODUCTION OF TACONITE CONCENTRATE TO 1954

Until 1951 all of the taconite concentrate made in Minnesota was produced at the Erie Pilot Plant near Aurora.

In 1951 the Babbitt Plant of Reserve Mining Company was in pro-

duction; and in 1953 the Pilotac Plant of Oliver Mining Division, U. S. Steel Corporation at Mountain Iron began production of taconite fines which were shipped by railroad to the Extaca Plant at Virginia to be agglomerated.

The following figures show:

Col. 1. Total tons of taconite product by years.

Col. 2. Total tons of fine iron ore recovered and not agglomerated.

Col. 3. Total tons of finished pellets, sinter or nodules from taconite.

Year	Col. 1	Col. 2	Col. 3
1949	45,290	45,290	None
1950	129,666	88,737	40,929
1951	99,977	21,765	78,212
1952	114,396	1,837	112,559
1953	619,438	118,246	501,192
TOTAL	1,008,767	275,875	732,892

The above figures are of interest since they show the increasing output of finished product in the total production.

HISTORY OF TACONITE

For many years, the need of experimental work on taconite was urged by Professor E. W. Davis, in charge of the Mines Experiment Station at the University of Minnesota. With the able assistance of Messrs. John J. Craig and H. H. Wade, much valuable pioneer work was accomplished by the Station in perfecting the separation of iron particles from iron bearing (taconite) rock by use of fine grinding and magnetic classifiers. The iron ore thus recovered is a very fine powder and cannot be shipped or used in a blast furnace in that form. This necessitated a long and persistent study of methods for compacting this fine powder into pellets, called agglomerating. Methods have been found.

The attention of the major mining companies was actively aroused by the terrific impact of World War II on the formerly large reserves of high-grade, open pit ore in the Mesabi Range; and several experimental plants were built to carry on the work of making iron ore from taconite, the hard, close-grained iron-bearing rock from which, through ages of time, nature has been producing iron ore.

First came the experimental laboratory of Pickands-Mather & Co. at Hibbing; the larger experimental laboratory of the Oliver Company in Duluth; experimental work at the Battelle Institute, Columbus, Ohio; and continued studies at the Minnesota Mines Experiment Station. This was followed by the building of the Erie Taconite Pilot Plant of Pickands-Mather & Co. near Aurora, in 1947; the Extaca

Plant of Oliver Mining Division of U. S. Steel Company at Virginia in 1950-51; the pilot plant completed by Reserve Mining Company at Babbitt, Minnesota; the pilot plant of Oliver constructed near Mountain Iron, to be followed by the new commercial plant of Reserve Mining Company at Silver Bay and the new commercial plant of Erie Mining Company a few miles east of the present Erie Plant.

Under the heading of "New Developments" in this section, the above mentioned commercial plants are more fully described.

TACONITE RESERVES

In a recent technical article[1] Professor John W. Gruner of the University of Minnesota described the basis of his estimate reported to this Commission on May 23, 1952, of 5,100,000,000 tons of crude magnetic taconite minable by open pit methods. He used a maximum mining depth of 230 feet below the top of the iron formation and a width of one mile for a length of 60 miles from Mesaba to Nashwauk.

He states that another billion tons might be added for magnetic material in the central part of the range, formerly regarded as beyond recovery. This would bring his estimated total to about 6 billion tons, figured to yield 2 billion tons of concentrate.

In addition, assuming that underground mining of taconite may later become economically possible, he estimates another 10 billion tons.

On April 23, 1954, Mr. H. S. Taylor, consultant of Reserve Mining Company, gave as his estimate 10 billion tons of crude magnetic taconite recoverable by open pit methods that would yield at least 3 billion tons of concentrate.

There are also billions of tons of non-magnetic taconite in Minnesota. This material is being studied by metallurgists who are confident that this material, not now economically treatable, can eventually be utilized to produce high-grade ore.

Minnesota, however, has no monopoly on taconite. There are billions of tons of it (called Jasper) in Michigan and in Canada.

BENEFICIATION OF MAGNETIC TACONITE

Separation of Fine Ore from Rock Particles

In taconite, which is very hard and tough, the iron particles are very fine, and the material needs not only repeatedly finer crushing, but extremely fine grinding. It has been proved that the iron particles can be recovered on a commercial scale.

(1) Mining Engineering, March, 1954. A Realistic Look at Taconite Estimates by John W. Gruner.

Agglomeration General Note

Agglomeration, the final step, has proved more difficult, but now appears nearer to success on a substantial scale. This has to be done to make the product usable in the blast furnace, since the fine ore particles would be blown out of the top of the furnace by the high air pressure.

Sintering

Sintering of the finely ground taconite is made difficult due to the impossibility of getting enough air through the bed of fine ore on the sintering machine. This is one method used to agglomerate or put together fine particles of ore (too fine for use in the blast furnace) into coarser pieces that will withstand handling, and that can be used to advantage in the blast furnace. Briefly, this process includes the following steps: A mixture of fine ore and coke, in the ratio of 100 parts of crude ore and 15 parts of coke, with a small amount of petroleum, is made in an enclosed bin above the head of the sintering machine. The mixture of ore and fuel is fed on to the moving steel bar conveyor in a flat bed varying in depth from 8 inches to 15 inches, over the full 6-foot width of the Dwight-Lloyd sintering machine. Carried along at 5 to 6 feet per minute, the fuel in the mixture is ignited as it passes under a row of burning gas jets. Induction fans, set below the moving load, pull the fire downward through the ore bed, and the burning under induced draft continues for the full length of travel, or over 100 feet. By that time the fuel has all burned out, and the ore, semi-fused into a spongy, white-hot mass, breaks off from the bed as it projects over the end pulley and slides down a steel chute, breaking into smaller chunks, as it drops into a steel bin under a cooling spray. Then it is taken by a bucket conveyor to a storage bin for further cooling before loading into ore cars. It should be noted that sintering merely improves the physical structure of the ore, but does not reduce or remove any of the impurities in the ore, beyond driving off all moisture.

The method of agglomeration by pelletizing has been the subject of much work and study both on the Mesabi Range, at the University of Minnesota Mines Experiment Station,[2] and at the Battelle Institute, at Columbus, Ohio.

Agglomeration by Pelletizing

In this process, the fine iron powder, partially de-watered in a centrifugal drum, is passed through a revolving cylinder. As the ore is repeatedly turned over, it forms into small pellets (much like the effect of rolling a snowball in melting snow), most of which are strong enough to permit careful handling by conveyor to a special furnace for hardening, after which they will stand shipment.

(2) See Information Circular No. 6, Jan. 17, 1951, by E. W. Davis and H. H. Wade—Agglomeration of Iron Ore by the Pelletizing Process.

These pellets, having a high percentage of voids, are said to be highly desirable blast furnace feed.

Nodulizing

Nodulizing, or making of nodules, is another process used to form the fine ore particles into small balls, hardened by heat. At some nodulizing plants in the Pittsburgh district, about 7½% of finely crushed limestone is mixed with the fine ore. This limestone serves two purposes: first is that of a binder, making harder nodules, that are not easily broken in handling; and second, to serve as part of the flux needed to absorb the impurities in the molten iron, when the nodules are reduced in the blast furnace.

The nodulizing process makes use of a long rotary kiln, lined with firebrick, and gas fired to nearly 2,200 degrees F. The mixture of fine ore and crushed and ground limestone is fed into the upper end of the long, rotating inclined cylinder. This is rotated rather slowly, the ore being tumbled over and over as it rises and drops on the inside of the heated tube, taking the form of small nodules, not over one-half inch in diameter, hard enough to withstand handling without breakage.

Operating Problems

Some problems in connection with taconite reduction:

Drilling and Blasting

1. The drilling problem has been solved by what is known as "jet piercing," using kerosene, oxygen and superheated steam. The combined heat and moisture, blown against the bottom and sides of the blast-hole cause the rock surface to chip, or spall, and the pieces are blown out of the hole by the high pressure of the steam jet. Remarkable progress in drilling 8-inch to 10-inch holes is made by this method.

The drill holes, about 30 feet deep, are usually about 20 feet apart, and spaced about 12 feet back from the crest of the cut, and are fired in series for best breakage. Secondary blasting is avoided by use of a "skull-cracker," or heavy iron or steel weight, attached by chain or cable to the end of a power shovel boom, and allowed to drop on the larger chunks, most of which break up readily under this treatment.

Crushing

2. Aside from abrasion, always heavy with any hard rock, the job of crushing gives little trouble.

Fine Grinding

3. Fine grinding also causes heavy wear on movable parts.

Water

4. Water supply is a major problem in the processing of taconite on the range, though not in the projected Silver Bay plant of Reserve Mining Company. The Erie and Babbitt plants get water from lakes in the

area, using a long supply pipe line. Roughly two-thirds of the water can be reused after settling out clear in the waste settling basin.

Waste Disposal

5. Waste disposal is also a serious problem at plants on the range, since the quantity of rejects will be at least double the amount of concentrate recovered. As the waste is pumped from the plant to waste reservoirs in suspension in water, larger areas will be needed for settling basins, and impounding dikes will have to be built ever higher as the sands accumulate.

EXPERIMENTS AND DEVELOPMENT

In September, 1951, this Commission made its first inspection trip to the iron ranges in Minnesota. Two pilot plants were experimenting on the production of merchantable iron ore from what is known as taconite; – The Erie Mining Company plant at Aurora and the Reserve Mining Company plant at Babbitt. These plants were producing pellets from magnetic taconite.

After another inspection trip by the Commission in June, 1953, to the taconite areas to gain first hand information on the progress being made in the production of merchantable iron ore, the Commission conducted hearings. Mr. H. S. Taylor, President, Oglebay-Norton Company, consultant company for Reserve Mining Company; Mr. H. C. Jackson, one of the partners of Pickands-Mather, managing agents for Erie Mining Company; and Mr. Lloyd Severson, Vice President, Mineral Development, of Oliver Iron Mining Division, United States Steel Corporation, all appeared before the Commission and explained fully the programs of their respective companies for future taconite development.

New Developments: 1. Reserve Mining Company. 2. Erie Mining Company. 3. Oliver Mining Division, United States Steel Corporation.

1. RESERVE MINING COMPANY

A. **Location:** Silver Bay (Beaver Bay) and Babbitt (47 miles Northwest of Silver Bay).

B. **Construction and Production Program.** The Reserve Mining Company which had been operating a pilot plant at Babbitt has commenced construction of a large commercial plant at Silver Bay on Lake Superior. Sufficient water supply is not available at Babbitt. The crude taconite rock will be mined or quarried at Babbitt, passed through the primary crusher and then loaded on ore cars for delivery to the plant at Silver Bay, 47 miles away. This operation requires employees' housing and other facilities at Babbitt and Silver Bay.

The investment in this undertaking is estimated at more than $160,000,000. Until the new plant is completed at Silver Bay in 1955 the pilot plant at Babbitt will continue experimentation and production of approximately 250,000 tons of taconite pellets per year. It is anticipated that in 1955 the commercial plant at Silver Bay will produce one million tons of taconite pellets per year. The production schedule calls for 2,500,000 tons in 1956; 3,300,000 tons in 1957; 4,000,000 tons in 1958. The ultimate goal of Reserve Mining Company is to enlarge the plant to produce 10,000,000 tons of merchantable taconite pellets per year.

C. **Railroad Facilities.** A 47 mile private ore carrying railroad has been constructed to move the crude ore from Babbitt to Silver Bay.

D. **Power Plant.** The smallest feasible commercial plant should produce 2½ million tons of iron ore per year. This requires the large power plant which has been built at Silver Bay and it will accommodate expansion to care for the ultimate goal of ten million tons of taconite pellets annually.

E. **Harbor, Dock and Storage Facilities.** A harbor, loading docks and storage facilities have been constructed at Silver Bay.

F. **Estimated Employment:**

1954 – 360 people at Babbitt
1955 – 1,100 people at both Silver Bay and Babbitt
1956 – 1,400 people at both Silver Bay and Babbitt
1957 – 1,700 people at both Silver Bay and Babbitt
1958 – 1,800 people at both Silver Bay and Babbitt

G. **Townsites.** Reserve has constructed 171 homes at Babbitt and plans to construct 200 more. It has completed 253 homes at Silver Bay and plans to construct 300 more. These townsites are laid out with streets, water, sewers and all facilities which are usually found in a modern city or village. Buildings for various businesses will naturally follow. When completed, Silver Bay and Babbitt will have an anticipated population of about 4,500 people each. The homes will be sold or rented to employees.

H. **Schools.** Reserve has constructed at Silver Bay a modern school building at a cost of $750,000 operated by the Lake County School District. A grade school building was constructed at Babbitt by Reserve in 1953.

2. ERIE MINING COMPANY

A. **Location:** Plant and mines located near Aurora, townsite to be Partridge Lake; dock facilities are at Two Islands (near Schroeder).

B. **Construction and Production Program.** In January, 1954 Erie Mining Company started construction of all facilities necessary to produce 7½ million tons of taconite concentrate per year. The plant is designed for expansion to 15 million tons capacity per year, but there are no plans at the present time to go beyond 7½ million tons. It is planned that production will start in the middle of 1957 and 7½ million tons annually will be reached by 1958.

The project, it has been announced, will cost approximately $300 million and further engineering estimates indicate that it will go to $360 million.

C. **Railroad Facilities.** Railroad from Partridge Lake (near Aurora) to Two Islands (Schroeder) is 73 miles long. The railroad, a private carrier, will be used to transport crude taconite rock from the mine to the mill, a distance of about five miles, and also to transport the finished taconite product from the plant at Partridge Lake to Two Islands.

D. **Power Plant.** Power required will be approximately 100 kilowatt hours per ton. On an annual basis of 7½ million tons, power requirements will equal the combined electrical consumption of the Cities of Duluth and Superior. The power plant is being constructed at Two Islands.

E. **Harbor, Dock and Storage Facilities.** These are under construction at Two Islands. Here the finished taconite pellets will be stored and then loaded for shipment to the blast furnaces.

F. **Estimated Employment.** 2,500 construction workers in 1954 and it may go to a peak of 5,000 in 1956. When the plant gets into operation, plans call for a total of about 3,350 employees, of which about 3,150 will be located at the plant site (Partridge Lake) and 200 to 220 at Two Islands.

G. **Townsite.** The townsite is to be located near Aurora and called Partridge Lake. The anticipated population is about 10,000 people. The plans for the townsite provide for laying of streets, installing sewers, light, water, power and other facilities usually found in a modern city or village.

H. **Schools.** As yet the school situation is undetermined.

3. OLIVER MINING DIVISION, UNITED STATES STEEL CORP.

A. **Location.** Mine and pilot plant just north of Mountain Iron. Agglomerating plant at Virginia.

B. **Construction and Production Program.** In September, 1951 we saw one of the diamond drills in operation near Mountain Iron and actually saw the taconite core coming out of the ground. Since that

time the drill location we saw has become the site of the first taconite mine at Mountain Iron. From information obtained Oliver was able to set up and run a small laboratory-sized taconite plant in Duluth. After eight years of intensive study Oliver decided to build a large-scale pilot concentrating plant near Mountain Iron. By this time the results of the laboratory studies had been translated into usable information on maps and cross-sections so that a mine could be planned and laid out and the stripping of the glacial overburden started.

The laboratory information was also translated into large-scale machinery and necessary related facilities by engineers in the design of the pilot plant. Construction of this plant was started in May, 1951. It is located just north of the Village of Mountain Iron. It has a designed capacity of 500,000 tons of taconite concentrates annually. Over 500,000 yards of earth was excavated in the construction. It required 4,200 tons of structural steel for the building. Two miles of earthen dam, 50 feet high was built to impound tailings (waste material). The plant was ready to operate in June, 1953 just two years after construction started.

As of April 1, 1954, they had produced 213,000 tons of taconite concentrates. In view of the complexity of processing taconite Oliver thinks it may be almost five years before they have the required information and background to start construction of a commercial plant. On the basis of experimental and development work to date, they plan to have facilities to produce about 5,000,000 tons of taconite concentrates per year in the early 1960's and about 10,000,000 tons annually by 1970.

C. **Railroad Facilities.** The concentrates are hauled from the Pilotac Plant (north of Mountain Iron) in ore cars by common carrier railroad to the agglomerating plant located at Virginia.

D. **Power Plant.** The power is being purchased from the Minnesota Power and Light Company.

E. **Harbor, Dock and Storage Facilities.** This company will ship their product to the presently existing docks and harbors on the Great Lakes and the existing storage facilities at Virginia are being used.

F. **Estimated Employment.** 135 employees.

G. **Townsite.** 126 homes, not company-owned, have been constructed on a townsite known as South Grove Addition to Mountain Iron. Streets, sewers and water are installed and the houses are for sale or rent.

H. **Schools.** The Mountain Iron School District issued bonds in the amount of $465,000 and is constructing a new school.

TACONITE TAXES AND PROBLEMS

Section 298.24, Minnesota Statutes 1953, imposes a tax of 5 cents for each gross ton of merchantable iron ore concentrate produced from taconite, plus 1/10th of one cent per gross ton for each 1% that the iron content of concentrate exceeds 55%, when dried at 212° Fahrenheit.

Section 298.25 provides that the above tax is in addition to the occupation and royalty tax, but is in lieu of all other taxes upon such taconite, or the lands in which they are contained, or upon the mining or quarrying thereof, or the production of concentrate therefrom, or upon the concentrate produced, or upon the machinery, equipment, tools, supplies and buildings used in such mining, quarrying or production. This section permits the assessment and taxation of the surface of such lands at their value thereof without regard to the taconite therein, and the assessment and taxation of merchantable iron ore or other minerals, or iron-bearing materials other than taconite in such lands in the manner provided by law.

Section 298.26 provides that in any year in which at least 1,000 tons of iron ore concentrate is not produced from any 40 acre tract or governmental lot containing taconite, a tax may be assessed upon the taconite therein at the mill rate prevailing in the taxing district and spread against the assessed value of the taconite, but also provides that the tax spread shall not exceed $1.00 per acre.

Section 298.28 provides that the tax on taconite shall be distributed as follows:

¼th to the city, village or town
¼th to the school district
¼th to the county, and
¼th to the State

The Taconite Tax Law was enacted in 1941, to encourage the production of merchantable iron ore from the tough, hard rock. Since the law was enacted the mining companies have spent millions of dollars on research, drilling and construction of experimental pilot plants, in an effort to perfect a process. A method has been found and commercial plants are now being constructed as hereinbefore stated.

We have already explained these new developments in taconite. The Reserve Mining Company is investing over $160,000,000 on its Babbitt and Silver Bay plants. Erie Mining is investing over $300,000,000 in its new plant at Aurora and Two Islands. The Oliver Division of United States Steel has expended over $30,000,000 on pilot plants at Mountain Iron and Virginia. During and after the construction period, thousands of people will be employed in this new

industry. There will be numerous children for whom educational facilities must be provided. The school district of Mountain Iron has issued bonds in the amount of $465,000 for a new school, which will take care of the additional children coming to that area.

The Reserve Mining Company is building schools at Babbitt and Silver Bay to take care of the additional children in that area. The plans and specifications have been approved by the school authorities. As soon as arrangements can be made to release the school buildings from the lien of the mortgage, it is the intention to deed the property to the school district. In the meantime, Reserve will lease the school buildings to the school district for $1.00 a year and thus enable the school district to operate them the same as any other public school. Reserve has also purchased and donated to the school district three large modern busses to transport the children.

At the Erie Mining Company location, school buildings heretofore closed at Aurora for lack of pupils are being rehabilitated to accommodate the additional school population. However, busses to transport the children will have to be provided.

In addition to the school problem, more money will be required to maintain the highways and to provide police protection and public services.

The many problems of financing schools, local and municipal governments created by this industrial development are being given consideration by the school districts, county and local governments and mining companies.

The construction of the new taconite plants has raised some questions on what is and what is not taxable under the taconite tax law, especially Section 298.25 which is commonly referred to as the "in lieu" tax provision. As an example, both the Reserve Mining Company and the Erie Mining Company are constructing a railroad from the mining area to Lake Superior. Both railroads will be private as distinguished from common carriers and will not be subject to the gross earnings tax under the Minnesota law. The Reserve railroad will haul the crude taconite rock from the primary crusher at Babbitt to the processing plant at Silver Bay. Under the "in lieu" provisions of Section 298.25 this railroad is equipment used in the production of taconite concentrate and therefore **is not taxable.** The Erie railroad will haul the finished taconite pellets from the processing plant at Aurora to the loading docks at Two Islands. In other words, it does not come into the picture until after the taconite concentrate has been produced and under the "in lieu" provisions of Section 298.25, **would be taxable.** Yet, this railroad is probably just as indispensable to Erie's operations as the Reserve railroad is to its operations.

As another example, the Erie Company will build its own power plant but will not furnish the power or light to the townsite. Under the "in lieu" provisions of Section 298.25, this plant **would not be taxable.** The Reserve Company is also building its own power plant but will furnish the electric power for the townsites. In other words, a part of the power will be used for purposes not related to the production of taconite concentrates. Under the "in lieu" provisions of Section 298.25, is this power plant non-taxable or taxable? If it is taxable, what formula is to be used in fixing the assessed value?

Another example, Reserve is constructing an ore dock and harbor at Silver Bay and Erie will do the same at Two Islands. Both installations will handle the finished taconite pellets and would therefore not come under the "in lieu" provisions of Section 298.25 and would be taxable. The ore docks at Two Harbors and Duluth are owned and operated by common carrier railroads, who pay a gross earnings tax in lieu of all other taxes. How should the ore docks of Reserve and Erie be taxed?

The foregoing are some of the problems created by the taconite tax law. There may be others.

It has been suggested to the Commission that the Erie railroad be taxed at the rate of 5% of its gross earnings and to determine its gross earnings that each gross ton of iron ore hauled be charged on the same basis as the legal railroad freight rate for transportation of iron ore from the Minnesota Ranges to Two Harbors, Duluth and Superior, and the gross earnings tax paid by the Erie Mining Company railroad be allowed as a deduction in computing its occupation tax.

It has also been suggested that the ore docks and loading facilities of both Reserve and Erie be taxed on the gross earnings basis, the gross earnings basis to be determined by charging to the docks on each gross ton handled, the same amount that is charged by the common carriers for this service at Duluth, Two Harbors and Superior.

It has also been suggested that if the Erie Railroad and the dock facilities of Erie and Reserve be put on the gross earnings basis, the tax derived therefrom be allocated to the local taxing unit.

The foregoing is sufficient to demonstrate that the present taconite law should be clarified.

Experts familiar with reserves and steel mill requirements claim that to keep Minnesota in the forefront as a supplier of iron ore, we must be producing annually by the year 1970 at least 40 million tons of taconite concentrates. On the basis of the present costs of $50 per ton of annual production, plants to produce this tonnage would cost $2,000,000,000. An industry with the courage to invest such large sums of money in this State is entitled to all possible encouragement.

COST OF DEVELOPING AND MINING MINNESOTA IRON ORE AND OF COMPETITIVE ORES IN OTHER PARTS OF THE WORLD.....

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COST OF DEVELOPING AND MINING MINNESOTA IRON ORE AND OF COMPETITIVE ORES IN OTHER PARTS OF THE WORLD.....

COST OF DEVELOPING

This is one subject upon which there is little available information. We have written to the state departments in the various states that are regular producers of iron ore, including Alabama, California, Michigan, New York, Pennsylvania, Texas, Utah, Wisconsin, and Wyoming, requesting information as to cost of producing iron ore in those states. The responses were all negative except those from Michigan and Utah. It now appears that Minnesota and Michigan are the only states requiring reports from which detailed cost information can be obtained.

We then wrote to the various mining companies operating in the above states, asking if they could furnish the desired cost figures, but the companies refused this information. The result to date is that the only states for which we have fairly complete cost figures are Minnesota and Michigan.

Due to the fact that the iron ore produced in Michigan is nearly all from underground operations, and that only about 6% of Minnesota's iron ore production is mined by underground methods, the comparative costs, beyond the fact that they appear to be fairly well in line as to the underground ore produced, are not very informative.

In the following table are shown the comparative costs of production in these two states for the years 1949-53, on underground mining operations. Note that the figures do not include taxes or royalties. It is seen that there is very little difference in the final result.

TABLE NO. 4

UNDERGROUND COST OF PRODUCTION
(Excluding Taxes and Royalties)

	1949	1950	1951	1952	1953
MICHIGAN*					
Labor	$1.9357	$1.9298	$2.3185	$2.8222	$2.8426
Supplies	.8827	.8522	1.0097	1.1504	1.1805
Deferred Costs	.1536	.1810	.2175	.2722	.2499
General Overhead	.2415	.3951	.4227	.4859	.5035
Marketing & Selling	.0532	.0521	.0485	.0506	.0679
TOTAL	$3.2667	$3.4102	$4.0169	$4.7813	$4.8444
MINNESOTA**					
Labor & Supplies	$2.742	$2.780	$3.077	$3.608	$3.888
Development	.047	.048	.040	.051	.064
General Overhead (includes marketing & selling)	.380	.726	.764	.877	.994
TOTAL	$3.169	$3.554	$3.881	$4.536	$4.946

* Department of Conservation, Geological Survey, Lansing, Mich.
** Figures from Department of Taxation.

The Commission also attempted to get the costs of production in the Steep Rock, Michipicoten and Labrador-Quebec iron ore fields in Canada and those of Chile and Venezuela, South America, but found the same situation existing there. The information is not available.

From information obtained on the inspection trip to the Labrador-Quebec field and the Commission's knowledge of Minnesota mining costs, an estimate of the cost to deliver Labrador-Quebec iron ore to Pittsburgh, Cleveland and Buffalo, with or without the St. Lawrence Seaway, is shown by the following Table.

TABLE NO. 5

ESTIMATED COST TO DELIVER LABRADOR-QUEBEC ORE TO VARIOUS UNITED STATES CONSUMING CENTERS BY PRESENT FACILITIES AND BY COMPLETED SEAWAY

Item	Estimated Cost Per Gross Ton, Present Facilities					By Seaway When Completed		
	Pitts. via Montreal	Pitts. via Sparrows Pt.	Pitts. via St. Lawrence	Cleveland via St. Lawrence	Buffalo via St. Lawrence	Pittsburgh	Cleveland	Buffalo
Mining & Transportation to crusher..	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25
Depreciation & Interest	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
R.R. Freight, Mines to Seven Islands..	3.35	3.35	3.35	3.35	3.35	3.35	3.35	3.35
Water Freight	1.20	2.54	3.30	3.30	3.30	2.54	2.54	2.54
R.R. Freight to Furnace	4.42[3]	2.81[2]	2.12[1]	—	—	2.12[1]	—	—
Total Gross Ton Labrador Ore	11.22	10.95	11.02	8.90	8.90	10.26	8.14	8.14
Lake Erie Selling Value	12.02	12.02	12.02	9.90[4]	9.90[4]	12.02	9.90[4]	9.90[4]
Difference	0.80	1.07	1.00	1.00	1.00	1.76	1.76	1.76

From figures compiled by the Department of Taxation, the following table shows the composite costs of open pit and underground iron ore operations in Minnesota; also the average tax per ton of production and the selling price of Mesabi non-Bessemer iron ore at lower lake ports for the odd numbered years, 1943 to 1953 inclusive.

(1) Lake Erie to Pittsburgh.
(2) Sparrows Point to Pittsburgh, all rail.
(3) Estimated — Montreal to Pittsburgh.
(4) 1954 Lake Erie ore value, 51.5% iron.

TABLE NO. 6

COMPARISON OF ORE PRODUCTION, COSTS AND PRICES FOR YEARS 1943, 1945, 1947, 1949, 1951 AND 1953 STATE OF MINNESOTA

Year	Tons Produced (in 1000's)			Av. Total Cost Per Ton for Development, Mining, Beneficiation & Royalty			Av. Cost Per Ton—All Taxes on Iron Ore Production	Value of Ore Per Ton at Lower Lake Ports
	Open Pit	Underground	Total	Open Pit	Underground	Total		
1943	63,762	5,243	69,005	$1.187	$2.603	$1.293	$.318	$4.45*
1945	59,013	3,469	62,482	1.236	2.923	1.331	.330	4.55*
1947	56,648	3,320	59,968	1.373	3.477	1.489	.422	5.55
1949	51,804**	3,383	55,188	1.711	3.799	1.839	.570	7.20
1951	74,832	3,925	78,307	1.991	4.521	2.119	.591**	8.30
1953	75,789	3,294	79,083	2.606	5.528	2.727	.693***	9.70 to July 1 9.90 after July 1

* Prices under control of O.P.A.
** Six weeks steel strike — mining stopped.
*** Source — Department of Taxation.

TABLE NO. 7
AVERAGE PRODUCTION COSTS OF IRON ORE PRODUCED IN MINNESOTA*

Year	Total Tonnage Mined	Total Cost of Development, Royalty, and Other Costs as Indicated, Except Taxes	Average Cost Per Ton of Development	Average Cost Per Ton of Mining and Beneficiation				Average Cost Per Ton of Royalty Paid	Total Cost Per Ton of All Preceding Items	Approximate Total Cost of Ad Valorem and Other Taxes	Average Cost Per Ton of All Taxes Levied	Percent of Total Taxes to Total Costs
				Labor	Supplies	Other Items**	Total					
1938	14,728,556	$ 24,197,575	$.186	$.409	$.254	$.407	$1.070	$.387	$1.643	$18,481,639	$1.255	43.3
1939	31,789,650	41,771,509	.215	.241	.168	.258	.667	.432	1.314	22,186,212	.698	34.7
1940	48,304,658	54,780,886	.201	.183	.142	.212	.537	.395	1.133	23,075,470	.478	29.7
1941	63,736,394	72,013,215	.206	.207	.140	.162	.509	.415	1.130	24,787,232	.389	25.6
1942	70,048,716	85,168,023	.190	.234	.161	.240	.635	.390	1.215	23,644,204	.338	21.7
1943	69,004,461	89,147,416	.209	.281	.182	.269	.732	.352	1.293	21,957,593	.318	19.8
1944	65,073,476	86,156,863	.234	.253	.198	.288	.739	.351	1.324	20,667,685	.318	19.3
1945	62,482,046	83,099,814	.208	.251	.201	.324	.776	.347	1.331	20,639,726	.330	19.9
1946	49,650,356	68,658,404	.223	.271	.216	.325	.812	.348	1.383	20,599,468	.415	23.1
1947	59,967,761	89,303,822	.254	.304	.263	.336	.903	.332	1.489	25,278,693	.422	22.1
1948	65,013,706	107,734,083	.298	.308	.284	.405	.997	.362	1.657	26,927,951	.441	20.0
1949	55,187,871	101,501,196	.341	.360	.294	.492	1.146	.352	1.839	31,452,161	.570	23.7
1950	64,793,019	126,736,978	.395	.396	.247	.542	1.185	.376	1.956	36,713,983	.567	22.5
1951	78,307,286	165,854,594	.484	.696		.580	1.276	.359	2.119	46,271,049	.591	21.8
1952	63,374,126	164,759,987	.558	.878		.790	1.668	.374	2.600	41,820,073	.660	20.2
1953	79,083,401	215,691,437	.659	.874		.800	1.674	.394	2.727	54,837,248	.693	20.3

* Tonnage of all ore mined in Minnesota; total costs and costs per ton of development and operation chargeable to mining; and total costs and costs per ton of all mining taxes, as reported for Occupation Tax purposes, for years 1938-1953, inclusive.

** Includes: administration (local and district), depreciation, beneficiation (including crushing and screening), stockpile loading, and miscellaneous costs. Authority: Minnesota Department of Taxation.

TABLE NO. 8
AVERAGE PRODUCTION COSTS OF OPEN-PIT AND UNDERGROUND ORE PRODUCED IN MINNESOTA*

Year	Total Tonnage Mined	Total Cost of Development, Royalty, and Mining	Average Cost Per Ton of Development	Average Cost Per Ton of Mining and Beneficiation					Average Cost Per Ton of Royalty Paid	Average Cost Per Ton of All Preceding Items
				Labor	Supplies	Total Labor and Supplies	Other Items (Including Benef.)	Total		
Open Pit Operations										
1938	11,535,101	$15,967,137	$.225	$ .238	$.174	$ .412	$.358	$ .770	$.389	$1.384
1939	28,033,250	32,953,986	.238	.141	.125	.266	.231	.497	.440	1.175
1940	44,008,093	44,640,364	.217	.108	.109	.217	.184	.401	.397	1.015
1941	58,771,355	60,547,192	.218	.138	.109	.247	.149	.396	.418	1.032
1942	64,951,827	72,290,635	.202	.154	.131	.285	.232	.517	.394	1.113
1943	63,761,539	75,491,717	.221	.195	.152	.347	.267	.614	.352	1.187
1944	61,177,038	75,309,811	.246	.185	.170	.355	.279	.634	.351	1.231
1945	59,012,981	72,960,183	.217	.183	.175	.358	.320	.678	.341	1.236
1946	47,312,655	61,036,079	.232	.199	.188	.387	.325	.712	.346	1.290
1947	56,648,191	77,761,752	.266	.217	.232	.449	.331	.780	.327	1.373
1948	61,075,597	93,888,374	.313	.219	.251	.470	.405	.875	.349	1.537
1949	51,804,480	88,647,173	.360	.260	.258	.518	.500	1.018	.333	1.711
1950	61,098,092	111,225,426	.416	.292	.221	.513	.531	1.044	.360	1.820
1951	74,382,213	148,105,427	.507	—	—	.570	.570	1.140	.344	1.991
1952	60,054,675	147,894,220	.587	—	—	.727	.785	1.512	.364	2.463
1953	75,789,280	197,481,036	.685	—	—	.743	.791	1.534	.387	2.606
Underground Operations										
1938	3,193,455	8,230,438	.048	1.027	.544	1.571	.585	2.156	.374	2.578
1939	3,756,400	8,817,523	.042	.997	.494	1.491	.466	1.957	.378	2.377
1940	4,296,565	10,140,522	.040	.947	.487	1.434	.507	1.941	.381	2.362
1941	4,964,992	11,466,023	.060	1.033	.501	1.534	.335	1.869	.380	2.309
1942	5,096,889	12,877,388	.054	1.238	.543	1.781	.347	2.128	.344	2.526
1943	5,242,922	13,655,699	.064	1.353	.550	1.903	.293	2.196	.343	2.603
1944	3,896,438	10,847,052	.043	1.321	.628	1.949	.425	2.374	.367	2.784
1945	3,469,065	10,139,631	.050	1.403	.637	2.040	.392	2.432	.441	2.923
1946	2,337,701	7,622,325	.044	1.734	.780	2.514	.324	2.838	.379	3.261
1947	3,319,570	11,542,070	.043	1.787	.797	2.584	.441	3.025	.409	3.477
1948	3,938,109	13,845,709	.055	1.697	.808	2.505	.390	2.895	.566	3.516
1949	3,383,391	12,853,923	.047	1.896	.846	2.742	.380	3.122	.630	3.799
1950	3,694,127	15,511,552	.048	2.112	.668	2.780	.726	3.506	.645	4.199
1951	**3,925,073	17,749,167	.040	—	—	3.077	.764	3.841	.640	4.521
1952	**3,319,451	16,900,867	.051	—	—	3.608	.877	4.485	.555	5.091
1953	**3,294,121	18,210,401	.064	—	—	3.888	.994	4.882	.582	5.528

* Tonnage of all ore mined in Minnesota in years 1938 to 1953, inclusive; comparison of total costs per ton for development and other costs incurred in mining, as between open pit and underground operations.

** Percent of Total: 1940, 8.89%; 1945, 5.55%; 1950, 5.70%; 1953, 4.16%.

Authority: Minnesota Department of Taxation.

COMPETITIVE ORES .....

What Is the Competitive Relation of Scrap Iron and Steel to the Production of Iron Ore?

TABLE NO. 9

Composite Average of No. 1 and No. 2 Heavy Melting Scrap Steel Prices at Philadelphia, Pittsburgh and Chicago
Prices of Pig Iron

COMPETITIVE ORES

Venezuela is now producing iron ore from Cerro Bolivar, mined and shipped by Orinoco Mining Co., for United States Steel. Here a large tonnage of high grade ore was proved by drilling, the Company's figures for that one deposit showing 500 million tons of ore with 58% natural iron. Other large deposits are known to exist in the Orinoco concession, both east and west of the Caroni River.

The mountain of ore has been developed for steady production. All facilities, including loading pockets 1,000 feet above mountain base; an excellent 90-mile railroad to a port on the Orinoco River; a completely equipped modern port for receiving, sizing, grading and loading ore into ocean-going vessels at dockside; and a 35-ft. low water channel down river, via the Orinoco and Cano Macareo to the Atlantic are now completed and the entire system is automatically operated under high frequency radio control. Capacity of the port facilities is now ample for any anticipated early needs and can readily be doubled whenever necessary.

The climate, physical and political appears favorable for steady and substantial year-round production of high-grade iron ore. This ore is being advertised for sale at $5.80 per gross ton, F.O.B. Puerto Ordaz.

El Pao Mine, operated by the Iron Mines Co. of Venezuela (Bethlehem Steel), has been shipping since 1950, as follows:[1] 1951, 635,000 tons; 1952, 1,845,000 tons; 1953, 1,950,000 tons. The Company plans to increase production to 3,000,000 tons annually, of ore having 64% natural iron.

This ore reaches Bethlehem's Palua port on the Caroni River near the junction with the Orinoco, via a 38-mile railroad and is there transferred to light draft carriers that follow the Orinoco, then the Cano Manamo out to the Gulf of Paria, and cross the gulf to Bethlehem's Puerto de Hierro. There the ore is transferred to large carriers, formerly part of the Chilean ore fleet; and goes to Bethlehem's steel plant at Sparrows Point, Maryland, about 2,000 miles. This extremely high-grade ore is priced to buyers at Puerto de Hierro, Venezuela, at $8.75 per gross ton.[2]

Labrador-Quebec is now producing iron ore and is shipping it by ocean carriers to ports on the Atlantic Coast. The first cargo, 20,000 tons, went forward, bound for Philadelphia, on July 31, 1954. The average grade of the 418 million tons reported by the Iron Ore Company of Canada as having been proved by drilling up to 1950, will run about 54% natural iron, which is somewhat higher than the 51.5%

(1) W. W. Wanamaker, American Metal Market, Oct. 23-30, 1953.
(2) Near the Island of Trinidad.

guarantee of Minnesota ore, but not as high as that from Venezuela, which has 58% natural iron.

All facilities for sustained regular ore production through the short (six-months) operating season are now completed. This includes the 360-mile railroad with spur tracks to the mines, the fine new port with large modern dock on deep water, large stockpile area where ore can be accumulated throughout the six months of active mining to extend the boat shipping over the 9-month period when the harbor is open; the ore-receiving and grading yards at Seven Islands, the two power plants, one at Marguerite Falls some 18 miles west of Seven Islands to furnish current for the town, dock and the railroad ore yards, and the other at Menihek Falls 330 miles north on the new railroad to furnish current for the mines, headquarters, the town to be built known as Schefferville and the upper part of the railroad system.

The entire operating system is under radio control from mines to ore dock and can deliver substantial shipments each year after 1955. The 1955 shipment is planned for 5 million tons and in 1956, 10 million tons per year. Very little expansion and modification of facilities will permit the out-shipment of 20 million tons per year to Seven Islands. To date the expected goals have been met at the time set far in advance even under the most extreme difficulties due to cold climate, short seasons and need of carrying on the surveys, explorations and part of the railroad construction by use of air transport. With that record of performance there is good reason to expect that the future goals will also be met.

Due to the large initial investment of over $250,000,000, minimum yearly shipments of 10 to 12 million tons will be required to provide a fair return on the investment.

There are now three major sources that can furnish all ore needed for steel making in the United States: the Lake Superior District, Labrador-Quebec and Venezuela. There are several other countries that have sent iron ore to this country each year amounting to about 10 million tons. These imports will probably continue. Some of the more recent sources are Liberia, with potential of about one million tons annually; and Peru which furnished 840,000 tons in 1953. Their long ocean haul is offset by their nearness to tidewater.

Following are the distances from foreign ports to ports on the Atlantic coast of the United States:

Puerto Ordaz, Venezuela, S. A. to Morrisville, Pa. (River 175, Ocean 2124)	2,300 Miles
Puerto de Hierro, Venezuela, S. A. to Baltimore (Ocean)	2,120 Miles
Victoria, Brazil, S. A. to Baltimore (Ocean)	5,250 Miles
El Tofo, Chile, S. A. to Baltimore (Ocean)	5,050 Miles

Monrovia, Liberia, West Africa to Baltimore (Ocean)	4,880 Miles
Narvik, Norway to Baltimore (Ocean)	4,950 Miles
Seven Islands, Quebec to Baltimore (River and Ocean)	1,550 Miles

Railroad distances are as follows:

From Cerro Bolivar to Puerto Ordaz	about 90 Miles
From Labrador-Quebec Mines to Seven Islands	365 Miles
From Minnesota mines to docks on Lake Superior — average	90 Miles

Note: Total distance from Minnesota mines to lower lake ports, both rail and lake is about 876 miles.

The following is a computation of the total iron unit costs of Mesabi non-Bessemer ore with 51.50% natural iron, Bethlehem's Venezuela ore with 64% natural iron, U. S. Steel's Venezuela ore with 58% natural iron and Labrador-Quebec ore with 54% natural iron, all carried through to Pittsburgh using quoted 1954 rates by rail and average ocean contract rates as reported by mining companies and the U. S. Bureau of Mines.

Field	Nat. Iron in Base Ore	1954 Price at Basing Point	Freight Ocean	Freight R.R.	Delivered-Cost Per Gr. Ton Pittsburgh	Pittsburgh Delivered-Cost Per Unit of Iron
Mesabi Range	51.5%	$9.90[1] at L. Erie		$2.12	$12.02	$12.02 ÷ 51.5 = $.233
Venezuela Bethlehem	64.0%	$8.75[2] at Puerto de Hierro	$3.00[4]	2.81	14.56	$14.56 ÷ 64.0 = $.227
Venezuela U. S. Steel	58.0%	$5.80[3] at Puerto Ordaz	$3.50[5]	2.81	12.11	$12.11 ÷ 58.0 = $.209
Labrador-Quebec	54.0%	$10.38 at L. Erie		2.12	12.50	$12.50 ÷ 54.0 = $.231

The above figures indicate an advantage in favor of the Venezuelan ore per unit of iron delivered at Pittsburgh. Water transportation rates are the average of contract vessel rates in effect thus far. Rail rates are the published rates in effect between Lake Erie and Pittsburgh and between Atlantic ports and Pittsburgh.

(1) Published 1954 market price for 51.5% natural iron ore at rail of vessel, at lower lake ports.
(2) Price published by Bethlehem Steel Co., effective for 1954, at Puerto de Hierro, Venezuela.
(3) Price publishd by U. S. Steel Corp., effective for 1954, at Puerto Ordaz, Venezuela.
(4) Testimony of H. C. Jackson before Interim Commission April 23, 1954.
(5) Testimony of H. C. Jackson before Interim Commission April 23, 1954.

On completion of the St. Lawrence Waterway, both Venezuelan ore and that from Labrador-Quebec will undoubtedly show an advantage over Minnesota natural ores, on an iron unit basis that will be hard to overcome. Minnesota's better grade ore may still be able to meet imports on an equal basis even then. However, segregation of the better grade ore for one market might result in placing Minnesota ore at a disadvantage in other steel centers.

What other districts, and with what ore requirements, will likely remain open to ores from this area?

1. Chicago area, with estimated yearly ore requirement of...	24,000,000 Tons
2. Duluth area, estimated yearly requirement of.....	1,000,000 Tons
3. Lake Erie area, estimated yearly requirement of.....	11,000,000 Tons
4. Youngstown area, estimated yearly requirement of.....	14,000,000 Tons
Total requirement for these four districts.....	50,000,000 Tons
Assume that by 1970 the above total will reach.....	75,000,000 Tons
and by that year production of taconite concentrate will amount to.....	40,000,000 Tons
Leaving for Minnesota, Michigan, Steep Rock & Algoma..	35,000,000 Tons

Of the latter only Minnesota's Vermilion ore, some Michigan ore, Michipicoten (Algoma) sinter and Steep Rock lump ore can likely compete on an iron unit basis at Pittsburgh with ore from either Labrador-Quebec or Venezuela, after completion of the Seaway.

How then can Minnesota retain its competitive position in the Pittsburgh market?

By increasing taconite production in large scale commercial plants so that its per ton costs will be so reduced as to be competitive with other ores at the Lake Erie ports.

Minnesota's share of the iron ore market will be determined by relative cost of producing iron and steel from ores from all sources. When large-scale processing of taconite becomes a reality the high unit value may offset relatively high production costs.

With the remaining reserves of Minnesota natural ores, however, there is a combination of declining grade of ore and increasing costs. Indications are that the period preceding large-scale taconite production may be difficult. The two major outside sources have plenty of high-grade ore and real competition is to be expected in the main steel centers east of the Chicago area.

Every ton of competitive iron ore which supplants the market for a ton of Minnesota iron ore is of vital importance to the entire State and can be serious to the range communities which depend upon the iron ore industry to sustain their economy. It has been pointed out to the Commission that it takes 265 men working in the mines and 115 men on the railroads, a total of 380 men, to produce and deliver annually at the docks on Lake Superior one million tons of iron ore. A loss of 5 million tons in production due to competition means that 1,900 men would be out of work and a loss of 10 million tons means that 3,800 men would lose their jobs. As the tonnage production decreases the job losses increase.

WHAT IS THE COMPETITIVE RELATION OF SCRAP IRON AND STEEL TO THE PRODUCTION OF IRON ORE?

A common idea of scrap is that of the kind gathered up around railroad shops, junk yards, and farms. This is only one of the two main sources. The other, known as "home scrap," comes from the daily

operations of the steel plants and includes scale, turnings and many other forms of waste metal. Figures for years 1951 and 1952 show that slightly more "home scrap" than purchased scrap was used in steel making.

In years preceding 1945 roughly one half of the steel made in the United States was made from scrap metal and one half from pig iron which in turn is made from iron ore. Formerly the pig iron made from iron ore in the blast furnace, was cast in heavy blocks called "pigs." These had to be re-melted in the open hearth furnace and refined into steel. Later it was found to be cheaper to send the molten iron, or "hot metal," directly from the blast furnace to the open hearth plant.

Either scrap or pig iron (or "hot metal") or any combination of the two can be used to make steel. In theory, the ratio of their use depends mainly on their relative cost at the time needed.

The amount of "home scrap" is quite large and varies with the output of steel. In late years its tonnage has exceeded that of the purchased scrap.

In the years after 1938 purchased scrap was in good demand at high prices; but the scrap market, still high in the first half of 1953, broke badly toward the end of the year. This condition in a year like 1953 indicates an abundant scrap supply.

The following table shows the composite average prices of No. 1 and No. 2 heavy melting scrap for the past 17 years, and the corresponding prices of basic pig iron for those years. Note the comparison for years 1950-1953 inclusive.

TABLE NO. 9
COMPOSITE AVERAGE OF NO. 1 AND NO. 2 HEAVY MELTING SCRAP STEEL PRICES AT PHILADELPHIA, PITTSBURGH, AND CHICAGO AND PRICES OF PIG IRON

	Average Prices by years:		
Year	No. 1 Grade	No. 2 Grade	Basic Pig Iron
1937	$17.91	$16.79	$22.99
1938	13.42	12.65	21.71
1939	16.21	15.82	21.10
1940	18.51	17.67	22.50
1941	19.43	19.29	23.50
1942-43	19.17	20.00	23.50
1944	18.62	18.98	23.50
1945	19.14	20.00	24.52
1946	20.15	21.01	27.13
1947	35.64	36.27	33.82
1948	41.55	41.60	41.60
1949	27.49	27.72	46.00
1950	35.34	35.15	47.04
1951	43.14	42.64	52.00
1952	41.89	42.74	53.08
1953	39.90*	37.89	55.25

* Nov., 1953, price of No. 1 steel scrap was down to about $30.00 per ton.

TOTAL PRODUCTION OF STEEL INGOTS AND CASTINGS IN THE UNITED STATES (In thousands of net tons)

Years:	1946	1947	1948	1949	1950	1952	1953
Amounts	66,600	84,900	88,600	78,000	96,800	93,200	112,000

C. K. Leith, in his book "Mineral Valuations of the Future," published in 1938, commented on the rising use of scrap replacing primary raw materials. Soon thereafter the effects of World War II and the following period of reconstruction temporarily reversed the trend. By late 1949 the supply of steel and of scrap had caught up to demand. In 1950 came the Korean War with renewed pressure for more steel and increased demand for scrap. This condition continued beyond the Korean cease-fire, but in late 1953 came the sharp break in scrap prices with no pronounced drop in demand for steel again indicating that scrap was in plentiful supply.

Based on the existing spread between scrap and pig iron prices a shift to greater use of scrap might seem warranted from merely a cost standpoint. However, there are other considerations, among them the possible need of laying off men now employed at blast furnaces and the damage to the refractory lining of those furnaces resulting from a shutdown.

Another factor is the lack of stability of the scrap market. Published graphs and charts of probable future requirements of the several items of raw material for steel do not show any provision for separate tonnages of scrap.

Recent heavy investments by American steel companies in the exploration and development of large foreign ore deposits seem to indicate the belief of these companies in the steady continuing growth of the U. S. steel industry along much the same pattern that has existed in the past. Any further increase in the use of scrap will mainly parallel the gain in steel production to meet the needs of population growth and national defense.

In a recent study of the part played by scrap in steel-making answers have been sought for the following questions. Answers follow each question.

1. Q. What part of the total tonnage of scrap used in steel-making is purchased from scrap dealers and from independent manufacturers of articles containing steel?

A. Slightly less than one half. The rest is "home scrap," which is the daily clean-up of the large amount of mill scale, edgings and other waste metal around the steel plants.

2. Q. What is the comparison between the prices of scrap and of pig iron in recent years?

A. See Table No. 9 on page 173.

3. Q. Has there been any definite trend toward the use of scrap in place of iron ore in recent years resulting in closing blast furnaces and making steel from scrap in open hearth furnaces?

A. This condition existed to some extent in the depression years of the 1930's but not since 1938. The question implies the use of scrap in excess of that prevailing in recent years. Since 1938 this nation has been on either a war or a defense economy.

4. Q. What is the likelihood of scrap replacing iron ore to any great extent in future years?

A. There may be a gradual increase in the over-all percentage of scrap used over a long period. Probably no accurate forecast can be made since there are too many uncertainties. It is assumed that answers to this and the foregoing questions apply to conditions short of war involving the United States.

What Impact Will the Great Lakes-St. Lawrence Waterway Have on the Iron Ore Industry of Minnesota

The Commission obtained transcripts of the hearings on the St. Lawrence Waterway held by various Congressional committees including the most recent conducted by the Committee on Public Works, House of Representatives, during February, 1954. It has examined numerous writings and heard testimony in favor of and in opposition to the project. A lengthy narration of the engineering and financial problems involved on this project is unnecessary to determine what impact its completion will have on the iron ore industry of Minnesota.

For at least forty years bills relating to this waterway have been introduced in the Congress. However, the proponents could never muster enough votes to enact them into law. In 1941 the Dominion of Canada and the United States signed an agreement for the development of the waterway with navigable channels 27 feet deep from Montreal, Canada to all ports on the Great Lakes and to develop in the International Rapids section of the seaway hydro-electric power of more than two million horsepower. Subsequent to this arrangement bills were introduced at each session of Congress but the opposition always prevailed.

In 1951 the Parliament of Canada created the Saint Lawrence Seaway Authority of Canada and authorized it to proceed with the construction of the waterway, including the power developments, with or without United States participation. This action on the part of the Dominion of Canada undoubtedly led to the introduction and passage by the United States Congress of the bill known as S. 2150, which was signed by the President on May 13, 1954 as Public Law 358, 83rd Congress, Chapter 201, 2nd Session. This law created the St. Lawrence Seaway Development Corporation and authorized it to join with Canada in the construction of the deep-water navigation works only in United States Territory. It authorized the corporation to issue bonds in the amount of $105,000,000 to be purchased by the Secretary of the Treasury of the United States. The power development will be constructed and financed by the State of New York and the Canadian agency.

The present channel has a 35 foot draft from the Atlantic Ocean to Quebec. From Quebec to Montreal the depth is 32.5 feet. This depth permits large ocean vessels to reach Montreal. Between Montreal, Canada and Ogdensburg, New York, a distance of 114 miles, the Lachine, Soulanges and International Rapids are located. At present

these rapids are bypassed by means of canals 14 feet deep with 22 locks, 14 feet deep, 43 feet wide and 252 feet long. This particular part of the river is the big job confronting the engineers on the new project, for it is necessary to create a channel 27 feet deep through this section of the river. This requires the construction of numerous dams, canals and locks, and miles of dredging. Between Ogdensburg and Lake Ontario, a distance of 68 miles, the entire distance will have to be dredged. Between Lake Erie and Lake Ontario, a distance of 27.6 miles, the Welland Canal will be deepened from 25 to 27 feet.

The locks are to be at least 800 feet long, 80 feet wide and 30 feet over the sills. **The present plans do not provide for a 27 foot channel beyond Lake Erie,** therefore deep draft ocean vessels will be unable to reach the Minnesota ports on Lake Superior.

Engineers estimate that it will take 4 or 5 years after commencing the work to complete the project. We stated in our last report:

> "If the present unprecedented demand for iron ore continues and the St. Lawrence Waterway is completed, it will not seriously affect the iron ore industry of Minnesota. However, if this enormous demand for iron ore diminishes, it will make the foreign ores, with cheap transportation, highly competitive with our Minnesota ore and particularly with taconite concentrate. It is true that it will take several years for the proposed new seaway to be completed and that large tonnages of foreign ore will probably not be delivered to the inland and the Great Lakes consuming districts until that time arrives, but anyone can visualize what the impact will be on the Minnesota iron ore industry when it is completed and the foreign ore fields are operating at full scale and the transportation facilities are available to move it into a slackening market."

In 1953, the demand for iron ore was great. The Lake Superior District shipped approximately 99,000,000 tons. Of this total Minnesota shipped 81,511,479 tons, the largest tonnage in the history of the state.

On January 1, 1954 the steel mills had a stock pile of iron ore of about 40,000,000 tons. In the first two quarters of 1954 the mills have been operating at about 68% to 70% of rated capacity. The slump in steel mill operation has been reflected in the shipments of Minnesota iron ore. Up to July 1, 1954 Minnesota shipments were only 70% of those for the same period in 1953.

The Labrador-Quebec field in Canada began mining operations in June, 1954 and about 1,500,000 tons of high grade iron ore have been produced. In 1955 five to six million tons will be produced. In 1956 the goal is ten million tons. When the St. Lawrence Seaway is completed, the production will be increased to 20 or 30 million tons. In view of

the fact that control of this field is shared by six U. S. companies there is no doubt that this ore will be used in U. S. furnaces.

The Orinoco Mining Co. (U. S. Steel) of Venezuela is shipping in 1954 from the Cerro Bolivar Mine three million tons of exceptionally high grade iron ore to the U. S. Steel plant at Morrisville, Pennsylvania. The Iron Mines Company (Bethlehem Steel) of Venezuela is shipping annually two million tons of 64% natural iron ore from its El Pao Mine to Sparrows Point, Maryland. Testimony before the Commission showed that the Venezuelan ore from Cerro Bolivar and El Pao, without the St. Lawrence Seaway, can be delivered to the Atlantic seaboard mills and also as far inland as Pittsburgh, Pennsylvania, at a lower cost per unit of iron than the Minnesota iron ore. With the seaway these foreign ores could be delivered at Lake Erie ports at a further reduced cost per unit of iron.

Exact cost figures are not available on the Labrador-Quebec ore. It is a high grade ore mined by open pit methods with little overburden, and undoubtedly can be delivered to the Eastern seaboard and the U. S. inland plants with or without the seaway as cheaply as the Venezuelan or Minnesota ore.

The demand for steel regulates the production of iron ore. In 1953 the demand was enormous. In 1954 the demand slackened. At present the steel mills are only operating at about 70% of rated capacity. Iron ore production and shipments have dropped to about 70% of the 1953 output. If this slow pace continues the situation referred to in our 1953 report has arrived and the foreign ores are available for delivery in a slackened market. Regardless of the benefits the seaway will have on the economy of the state as a whole if the present economic conditions in the steel industry continue and the seaway is completed the impact against the iron ore industry of Minnesota will be quite substantial.

Impact of National Defense

There is no way to make any accurate appraisal of this subject. The National Government is aware of the world-wide tension caused by the Communist threat and is doing everything possible to avert war and restore peace. Because of this turmoil in world affairs our Government is appropriating and expending huge sums of money for our own National Defense.

For the fiscal years ending June 30, 1954 and 1955, the following appropriations have been made:

NEW OBLIGATIONAL AUTHORITY
(In millions of dollars)

	Fiscal Year 1954	Fiscal Year 1955
Total Department of Defense — Military Functions	$34,532	$29,583
Army	12,995	7,620
Navy	9,358	9,777
Air Force	11,409	11,558
Establishment-wide Activities	770	629

Source: Letter dated August 28, 1954, from Office of the Assistant Secretary of Defense, Washington, D.C., signed by Glen V. Gibson, Acting Deputy, Comptroller for Budget.

The above appropriations are in addition to the unexpended balances in prior appropriations.

There is no doubt that a considerable portion of this money will go into the manufacture of military equipment made from steel which will require large tonnages of iron ore. We have been unable to get any figures on tonnage requirements of iron ore for National Defense.

Minnesota has supplied about 65% of the Nation's iron ore requirements for years and whatever happens in the next few years, Minnesota will continue to do so, because it is the only source of iron ore in this country that can meet the demand.

When the Labrador-Quebec and Venezuela fields get into full production and the St. Lawrence Seaway is completed and ships are available to move the ore, the heavy burden on our Minnesota iron ore mines can be lightened. However, in case of another war the Venezuelan iron ore could not be relied upon because the transportation perils would be insurmountable.

The appropriations for National Defense for the fiscal year 1953 were $46,610,938,912, or about 30% more than for the fiscal year

1954. The production of iron ore and steel in 1954 dropped 30% below the year 1953. In other words, the production of iron ore and steel has diminished in the same ratio as the reduction in appropriations for National Defense.

If this fact is not wholly accidental it seems to indicate that at least for the years 1953 and 1954, the production of iron ore and steel was definitely tied in with expenditures for National Defense.

In view of the fact that appropriations for National Defense for the fiscal year 1955 are only 85% of those for 1954, another drop can be expected in the production of iron ore and steel, unless the normal commercial demand increases.

Drilling Permits and Moratorium

The Commissioner of Taxation suggested that Minnesota require drilling permits from anyone exploring for minerals and that reports of discovery be required because the State sometimes receives royalty taxes while having no record or information of ore existing on the lands involved. He suggested that such a law would cause disclosure of such deposits.

The subcommittee appointed to investigate this subject held hearings. It appeared from the testimony that the royalty taxes referred to by the Commissioner of Taxation were upon minimum royalties paid on leases, even though no drilling had been done on the property or ore deposits known to exist.

This fact has caused some people to believe that new deposits have been discovered and not reported to avoid payment of the tax. No evidence sustained this belief. As soon as iron ore is discovered it becomes taxable.

Drilling is being done constantly in every active mine to prepare ore for removal. To require a drilling permit under these circumstances would be impractical. Testimony indicated that mining companies report to the School of Mines all drill core analyses of exploratory drilling on reserve properties and on inactive mines. This information is certified by the School of Mines to the Commissioner of Taxation.

Testimony fails to show a single instance where the discovery of iron ore has been concealed from the State or local taxing units. On the contrary, the local taxing units have been most diligent in requiring that all known deposits are placed upon the tax rolls.

In considering all of the testimony presented on the subject the subcommittee concluded that there is no need for such a law at the present time. The Commission concurs in the conclusion of the subcommittee.

Because iron ore in Minnesota becomes taxable as soon as it is discovered it was suggested that Minnesota enact a law similar to the "Lindquist" law of Michigan. The "Lindquist" law provides that "Metallic mineral ore newly discovered and/or proven in the ground and not part of the property of an operating mine shall be exempt from the general property tax laws for a maximum period of ten years or until such time as it becomes part of the property of an operating mine or it in itself becomes an operating mine."

The subcommittee appointed to explore this subject concluded that there is no need for such a law at the present time. There is grave doubt as to the constitutionality of such a law. The Commission concurs in this view.

Tax on Ore Carriers

It has been suggested that the State impose a tax on boats transporting iron ore on the Great Lakes.

The subject has been thoroughly explored by a subcommittee and the Commission conducted hearings to determine the merits of this suggestion.

The Commissioner of Taxation has been consulted, available Congressional reports have been studied, testimony was taken from representatives of the Lake Carriers Association, American Merchant Marine Institute, American Association of Railroads, Inland Waters Association, U. S. Treasury Department and the President's Commission on Intergovernmental Relations.

From 1933 through 1944 the Minnesota income tax law imposed an income tax upon foreign corporations engaged in the operation of ships on the Great Lakes. During these years the following returns were realized in taxes collected:

1940	$ 4,228.58
1941	18,560.10
1942	10,924.38
1943	1,345.15
1944	2,780.59

The 1945 Legislature exempted foreign corporations engaged in interstate and foreign shipping on the Great Lakes from said tax. That action was in accordance with the request of the United States Government made through the Secretary of State because of a protest lodged by the Canadian Government. The Canadian Government called attention to the fact that such tax violated the provisions of Article V of the Treaty between the American and Canadian Governments dated March 4, 1942 limiting the taxing power of the two nations as follows:

1. "Income which an enterprise of one of the contracting states derive from the operations of ships or aircraft registered in that state shall be exempt from taxation in the other contracting states."
2. "The taxes referred to in this convention are (a) for the United States of America, the federal income taxes including surtaxes and excess profits tax and (b) for Canada the Dominion income tax, including surtaxes and excess profits tax."

In addition to the Treaty herein cited we have considered the following legal problems:

1. No state or subdivision of a state may tax or impose other legislative obligations upon any corporation engaged solely in interstate commerce when the tax or legislative obligation is a burden upon interstate commerce in contravention of the Constitution of the United States.

2. In order for a state or a subdivision of a state to tax, there must be legal jurisdiction of the subject matter by the state through some factor or factors. Examples of these factors would be doing intrastate business within the state, domicile within the state or situs of operation within the state and so forth.

3. The fact that shipping in and out of Minnesota is carried on by both foreign and American steamship lines is another consideration. Assuming a tax could legally be imposed which would not burden interstate commerce in violation of the Federal Constitution, a further problem exists with respect to the uniform imposition of taxes as between interstate and international commerce.

In evaluating all the foregoing considerations, testimony and legal history, it is the opinion of the Commission that it is legally doubtful whether a tax can be imposed upon non-Minnesota corporations engaged in foreign and interstate shipping on the Great Lakes. There is some substantial and authoritative legal opinion that an apportioned net income tax could be sustained. However, based upon the history of the law from 1933 to 1944, the Commission is of the opinion that the realized tax return from such a law would be negligible and would not pay the costs of collection or enforcement in the courts which would probably be necessary.

For a good many years, and particularly since the exemption relieving foreign corporations engaged in shipping in interstate and foreign commerce from the income tax, much criticism has been heaped upon the Legislature for failing to enact laws on these corporations engaged in shipping as aforesaid. Assertions have been made that huge tax revenues have been lost because of the failure of the Legislature to enact tax laws on ore carriers.

In view of the legal obstacles involved and the fact that even if an apportioned net income tax could legally be enacted, the tax collected therefrom would be negligible, the claims and assertions made that the Legislature has been derelict in abolishing the income tax provision as it relates to water carriers or in failing to enact other tax legislation relative thereto and thus is losing substantial tax revenue, are unfounded and untrue.

There is a policy question in view of the original request of the United States Government that the State of Minnesota remove itself from this field of taxation. This problem will no doubt become more

complex by the completion of the Great Lakes St. Lawrence Waterway, not only with relation to Canadian vessels but to vessels from many other foreign nations.

Therefore, it is the recommendation of the Commission that no action be taken to impose any tax upon foreign corporations engaged in shipping upon the Great Lakes. However, this subject should not be foreclosed and if there be a change in the policy of the United States Government or a change in the legal basis of achieving a substantial tax return upon such shipping, then the Legislature should review this subject. In that event the Legislature should be well advised on the subject.

Labor Credit

To encourage the mining of low grade ore, the Legislature, in 1937, passed a law which reduced the assessed value of low grade iron bearing formations (for ad valorem taxes). The law provided that if the tonnage recovery was less than 50% and not less than 49%, the assessed value should be 48½% of the full and true value (regular iron ore is assessed at 50%). If the tonnage recovery was less than 49% and not less than 48% the assessed value was 47% and for each subsequent reduction of 1% in tonnage recovery, the percentage of assessed value to the full and true value shall be reduced an additional 1½% of the full and true value, but in no event should the assessed value be less than 30% of the full and true value. (Laws 1937, Chapter 364, M.S.A. 273.15.)

In 1941, to further encourage the production of low grade and high labor cost ores, and to increase employment on the range, the labor credit law was enacted. (M.S.A. 298.02.) This law allowed as a credit on the occupation tax an amount equal to 10% of that part of the cost of labor (excluding administrative labor) in excess of 20 cents per ton and limited the credit to two-thirds of the gross tax. (Laws 1941, Chapter 544.)

In 1945, by Chapter 445, the law was amended and the allowance was 10% of the labor cost in excess of 30 cents per ton and not in excess of 40 cents per ton; and 15% on that part of the labor cost in excess of 40 cents per ton and limited to 75% of the gross tax. The law was again amended in 1947, Chapter 541, and the allowance was 10% of that part of the labor cost in excess of 40 cents per ton and not in excess of 50 cents per ton; and 15% of that part in excess of 50 cents per ton and limited to 75% of the gross tax.

It was again amended in 1949 by Chapter 639 and the allowance was 10% of the labor cost in excess of 50 cents per ton and not in excess of 65 cents per ton and 15% on the labor cost in excess of 65 cents per ton and the allowance was limited to 75% of the gross tax for underground and taconite operations and 60% for all other operations.

In 1951, by Chapter 664, the law was again amended so that underground mines and mines in which during the year in question, more than 50% of the crude ore produced had been beneficiated by jigging, heavy media, roasting, drying or by artificial heat, sintering, magnetic separation, flotation, agglomeration, or any process requiring fine grinding, the allowance was 10% of that part of the cost of labor employed by said mine or in the beneficiation of such ore in said calendar year, in excess of 50 cents per ton and not in excess of 65

cents per ton of the merchantable ore produced during that year, and 15% of the labor cost in excess of 65 cents per ton. In the case of other mines 10% of the amount by which the average labor cost exceeds 50 cents but does not exceed 65 cents, plus 15% of the amount by which the average labor cost per ton exceeds 65 cents, multiplied by the number of tons of ore produced at said mine, not exceeding 100,000 tons, and 10% of the amount by which such average cost per ton of such labor exceeds 80 cents, multiplied by the number of tons of ore produced at said mine in excess of 100,000, limiting to 75% of the gross tax on underground and taconite operations, and 60% on all other operations.

In 1953, by Chapter 646, the law was amended as follows:

(a) This applies to underground mines and to open pit mines where over 40% of the crude ore produced has been beneficiated by processes more difficult than ordinary crushing and washing; and allows a credit of 10% of labor cost at such mines in excess of 60 cents and not over 78 cents per ton of concentrate produced; and 15% of that part of cost of such labor above 78 cents per ton of concentrate produced.

(b) Other mines (Open pit). On the first 100,000 tons allow a credit computed in the same manner as under (a). On all concentrate in excess of 100,000 tons from any mine, 10% of labor cost in excess of 96 cents per ton of concentrate, provided that the maximum allowable credit be limited to 75% of the computed gross tax in the case of underground and taconite operations, and to 60% as applied to all other operations, of the total tax computed under the provisions of Minnesota Statutes 1953, Section 298.01.

(c) But the labor credit shall not exceed 7.3% of the aggregate amount of occupation taxes, excluding such taxes levied for the Veterans' Compensation Fund (Sec. 298.01) assessed against all mines in the state for said year prior to the deduction of said credit. At the time of his final determination of occupation tax pursuant to Sec. 298.09, Subdivision 3, the Commissioner shall reduce the credit otherwise allowable to each mine hereunder by such equal percentage as will bring the total within such limitation.

The amendments to the labor credit law were necessitated in the main by the National inflationary spiral, and partly to prevent low cost mines from receiving the credit. As costs increased, the law had to be amended. Otherwise the low cost mines as well as the high cost mines would have received credit and the credits allowable would have been so large that the gross occupation tax would have been greatly reduced. Additional experience may indicate the necessity for further amendments.

Tables were presented to the Commission which illustrate the above statement. The 1951 gross occupation tax was $28,278,289; the labor credit allowed was $2,002,914; and the tax certified was $26,275,375. If the 1949 law had been used to compute the labor credit on the 1951 tonnage, the credit would have been $3,056,352, thus reducing the tax certified by more than $1,000,000.

The 1953 gross occupation tax was $32,591,700; the labor credit allowed was $2,285,897; and the tax certified was $30,305,803. If the 1951 law had been used to compute the labor credit on the 1953 tonnage, the credit would have been $3,389,000, thus reducing the tax certified by $1,103,000.

HAS THE LABOR CREDIT LAW ACCOMPLISHED ITS PURPOSE?

Whether or not the labor credit law has increased employment and the utilization of low grade, underground and high labor cost ores, is a controversial question.

In the hearings before the Commission, there was much diversity of opinion. Mr. G. Howard Spaeth, Tax Commissioner, stated "that it has not encouraged the employment of labor or the mining of even low grade ores." He attributed the increase of concentrated ore and employment on the range, since the enactment of the labor credit law, to the unusual demand for ore.

Mr. E. Tom Binger, an attorney, representing some 12 small mining companies, stated in substance, that he was certain that the labor credit law had encouraged the mining of low grade ore and that employment had increased because of it; that the labor credit law was an important factor for the small scram operators in determining their costs and whether or not the operation could be conducted at a profit; that the law was doing just what the Legislature intended it to do.

Mr. Francis D. Butler, an attorney representing Butler Bros. Mining Company, expressed his opinion that the labor credit law widens the use of low grade ores and of that type of operation which will require more labor per ton than would be otherwise required, and that the law reasonably accomplishes what it was intended to do.

Mr. W. K. Montague, an attorney representing large mining interests, stated in substance, that the labor credit law had increased the production of low grade ore and employment but because of the National economic situation and the great demand for iron ore, no one could determine to what degree the increased production and employment could be attributed to the labor credit law.

LABOR CREDIT

Mr. Warren S. Moore, President of W. S. Moore Company, a former member of the Legislature and an iron ore producer, stated in substance that he was processing ore from the Prindle Mine which was formerly operated by the Oliver Mining Company and abandoned because they had removed all the merchantable iron ore; that the labor credit allowed on this high cost mine was a great benefit and that the labor credit law was an important factor for the small operators in making their decisions on scram operations.

The following table shows the employment on the range and the tonnage of concentrates produced, before and since the passage of the labor credit law. These figures show that employment and concentrated iron production have increased since its enactment, but from our investigation of the subject, we have been unable to determine to what extent these increases can be attributed to the labor credit law.

TABLE NO. 10

EMPLOYMENT AT THE RANGE MINES AND ORE SHIPMENTS PRIOR TO AND SINCE THE ENACTMENT OF THE LABOR CREDIT LAW OF 1941

EMPLOYMENT:	1940	Low	6820	February
		High	9827	August
	1941	Low	8304	January
		High	12373	August
	1951	Low	15549	January
		High	17737	August
	1953	Low	16600	February
		High	19525	August
	First Half — 1954	Low	16019	May
		High	17840	January

SHIPMENT IN GROSS TONS:

	Direct	Total Concentrate	Total	Percent of Concentrate
1940	39,741,641	9,207,681	48,949,322	18.8%
1941	49,347,380	14,713,346	64,060,726	23.
1951	56,345,750	22,722,939	79,068,689	28.7
1953	54,509,204	27,002,275	81,511,479	33.1

Source: U. S. Bureau of Labor Statistics and Lake Superior Iron Ore Association.

There is sharp criticism of the labor credit law. Some claim the formula is too complicated. Others claim that mines which were never intended to receive labor credits are given them. The Interim Committee on Tax Research in its 1951 report to the Legislature, suggested that the labor credit against the occupation tax should be computed on a "Percentage Recovery" method. Others have made the

same suggestion. None of the advocates of this plan have presented to the Commission any factual background or figures showing its effect on revenue and on the industry.

We know that the present labor credit law is complicated and that simplicity in tax laws is desirable.

The only evidence or method submitted to the Commission outlining a way of computing a specific credit in lieu of the present labor credit is as follows:

On a certain designated value per ton of ore at the mine, a credit is figured varying with the amount by which the mine value of ore **falls below** the designated value chosen. (For a mine value of $3.00 or over, with a designated $3.00 value, there is no credit allowed.)

The higher the total production cost of the ore, the lower will be the mine value. In effect, this alternative credit would apply only to the high cost ores and taconite.

Comparative figures prepared showing the labor credit allowed on Minnesota mining operations in 1953 and the alternate credit computed on designated mine value of $3.00 and of $3.40 per gross ton are as follows:

Labor Credit Allowed in 1953	Computed Mine Value Credit $3.00 Base	Computed Mine Value Credit $3.40 Base
$2,285,898	$693,988	$1,154,323
Application of over-all 7.3% limitation: .073 × $29,875,726 (Gross tax @ 11%) = $2,180,928		
Plus elective credit on ores processed in Minnesota	104,970	
Total labor credit allowed on 1953 mining operations	$2,285,898	

A separate comparison made on 26 mines taken at random, gives the following results:

1953 Labor Credit Allowed	Mine Value Computed Credit $3.00 Base	Mine Value Computed Credit $3.40 Base
$606,812 (26 Mines)	$168,077	$346,302

The total number of tax mines in 1953 was 126. In addition there were 19 no-tax mines, making a total of 145 mines operating in Minnesota in 1953.

In computing the mine value credit on the $3.00 base, the credit on 17 open pit mines was governed by the 60% limitation; and on 3 underground mines, by the 75% limitation.

LABOR CREDIT

Computations made on the $3.00 base showed 26 open pit mines coming under the 60% limitation, and 3 underground mines under the 75% limitation.

The number of mines receiving a labor credit in 1953 was 112.

Figured on the mine value basis, 66 mines would have been entitled to mine value credit on the basis of $3.00; and 79 mines on the basis of $3.40.

ARE THE PRESENT TAXES ON IRON ORE TOO LOW, TOO HIGH, OR ARE THEY EQUITABLE?.....

In the preceding sections we have explained the law and the administration of the ad valorem, occupation and royalty taxes imposed on iron ore. The following table is a compilation of the taxes paid and the tonnage of iron ore produced by the mining companies from 1914 to 1953 inclusive:

TABLE NO. 11

	IRON ORE TAXES				Total Tonnage of Iron Ore Produced*
	Ad Valorem 1	Occupation 2	Royalty 3	Total	4
1914-1915	$ 13,935,202	.....	.....	$ 13,935,202	55,411,561
1916-1920	70,168,134	.....	.....	70,168,134	206,588,420
1921	18,185,156	$ 2,238,328	.....	20,423,484	17,495,578
1922	18,411,500	3,440,597	.....	21,852,097	28,770,120
1923	19,655,268	6,126,443	$ 1,027,847	26,809,558	44,843,457
1924	18,736,356	2,859,735	895,825	22,491,916	32,425,027
1925	18,570,829	2,316,432	845,072	21,732,333	37,580,850
1926	17,267,679	2,725,312	910,636	20,903,627	41,662,490
1927	17,342,382	2,183,308	916,825	20,442,515	36,474,549
1928	16,844,349	2,466,257	879,520	20,190,126	38,532,003
1929	17,251,700	3,786,352	1,044,696	22,082,748	46,922,911
1930	17,085,645	2,782,361	921,167	20,789,173	36,239,106
1931	16,617,217	1,383,145	649,804	18,650,166	18,370,526
1932	15,857,490	260,604	415,793	16,533,887	5,496,070
1933	16,582,129	958,388	335,600	17,876,117	12,597,805
1934	17,666,132	1,228,626	364,129	19,258,887	16,206,453
1935	17,323,829	1,387,546	459,951	19,171,326	19,954,430
1936	18,012,178	2,637,977	547,048	21,197,203	32,501,729
1937	17,269,567	9,033,930	1,305,385	27,608,882	49,619,930
1938	16,255,212	1,618,439	607,988	18,481,639	14,728,556
1939	16,431,322	4,888,964	865,926	22,186,212	31,789,650
1940	15,579,856	6,387,700	1,107,914	23,075,470	48,304,658
1941	14,564,253	8,399,387	1,823,592	24,787,232	63,736,347
1942	13,244,037	8,233,102	2,167,065	23,644,204	70,048,716
1943	13,300,103	6,711,683	1,945,807	21,957,593	69,364,022
1944	12,477,270	6,301,570	1,888,845	20,667,685	65,073,476
1945	12,588,313	6,289,279	1,762,134	20,639,726	62,482,046
1946	12,732,769	6,507,835	1,358,864	20,599,468	49,650,356
1947	13,923,528	9,700,773	1,654,392	25,278,693	59,967,761
1948	13,257,828	11,762,769	1,907,354	26,927,951	65,013,706
1949	14,901,587	14,355,466**	2,195,108**	31,452,161**	55,187,871
1950	16,565,954	18,822,662**	1,896,474**	37,285,090**	64,793,019
1951	17,241,113	26,275,375**	2,754,461**	46,271,049**	78,407,263
1952	18,721,241	20,788,836**	2,309,996**	41,820,073**	63,374,126
1953	21,039,931	30,305,803**	3,491,514**	54,837,248**	79,712,363
Total Taxes	$625,607,059	$235,164,984	$41,256,832	$902,028,875	1,719,326,951

* Production 1921 to date, as reported for occupation tax purposes.
** These figures include the additional 1% Veterans' Compensation Fund.
Authority for tax figures: Minnesota Department Taxation.
Authority for tonnage: Minnesota Mining Directory, 1954.

Organizations and individuals appearing before the Commission who claim the taxes are too low advance the theory that iron ore is a natural resource and that every ton shipped out of the state, so far as taxes are concerned, is gone forever; that foreign corporations have been and presently are making large profits from Minnesota iron ore and conclude therefore that iron ore, whether mined or unmined, should be taxed at a higher rate than any other property.

Up to 1921 the only tax paid on iron ore was the ad valorem tax. Under this law iron ore was assessed at 50% of its full and true value,

the highest percentage against any property. The foregoing led to the passage of the occupation tax in 1921 and the royalty tax in 1923, both being in addition to the ad valorem tax.

The same arguments are now being advanced to increase the taxes on iron ore. The Commission in examining into the strength or weakness of these arguments has heard the testimony of a great number of witnesses, made on the ground inspections of installations of the industry and examined analyses of experts in economics who have thoroughly explored these questions and expressed their opinions thereon.

As early as November, 1932 Roy G. Blakey, Professor of Economics at the University of Minnesota, and a staff of research experts wrote a book entitled *Taxation in Minnesota.* On page 248, we find the following statement:

> "At different times different arguments have been advanced to justify unusually heavy taxes on mines. The so-called 'natural heritage' argument asserts that because the mines are a gift of nature they should be subject to heavier taxes than property that has been created by human effort and saving. But the same argument would apply also to agricultural land and to manufacturing sites on navigable waters, as well as to forests. It might even be logically extended to cover the earnings of human beings who possess unusual talents that are the result of inherited characteristics. A more practical view of the problem must, moreover, take account of the fact that the development of a mining center adds to the opportunities for labor, merchandising, transportation, and all other economic enterprises. It must be remembered too that mining is usually a speculative venture, more hazardous to capital than are most economic activities. Too often men are inclined to look only at the enormous profits made in successful ventures and to ignore the losses of the unsuccessful. Our conclusion is that the natural heritage argument is not a strong one and that it does not of itself justify heavier taxation of mines."

In 1952, H. Kenneth Allen, Professor of Economics at the University of Illinois, writing on the subject of **Ad Valorem vs. Severance Taxes on Minerals,** stated as follows:

> "A proper point of departure for a discussion of the relative merits of ad valorem property taxes and severance taxes is a consideration of the basic question of whether mineral resources should be subjected to a heavier burden of taxes than other real estate. On the affirmative side of the argument, it is contended that mineral resources are a natural heritage. Unrecovered mineral resources, the argument goes, are provided by nature

> and do not result from any sacrifice or effort on the part of man. Thus it is contended that they should be singled out for especially heavy taxation. The diminishing-value theory is another argument that has been advanced for higher taxation of mineral resources than for other real estate. According to this argument, mineral resources do not reproduce themselves and their value is depleted through removal from the ground. Hence the justification for heavier taxation.
>
> "Upon examination, the arguments for imposing heavier taxes upon mineral resources than upon other real estate are not convincing. The fact that mineral resources are a natural heritage is admitted, but it is also true that the original surface land and, at least to some extent, superior human skills are natural endowments. Economic surpluses arise from the utilization of all factors of production – land, labor, and capital – not just from mineral resources. In our modern economy, economic surpluses find expression in net income, or that part of the accounting concept of net income which the economist calls profit. Income advantages from natural heritages of whatever type are generously tapped by federal and state income taxes. It might also be added that the hazards and risks of discovering and recovering mineral resources are greater than those that attach to most other natural heritages."

We acknowledge our ineptitude to discuss economics but we wonder if the people who assert "that every ton of iron ore shipped out of the state is gone forever as far as taxes are concerned," have given any thought to the fact that a certain percentage of that iron ore, after it is fabricated into steel, with a value much higher than it had as iron ore, comes back to the State of Minnesota as automobiles, tractors, farm machinery of all kinds, hardware, outboard motors, engines of all types, structural steel used in the construction of homes, office buildings and industrial plants, airplanes, boats, pipes, heating plants, nails, fencing and other items too numerous to mention, which becomes taxable.

We also wonder if they have given any thought to the fact that the trust funds derived from the occupation tax and from the sale of iron ore on State-owned lands amounting to millions of dollars and growing annually, remain permanently in the State of Minnesota.

Due to the fact that Minnesota has dominated the production of iron ore in the United States, a comparison of iron ore taxes in Minnesota with any other state is meaningless. However, the states of Texas and Oklahoma are endowed with an abundance of oil, which is also a natural resource comparable with iron ore. The following table shows

that the percent of value collected by Texas and Oklahoma on oil is less than the percent of value collected by Minnesota on iron ore.

TABLE NO. 12

COMPARISON OF SEVERANCE TAXES ON IRON ORE AND OIL

MINNESOTA IRON ORE

Year	Tonnage	Value at Mouth of Mine	Occupation and Royalty Tax	Percent of Value
1948	65,013,706	$ 220,025,130	$ 13,670,123	5.75
1949	55,223,161	224,813,716	16,550,574	7.3
1950	64,922,685	289,848,383	20,719,136	7.1
1951	78,407,263	381,339,034	29,029,836	7.6
1952	63,374,126	336,296,147	23,098,832	6.8
1953	79,083,000	465,974,787	33,797,317	7.25

Source: Department of Taxation.

OKLAHOMA OIL

Fiscal Year	Barrels	Value — (Surface of Well)	Tax	Percent of Value
1948-49	158,031,547	$ 402,866,754	$ 20,141,792	4.9
1949-50	150,861,008	384,289,715	19,211,019	4.9
1950-51	175,836,819	448,044,092	22,400,502	4.9
1951-52	186,903,632	475,700,536	23,779,070	4.9
1952-53	194,888,518	497,105,997	24,853,648	4.9

Source: Oklahoma Tax Commissioner.

TEXAS OIL

Year	Barrels	Value — (Surface of Well)	Tax	Percent of Value
1948	863,112,410	$2,226,830,017	$ 85,795,211	3.8
1949	879,617,458	2,269,373,041	87,435,848	3.8
1950	733,145,493	1,891,505,391	81,368,499	4.3
1951	939,307,991	2,423,414,616	110,087,654	4.5
1952	992,907,619	2,561,701,657	117,804,900	4.6
1953	995,500,707	2,710,876,870	124,700,336	4.6

Source: Comptroller of Public Accounts.

In Minnesota companies or individuals engaged in mining iron ore do not pay a state income tax, but they pay an occupation and royalty tax at 12%, which is much higher than the rate under the income tax law. It has been suggested to the Commission that the mining companies should pay on the income tax basis.

The following tables show that the mining companies would pay much less under the income tax law.

TABLE NO. 13-A

OLIVER IRON MINING DIVISION

COMPARISON OF OCCUPATION TAX PAID ON 1952 MINNESOTA IRON ORE OPERATIONS WITH TAXES THAT WOULD HAVE BEEN PAID UNDER STATE INCOME TAX LAW

1. OCCUPATION TAX

Number of Mines	Marketable Tonnage	Market Value	Statutory and Non-Statutory Deductions	Value for Tax or Gross Profit	Total Gross Tax Before Labor Credit	Amount of Labor Credit
31	33,064,938	$293,017,554	$164,772,908	$128,244,646	$15,389,357	$1,036,330

2. TAX UNDER STATE INCOME TAX LAW, WITHOUT ALLOWANCE OF FEDERAL TAX AT 52%**
   6.3%* of $128,244,646 ..... $8,079,412

3. TAX UNDER STATE INCOME TAX LAW, ALLOWING FEDERAL TAX AT 52%**
   6.3%* of ($128,244,646 minus (52% × $128,244,646)) $3,878,118

* 0.3% for Veterans' Compensation (5% x 6% equals 0.3%.)

** Computed without special reference to the Excess Profits Tax, on the assumption that all of the operations here considered are subject to the Excess Profits Tax.
(Normal rate, 30%; Surtax rate, 22%; Total—52%)

TABLE NO. 13-B

JONES AND LAUGHLIN

COMPARISON OF OCCUPATION TAX PAID ON 1952 MINNESOTA IRON ORE OPERATIONS WITH TAXES THAT WOULD HAVE BEEN PAID UNDER STATE INCOME TAX LAW

1. OCCUPATION TAX

Number of Mines	Marketable Tonnage	Market Value	Statutory and Non-Statutory Deductions	Value for Tax or Gross Profit	Total Gross Tax Before Labor Credit	Amount of Labor Credit
6	2,220,256	$19,562,502	$12,848,689	$6,713,813	$805,658	$126,660

2. TAX UNDER STATE INCOME TAX LAW, WITHOUT ALLOWANCE OF FEDERAL TAX AT 52%**
   6.3%* of $6,713,813 ..... $422,969

3. TAX UNDER STATE INCOME TAX LAW, ALLOWING FEDERAL TAX AT 52%**
   6.3%* of ($6,713,813 minus (52% × $6,713,813)) $203,024

* 0.3% for Veterans' Compensation (5% x 6% equals 0.3%.)

** Computed without special reference to the Excess Profits Tax, on the assumption that all of the operations here considered are subject to the Excess Profits Tax.
(Normal rate, 30%; Surtax rate, 22%; Total—52%)

TABLE NO. 13-C

CLEVELAND-CLIFFS

COMPARISON OF OCCUPATION TAX PAID ON 1952 MINNESOTA IRON ORE OPERATIONS WITH TAXES THAT WOULD HAVE BEEN PAID UNDER STATE INCOME TAX LAW

1. OCCUPATION TAX

Number of Mines	Marketable Tonnage	Market Value	Statutory and Non-Statutory Deductions	Value for Tax or Gross Profit	Total Gross Tax Before Labor Credit	Amount of Labor Credit
6	1,839,002	$15,895,493	$12,202,631	$3,692,862	$443,143	$141,598

2. TAX UNDER STATE INCOME TAX LAW, WITHOUT ALLOWANCE OF FEDERAL TAX AT 52%**
   6.3%* of $3,692,862.....$232,650

3. TAX UNDER STATE INCOME TAX LAW, ALLOWING FEDERAL TAX AT 52%**
   6.3%* of ($3,692,862 minus (52% × $3,692,862)).....$111,672

* 0.3% for Veterans' Compensation (5% x 6% equals 0.3%.)

** Computed without special reference to the Excess Profits Tax, on the assumption that all of the operations here considered are subject to the Excess Profits Tax.
(Normal rate, 30%; Surtax rate, 22%; Total—52%)

TABLE NO. 13-D

HANNA-AFFILIATED COMPANIES OPERATING IN MINNESOTA

COMPARISON OF OCCUPATION TAX PAID ON 1952 MINNESOTA IRON ORE OPERATIONS WITH TAXES THAT WOULD HAVE BEEN PAID UNDER STATE INCOME TAX LAW

1. OCCUPATION TAX

Number of Mines	Marketable Tonnage	Market Value	Statutory and Non-Statutory Deductions	Value for Tax or Gross Profit	Total Gross Tax Before Labor Credit	Amount of Labor Credit
17	9,553,653	$81,174,570	$61,873,357	$19,301,213	$2,316,147	$542,938

2. TAX UNDER STATE INCOME TAX LAW, WITHOUT ALLOWANCE OF FEDERAL TAX AT 52%**
   6.3%* of $19,301,213.....$1,215,976

3. TAX UNDER STATE INCOME TAX LAW, ALLOWING FEDERAL TAX AT 52%**
   6.3%* of ($19,301,213 minus ($19,301,213 × 52%)).....$ 582,409

* 0.3% for Veterans' Compensation (5% x 6% equals 0.3%.)

** Computed without special reference to the Excess Profits Tax, on the assumption that all of the operations here considered are subject to the Excess Profits Tax.
(Normal rate, 30%; Surtax rate, 22%; Total—52%)

TABLE NO. 13-E

PICKANDS-MATHER-AFFILIATES

COMPARISON OF OCCUPATION TAX PAID ON 1952 MINNESOTA IRON ORE OPERATIONS WITH TAXES THAT WOULD HAVE BEEN PAID UNDER STATE INCOME TAX LAW

1. OCCUPATION TAX

Number of Mines	Marketable Tonnage	Market Value	Statutory and Non-Statutory Deductions	Value for Tax or Gross Profit	Total Gross Tax Before Labor Credit	Amount of Labor Credit
14	8,540,935	$74,762,002	$51,766,853	$22,995,149	$2,759,423	$348,045

2. TAX UNDER STATE INCOME TAX LAW, WITHOUT ALLOWANCE OF FEDERAL TAX AT 52%**
   6.3%* of $22,995,149.....$1,448,694

3. TAX UNDER STATE INCOME TAX LAW, ALLOWING FEDERAL TAX AT 52%**
   6.3%* of ($22,995,149 minus (52% × $22,995,149)).....$ 695,373

* 0.3% for Veterans' Compensation (5% x 6% equals 0.3%.)

** Computed without special reference to the Excess Profits Tax, on the assumption that all of the operations here considered are subject to the Excess Profits Tax.
(Normal rate, 30%; Surtax rate, 22%; Total—52%)

TABLE NO. 13-F

ALL MINING COMPANIES IN MINNESOTA

COMPARISON OF OCCUPATION TAX PAID ON 1952 MINNESOTA IRON ORE OPERATIONS WITH TAXES THAT WOULD HAVE BEEN PAID UNDER STATE INCOME TAX LAW

1. OCCUPATION TAX

Number of Mines	Marketable Tonnage	Market Value	Statutory and Non-Statutory Deductions	Value for Tax or Gross Profit	Total Gross Tax Before Labor Credit	Amount of Labor Credit
101	62,042,620	$543,093,380	$347,816,668	$195,276,712	$23,433,205	$2,644,369

2. TAX UNDER STATE INCOME TAX LAW, WITHOUT ALLOWANCE OF FEDERAL TAX AT 52%**
   6.3%* of $195,276,712.....$12,302,433

3. TAX UNDER STATE INCOME TAX LAW, ALLOWING FEDERAL TAX AT 52%**
   6.3%* of ($195,276,712 minus (52% × $195,276,712)).....$ 5,905,168

* 0.3% for Veterans' Compensation (5% x 6% equals 0.3%.)

** Computed without special reference to the Excess Profits Tax, on the assumption that all of the operations here considered are subject to the Excess Profits Tax.
(Normal rate, 30%; Surtax rate, 22%; Total—52%)

TAX EVALUATION

The estimated profit per ton of all the operating mines in the State for the year 1952, is shown in the following table.

TABLE NO. 14

(See explanation following)

		Amount	62,042,620 Tons Per Ton
1. Combined Gross Income (Value of Iron Ore at Mouth of Mine)		$336,296,147.00	$5.42040
2. Less: Cost of Mining		141,019,435.00	2.27294
3. Balance		$195,276,712.00	$3.14746
4. Less: Ad Valorem Taxes on operating Mines	$12,687,657.00		
Less Tax allowed on tonnage produced	1,866,044.00		
5.	$10,821,613.00	10,821,613.00	.17442
6. Balance		$184,455,099.00	$2.97304
7. Less Occupation Tax	$23,433,205		
8. Less Labor Credits	2,644,369		
9. Actual Occupation Tax	$20,788,836	20,788,836.00	.33507
		$163,666,263.00	
10. Less Royalty Tax		$ 2,309,996.00	.03723
11. Net Profit before Allowance for Depletion and Federal Income Taxes		$161,356,267.00	$2.60074
12. Less: Percentage Depletion (15% of Gross Income) (As permitted under the Fed. Income Tax Law)		$ 50,444,422.00	$ .81307
13. Net Profit before Provision for Federal Income Taxes		$110,911,845.00	$1.78767
14. Provision for Federal Income Taxes (52% of Net Income Less $5,500.00)		57,668,659.00	.92950
15. Net Profit		$ 53,243,186.00	$ .85817

NOTE: A. No credit has been allowed for $5,070,602 ad valorem taxes paid on reserve properties.
B. No credit has been allowed for Federal Excess Profits Tax.
C. Certain administrative expense has not been allowed.

EXPLANATION OF NUMBERED FIGURES ON TABLE NO. 14

1. This figure was arrived at by taking the tonnage and chemical analysis on the ore produced in each operating mine, computing the value on the Lake Erie Price and then deducting the transportation, handling, insurance and miscellaneous charges to arrive at the value at the mouth of the mine, which is the basis for computing the occupation tax. All of the tonnage averaged 50.36% Natural Iron.
2. This item represents the cost of mining, including wages for labor, fuel, power, depreciation on equipment and all items of expense

allowable in computing the occupation tax, in extracting the ore from the mine and making it merchantable iron ore.

3. This figure represents the amount upon which the gross occupation tax is computed.
4. The figure $12,687,657.00 represents the taxes on real and personal property (ad valorem taxes) paid by the mining companies on all operating mines. In computing the occupation tax, the State only allows the ad valorem tax on the ratio of ore produced to the ore in the mine and for the year 1952, $1,866,044.00 was allowed. This amount is included in the cost of mining showing at No. 2.
5. This simply represents the difference between the ad valorem taxes paid on the operating mines and what has been previously allowed and included in the cost of mining shown at No. 2.
6. This represents the profit after allowing the ad valorem taxes which were disallowed in computing the occupation tax.
7. This is the actual computation of the gross occupation tax.
8. This is the amount of labor credits actually allowed on the gross occupation tax.
9. This is the amount of occupation tax after deduction of the amount of labor credits.
10. This represents the amount of royalty taxes paid on the ore removed from the ground.
11. This represents the net profit on all the iron ore produced before deducting depletion and the federal income taxes.
12. This figure represents the depletion allowance under the federal income tax law on item No. 1.
13. This item represents the net profit before deducting the federal income taxes.
14. This figure is the amount of the federal income taxes both normal and surtax, but excluding excess profits tax.
15. This represents the net profit on all operating mines for the year 1952, after deducting all of the items from No. 2 to No. 14 inclusive.

On the basis of the foregoing computation, the estimated profit per ton of 85.8 cents is the average of all the operating mines in the state for the year 1952. Some mines operated on a smaller profit per ton; some had a larger profit, but the table reflects the average profit per ton on the production of iron ore.

The assessed value of iron ore for ad valorem taxes is higher than on any other class of property. The occupation and royalty tax of 12% is higher than the rate under the income tax laws or the railroads' gross earnings tax law. The severance taxes on iron ore are higher percentage-wise on the value at the mouth of the mine than the severance taxes on the value of oil at the surface of the well in Texas and Oklahoma.

It appears from the foregoing that iron ore, whether mined or unmined, is taxed by Minnesota at a higher rate than any other property or business.

It is obvious that the State of Minnesota has formulated its tax program on iron ore on the theory that natural resources should be taxed on a more onerous basis than any other type of property. An analysis of all the information obtained leads to the conclusion that the taxes imposed on the iron ore industry have been equitable. The future policy of the State for taxing iron ore must take into consideration several factors, to-wit:

1. Reserves of iron ore
2. Competition from domestic and foreign ores
3. St. Lawrence Seaway
4. Taconite development
5. Availability of scrap

On May 1, 1953, the regular merchantable iron ore reserves were estimated at 915,183,000 gross tons. See Table No. 2 showing the character of the reserves.

During the year 1953, 81,511,479 gross tons were shipped from Minnesota. Of this tonnage, 27,002,275 tons were concentrates, or 33% of the total. There is no doubt that the direct shipping ore is diminishing and the concentrates from low grade ore are increasing.

The following table shows the increase in the ratio of concentrates to the total production:

TABLE NO. 15

Year	Washed		Other Than Washed*		Total Concentrates Gross Tons	Total Ore Shipments Gross Tons	% Concentrates of Total Ore Shipments
	Gross Tons	% of Total Concentrates	Gross Tons	% of Total Concentrates			
Prior 1907....	0	0.0	0	0.0	0	148,247,423	0.0
1907-1910....	668,136	100.0	0	0.0	668,136	106,968,014	0.6
1911....	1,978,337	100.0	0	0.0	1,978,337	23,336,127	8.5
1912....	2,875,769	93.0	215,585	7.0	3,091,354	34,195,682	9.0
1913....	1,967,632	87.5	281,625	12.5	2,249,257	36,339,962	6.2
1914....	1,831,504	90.9	182,833	9.1	2,014,337	23,352,360	8.6
1915....	2,956,812	99.6	11,805	0.4	2,968,617	32,618,653	9.1
1916....	4,072,420	96.2	162,290	3.8	4,234,710	46,189,617	9.2
1917....	4,370,234	96.8	143,590	3.2	4,513,824	45,393,882	9.9
1918....	4,655,198	94.7	260,290	5.3	4,915,488	44,070,710	11.2
1919....	4,570,863	99.8	7,532	0.2	4,578,395	34,791,866	13.2
1920....	4,973,497	98.8	59,971	1.2	5,033,468	40,348,663	12.5
1921....	3,034,583	99.1	26,298	0.9	3,060,881	17,708,789	17.3
1922....	4,683,906	93.4	332,876	6.6	5,016,782	30,772,162	16.3
1923....	7,202,894	94.6	409,564	5.4	7,612,458	45,305,647	16.8
1924....	4,852,828	91.0	478,456	9.0	5,331,284	31,589,464	16.9
1925....	6,177,417	94.1	389,716	5.9	6,567,133	38,841,968	16.9
1926....	5,288,071	95.1	269,804	4.9	5,557,875	41,919,575	13.3
1927....	4,766,997	94.0	305,688	6.0	5,072,685	36,504,854	13.9
1928....	5,296,789	90.7	544,286	9.3	5,841,075	39,167,842	14.9
1929....	5,874,028	89.5	692,241	10.5	6,566,269	47,478,167	13.8
1930....	4,947,841	78.0	1,391,759	22.0	6,339,600	34,881,010	18.2
1931....	3,171,035	85.8	525,154	14.2	3,696,189	17,309,211	21.4
1932....	266,282	91.0	26,176	9.0	292,458	2,250,200	13.0
1933....	2,331,328	74.4	803,329	25.6	3,134,657	14,953,168	21.0
1934....	2,656,315	77.2	783,726	22.8	3,440,041	15,967,819	21.5
1935....	3,764,388	73.0	1,389,186	27.0	5,153,574	20,532,222	25.1
1936....	6,693,102	86.2	1,071,399	13.8	7,764,501	33,829,341	23.0
1937....	7,484,375	77.2	2,207,716	22.8	9,692,091	49,161,064	19.7
1938....	2,235,037	79.1	591,407	20.9	2,826,444	14,815,811	19.1
1939....	4,609,615	74.1	1,611,748	25.9	6,221,363	33,022,890	18.8
1940....	7,230,091	78.5	1,977,590	21.5	9,207,681	48,949,322	18.8
1941....	11,859,036	80.6	2,854,310	19.4	14,713,346	64,060,726	23.0
1942....	14,268,146	79.4	3,697,070	20.6	17,965,216	75,299,667	23.9
1943....	12,606,056	81.6	2,848,054	18.4	15,454,110	69,971,276	22.1
1944....	12,332,746	82.1	2,696,074	17.9	15,028,820	66,586,264	22.6
1945....	12,222,223	79.1	3,238,620	20.9	15,460,843	62,830,572	24.6
1946....	9,710,307	82.4	2,068,771	17.6	11,779,078	50,010,067	23.6
1947....	13,421,966	80.4	3,281,568	19.6	16,703,534	63,517,190	26.3
1948....	14,466,947	80.4	3,516,420	19.6	17,983,367	69,108,906	26.0
1949....	12,597,107	74.9	4,211,995	25.1	16,809,102	56,825,957	29.6
1950....	13,056,077	65.6	6,841,058	34.4	19,897,135	65,331,865	30.5
1951....	14,332,688	62.4	8,637,637	37.6	22,970,325	79,068,689	29.1
1952....	10,960,437	55.8	8,686,749	44.2	19,647,186	64,719,898	30.4
1953....	15,250,110	56.5	11,752,165	43.5	27,002,275	81,511,479	33.1
TOTALS .	294,571,170	78.3	81,484,131	21.7	376,055,301	2,099,656,041	17.9

* Includes jigged, hi-density and other gravity concentrates, magnetite concentrates, sinter, sinter-dried ore, dried ore and taconite magnetic concentrates.
Source: Minnesota Mining Directory, 1954.

It should be emphasized that most concentrated iron ore is a high cost ore. No one can foretell just how long our high grade direct shipping ore will last. It depends upon the demand; competition from domestic and foreign iron ore; the St. Lawrence Waterway and the future tax policy of the State. Undoubtedly the ever increasing ratio of the production of concentrates is due in part to legislative policy with relation to labor credits. The fact remains that in the not too distant future we will have to rely upon concentrates and taconite if Minnesota is to continue producing the major part of the iron ore requirements of the nation.

The most recent estimate on magnetic taconite is that there are 10 billion tons that can be quarried by open pit methods, which will produce 3 billion tons of merchantable iron ore containing 63% to 65% natural iron. But we must not lose sight of the fact that the processing of taconite is expensive.

Excessive taxes on iron ore could cause the mining companies to mine the high grade ore as rapidly as possible. On the other hand a fair tax policy would probably motivate the mining companies to conserve the high grade ore and increase the production of concentrates or low grade ore, thus conserving our reserves of high grade ore. Any increase of taxes on taconite would undoubtedly discourage the present investors in this field and curtail investments and research. However, by pursuing the present tax policy with relation to taconite the State can encourage this type of investment and industry and induce other venture capital to come into the state providing more jobs, homes and other types of business so necessary to the economic well-being of our range communities and the State as a whole.

With an equitable tax program there is reasonable assurance that our reserves of natural ore and taconite will last a long time and Minnesota will continue to be the leading producer of iron ore in the United States for years to come.

The importance of taxes in relation to reserves has been discussed but competition must be given consideration also.

The magnitude of the Labrador-Quebec and Venezuelan deposits are explained under the sections Reserves and Competitive Ores in this Report.

In addition to Labrador-Quebec and Venezuela we can expect competition from expanded production in the Steep Rock, Canada field and from Michigan Jasper.

From the evidence produced before the Commission it appears conclusively that the Venezuelan ore can be delivered at the Eastern

Seaboard or Pittsburgh, Pa., at a lower cost per unit of iron than Minnesota ore.

The Labrador-Quebec ore can be delivered to the steel mills on the eastern seaboard cheaper than the Minnesota ore. When the St. Lawrence Seaway is completed the Labrador-Quebec ore can be delivered to the inland steel mills of this country as cheaply as Minnesota ore.

CONCLUSIONS AND RECOMMENDATIONS.....

Determination of Tax Base

Reserves

Taconite

Cost of Developing and Mining Minnesota Ore and Competitive Ores in Other Parts of the World

Competitive Ores

What Impact Will the Great Lakes-St. Lawrence Waterway Have on the Iron Ore Industry of Minnesota?

Impact of National Defense

Drilling Permits and Moratorium

Labor Credit

Are the Present Taxes on Iron Ore Too Low; Too High; or Are They Equitable?

DETERMINATION OF TAX BASE

Conclusion: The use of the market value at Lake Erie ports as a principal factor in determining the base value for computing the ad valorem and occupation tax is just and fair. Its application determines a higher value and therefore produces more revenue than any other formula. It has been approved by the Supreme Court.

Recommendation: It is recommended that the use of the market value at Lake Erie ports be continued.

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RESERVES

Conclusion: Present figures on reserves of Minnesota iron ore indicate that under normal production the range life of high grade direct shipping ore will be about 30 years. Past experience indicates that new techniques for beneficiation of low grade ore may substantially lengthen the range life.

Ore manufactured from taconite is very high grade and a better material for use in blast furnaces than natural ore. When the taconite plants operate at full capacity and new beneficiating methods increase the utilization of low grade ore, the range life of Minnesota reserves, including taconite, will be prolonged indefinitely.

The iron ore reserves of the world which will furnish competition with Minnesota iron ore are those located in Michigan; Labrador-Quebec, Steep Rock, Michipicoten, all in Canada; and Venezuela, South America.

The present method of estimating iron ore reserves has been severely criticized because more ore has been shipped than was originally estimated.

Local assessors lack the facilities to determine iron ore reserves and the value thereof for tax purposes as required by present law. Therefore, for practical reasons the University School of Mines estimates the reserves and certifies its findings to the Commissioner of Taxation who then computes and certifies the values thereof to the county auditors as the base for tax levies. The auditors cause the listings and valuations to be entered on the local assessment books.

It is impossible to estimate the reserves of iron ore in the ground with exactitude. After numerous hearings and consideration of evidence on the subject, the method of estimating reserves has been found to be sound and practical, but has no sanction of law.

Recommendation: It is recommended that, for practical reasons above referred to and because the present law prescribing the method

of estimating and evaluating reserves is inadequate, a law be enacted placing the duty of estimating and evaluating reserves upon the Commissioner of Taxation in cooperation with the University School of Mines and local assessing and taxing authorities.

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TACONITE

Conclusion: Taconite can become Minnesota's greatest source of iron ore in the relatively near future. It may well surpass the total Mesabi tonnage and productive life.

The production of merchantable iron ore from taconite is expensive. Plants now under construction will cost $523,000,000 and the anticipated annual production is 11,000,000 tons. On this basis the capital investment is almost $50 per ton of annual production. Experts claim that to keep Minnesota in the forefront as a producer of iron ore the production of taconite concentrate must reach about 40,000,000 tons in 1970. At the present rate of capital investment, plants to produce this tonnage would cost two billion dollars.

An industry with the courage to invest that much money in this State is entitled to all possible encouragement.

Because of the equivocal language in the taconite law it should be clarified.

Recommendations:

1. It is recommended that the taconite tax remain at its present rate and the law be amended to change the distribution of the tax proceeds so that the local taxing units will receive a percentage necessary to enable them to provide the additional municipal functions brought about by the new industry.

2. It is recommended that the taconite tax law be amended so that the State and local taxing units can determine definitely what property is taxable and what property is non-taxable under the "in lieu" provisions of the law.

3. It is recommended that the private railroads of taconite companies be taken out of the "in lieu" provisions of the taconite tax law and be taxed on a gross earnings basis, the revenue therefrom to be appropriately allocated to the local governmental units into or through which such railroads operate; that the tax be at the same rate as the gross earnings tax on other railroads and that the gross earnings be determined by assuming a freight rate for the merchandise carried which is the same or comparable to the published tariffs of other railroads.

4. It is recommended that the private loading docks of taconite companies be taxed on a gross tonnage basis and revenue therefrom be appropriately allocated to the local taxing units.

5. It is recommended that the Legislature take note of the fiscal difficulties of local governmental units in the taconite industry area brought about by inordinate demands for governmental service during the construction period, and consider such relief as is appropriate.

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COST OF DEVELOPING AND MINING MINNESOTA ORE AND COMPETITIVE ORES IN OTHER PARTS OF THE WORLD

Conclusion: Mining companies, being in competition with each other, are reluctant to disclose their costs. The only states which require reports giving costs are Minnesota and Michigan. While Michigan is second only to Minnesota as a producer of iron ore in the United States, practically all of its ore is mined by underground methods. Table No. 4 shows that the costs on underground operations in Minnesota and Michigan are almost identical.

The greater part of Minnesota's low cost iron ore has been mined and shipped during the past 50 years. Much of the remaining ore is minable only at a substantially higher cost. The ores of Labrador-Quebec and Venezuela are among those most cheaply mined of any deposits known today. Their long distance from tidewater and longer transportation routes will partly offset Minnesota's higher mining cost.

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COMPETITIVE ORES

Conclusion: For many years Minnesota has furnished about two-thirds of the iron ore produced in the United States but recent developments in Canada and other foreign fields indicate that in a few years Minnesota ore will be entering a highly competitive market. Beginning in 1954 ore from Labrador-Quebec is being delivered both at coastal United States ports and steel mills located from 300 to 500 miles inland; and ore from Venezuela is being delivered at Morrisville, Pennsylvania, Sparrows Point, Maryland and Mobile, Alabama. The main advantage held by these two foreign fields is the high grade of the ore which makes it competitive on an iron unit basis with Minnesota's remaining direct-shipping ore and concentrate.

The Commission's studies and on-the-spot inspections of the main new sources of iron ore indicate that future annual imports therefrom may be expected to reach a minimum of 15,000,000 tons by 1957 and

may exceed 25,000,000 tons by 1960. Much of this imported ore will be competitive with Minnesota ore.

Recommendation: It is recommended that the future tax policy on iron ore be such as to aid in keeping Minnesota ore production costs competitive with imported ores and scrap iron. Every factor that enters into the cost of production of iron ore in Minnesota should be carefully considered by the Legislature in formulating its tax policy as it affects the industry.

* * *

WHAT IMPACT WILL THE GREAT LAKES-ST. LAWRENCE WATERWAY HAVE ON THE IRON ORE INDUSTRY OF MINNESOTA

Conclusion: Table No. 5 shows that the estimated saving on ore transportation to steel mills in the Pittsburgh area via St. Lawrence Waterway will be from 69 cents to 96 cents per ton without allowance for toll charges. The law provides that the seaway must be self-liquidating. Assuming 50 cents per ton for toll charges an estimated saving via the seaway would be 19 cents to 46 cents per ton.

This indicates that Labrador ore going to inland United States furnaces via the waterway when completed will be competitive with Minnesota ore.

* * *

IMPACT OF NATIONAL DEFENSE

Conclusion: There can be no doubt that National defense spending has a certain effect on the production of iron ore. Military equipment requires steel and steel is made from iron ore and scrap. In 1953 Minnesota produced 79,000,000 tons of iron ore. In 1954 production will not exceed 50,000,000 tons. It may be a coincidence that the production drop was in about the same ratio as the drop in National Defense appropriations.

National Defense spending is certainly a factor which must be considered with National economic trends in estimating future iron ore production.

* * *

DRILLING PERMITS AND MORATORIUM

Conclusions: Hearings on these two subjects did not bring to light any facts indicating a need for legislation at this time requiring permits to drill for minerals and it is apparent that a law exempting newly discovered mineral deposits from taxation for a period of years might be unconstitutional.

Recommendation: It is recommended that there is no need for a drilling permit law at this time. It is also recommended that there is no need for a moratorium law and the Commission has grave doubt as to the constitutionality of such a law.

* * *

LABOR CREDIT

Conclusion: The 1954 production of Minnesota iron ore to November 1 is about 36% below that of 1953, the all-time record year. This fact alone does not disprove the merits of a specific credit against the gross occupation tax on high cost ores. Such a credit undoubtedly does help to encourage the mining of such ores although in years of very high production the abnormal demand largely obscures that fact.

The 1954 decrease in the total production of Minnesota iron ore was from an all-time high in 1953 of 79,712,000 tons down to an estimated 50,000,000 tons. There was a sharp reduction in the output of direct shipping ore and straight wash ore. The reduced demand in 1954 is certain to affect some of the more marginal low-grade ore operations even with the labor credit now in effect. Taking away **all** credit against the tax would close down many more of these low-grade ore operations. This would result in heavy losses of jobs, because many more men are needed to produce 100,000 tons of product from the marginal operations than are needed for producing 100,000 tons of direct shipping or straight wash ore.

Operators of mines producing only direct shipping ore or straight wash ore are better able to expand or reduce production with changing demand than those mining ores requiring treatment methods other than ordinary crushing and washing.

The lower the profit margin on any low-grade ore operation the greater the chance that it will not be able to run in any but high-demand years. Removal of all credit would not only cause the loss of many jobs but would be detrimental to the conservation of iron ore, which is becoming more vital to the State of Minnesota every year. True conservation calls for an increasing rather than a decreasing use of the poorer ores along with the better ores.

Recommendation: It is recommended that the labor credit theory be retained but limited to underground and high labor cost mines and taconite operations.

* * *

ARE THE PRESENT TAXES ON IRON ORE TOO LOW; TOO HIGH; OR ARE THEY EQUITABLE?

Conclusion: The history of taxation in Minnesota shows very clearly that iron ore has been taxed on a more onerous basis than any other

class of property. The reasons for the higher rate of tax can be traced to the premise that iron ore is a natural resource and a diminishing asset and should therefore stand a heavier burden of taxation.

When Minnesota had a monopoly on low cost open-pit iron ore this premise may have been justified but conditions have changed. High-grade ore is rapidly diminishing – high-cost concentrates made from low-grade ore are increasing – plants to manufacture iron ore from taconite are under construction to supplement the dwindling supply of natural ore – competition from the large deposits of high-grade ore in Canada and Venezuela is now a reality.

Higher taxes on iron ore would have the following effects:

1. Cause foreign ores to become more competitive;
2. Hasten the depletion of remaining high grade ore reserves;
3. Be detrimental to many small high cost mine producers;
4. Tend to discourage further investments in Minnesota's taconite industries.

Recommendation: It is recommended that taxes on iron ore should not be increased unless the financial condition of the State makes it necessary to increase taxes generally to provide the additional revenue to operate the State Government, in which event the additional taxes should be spread equitably upon all taxpayers.

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General Statistics

Table No. 16

CLASSIFICATION OF IRON ORE SHIPMENTS FROM MINNESOTA

MESABI RANGE

Year	Direct Ore		Concentrates		Total Shipments Gross Tons
	Open Pit	Underground	Open Pit	Underground	
1892-1900 ...	19,505,000	11,885,000	.....	.....	31,390,000
1901-1910 ...	125,469,000	67,359,000	652,000	16,000	193,496,000
1911-1920 ...	208,521,000	89,256,000	34,178,000	973,000	332,928,000
1921-1930 ...	217,798,000	60,914,000	52,142,000	1,099,000	331,953,000
1931-1940 ...	159,314,000	24,979,000	45,036,000	1,553,000	230,882,000
1941-1945 ...	232,949,000	11,390,000	70,758,000	740,000	315,837,000
1946	34,830,000	918,000	10,561,000	17,000	46,326,000
1947	42,592,000	1,689,000	14,794,000	4,000	59,079,000
1948	45,899,000	2,168,000	15,965,000	15,000	64,047,000
1949	35,859,000	1,759,000	15,076,000	.....	52,694,000
1950	40,461,000	1,872,000	17,722,000	79,000	60,134,000
1951	50,967,000	1,718,000	20,517,000	113,000	73,315,000
1952	40,625,000	1,369,000	17,343,000	125,000	59,462,000
1953	50,275,000	1,234,000	24,315,000	129,000	75,953,000
Total.....	1,305,064,000	278,510,000	339,059,000	4,863,000	1,927,496,000

VERMILION RANGE

1884-1890 ...	(1)	3,223,000	.....	.....	3,223,000
1891-1900 ...	(1)	11,968,000	.....	.....	11,968,000
1901-1910 ...	(1)	15,138,000	.....	.....	15,138,000
1911-1920 ...	(1)	13,860,000	.....	.....	13,860,000
1921-1930 ...	(1)	14,339,000	.....	.....	14,339,000
1931-1940 ...	28,000	10,051,000	5,000	69,000	10,153,000
1941-1945 ...	52,000	8,343,000	74,000	67,000	8,536,000
1946	.....	1,330,000	.....	.....	1,330,000
1947	.....	1,430,000	.....	.....	1,430,000
1948	.....	1,560,000	.....	.....	1,560,000
1949	.....	1,300,000	.....	.....	1,300,000
1950	.....	1,651,000	.....	.....	1,651,000
1951	.....	1,788,000	.....	.....	1,788,000
1952	.....	1,642,000	.....	.....	1,642,000
1953	.....	1,613,000	.....	.....	1,613,000
Total.....	80,000	89,236,000	79,000	136,000	89,531,000

(1) Data not available on open pit shipments from early operations of Soudan and South Chandler Mines nor from milling operations of Section 30 Mine (1910 to 1923).

TABLE NO. 16 — Continued

CLASSIFICATION OF IRON ORE SHIPMENTS FROM MINNESOTA

CUYUNA RANGE

Year	Direct Ore		Concentrates		Total Shipments Gross Tons
	Open Pit	Underground	Open Pit	Underground	
1911-1920 ...	4,757,000	8,666,000	392,000	35,000	13,850,000
1921-1930 ...	5,949,000	8,201,000	3,727,000	.....	17,877,000
1931-1940 ...	2,952,000	2,040,000	4,588,000	176,000	9,756,000
1941-1945 ...	5,580,000	1,813,000	6,315,000	389,000	14,097,000
1946	977,000	176,000	1,178,000	23,000	2,354,000
1947	913,000	189,000	1,756,000	2,000	2,860,000
1948	1,262,000	236,000	1,651,000	.....	3,149,000
1949	925,000	175,000	1,630,000	.....	2,730,000
1950	1,178,000	273,000	1,774,000	.....	3,225,000
1951	1,292,000	334,000	1,875,000	13,000	3,514,000
1952	1,146,000	290,000	1,696,000	6,000	3,138,000
1953	1,156,000	230,000	2,328,000	1,000	3,715,000
Total.....	28,087,000	22,623,000	28,910,000	645,000	80,265,000

TOTAL MINNESOTA

1884-1890 ...	.....	3,223,000	.....	.....	3,223,000
1891-1900 ...	19,505,000	23,853,000	.....	.....	43,358,000
1901-1910 ...	125,469,000	82,497,000	652,000	16,000	208,634,000
1911-1920 ...	213,278,000	111,782,000	34,570,000	1,008,000	360,638,000
1921-1930 ...	223,747,000	83,454,000	55,869,000	1,099,000	364,169,000
1931-1940 ...	162,294,000	37,070,000	49,629,000	1,798,000	250,791,000
1941-1945 ...	238,581,000	21,546,000	77,426,000*	1,196,000	338,749,000*
1946	35,807,000	2,424,000	11,739,000	40,000	50,010,000
1947	43,505,000	3,308,000	16,698,000*	6,000	63,517,000*
1948	47,161,000	3,964,000	17,969,000*	15,000	69,109,000*
1949	36,784,000	3,234,000	16,808,000*	.....	56,826,000*
1950	41,639,000	3,796,000	19,818,000*	79,000	65,332,000*
1951	52,259,000	3,840,000	22,844,000*	126,000	79,069,000*
1952	41,771,000	3,301,000	19,517,000*	131,000	64,720,000*
1953	51,431,000	3,077,000	26,873,000*	130,000	81,511,000*
Total.....	1,333,231,000	390,369,000	370,412,000*	5,644,000	2,099,656,000*

* Includes open pit concentrates from Fillmore County District: 279,000 tons in 1942-1943, 148,000 tons in 1947, 353,000 tons in 1948, 102,000 tons in 1949, 322,000 tons in 1950, 452,000 tons in 1951, 478,000 tons in 1952, and 230,000 tons in 1953.

Ore mined by milling methods is included under "Open Pit."

Authority: Compiled by the Mines Experiment Station.

TABLE NO. 17

SHIPMENTS OF CONCENTRATED IRON ORE FROM MINNESOTA RANGES IN GROSS TONS

Range	Gravity Concentrates[1]				Sinter[2]	Dried	Taconite Magnetic[3]	Total Concentrates
	Washed	Jigged	Hi-Density	Other				
1952								
Mesabi	9,819,146	653,009	4,002,953	2,194,940	691,313	.....	106,388	17,467,749
Vermilion	.....	.....	.....	.....	.....	.....	.....	.....
Cuyuna	663,745	149,047	451,342	13,168	77,779	346,810	.....	1,701,891
Fillmore County Dist.	477,546	.....	.....	.....	.....	.....	.....	477,546
Minnesota	10,960,437	802,056	4,454,295	2,208,108	769,092	346,810	106,388	19,647,186
1953								
Mesabi	14,168,118	1,014,129	4,840,593	3,230,624	628,563	.....	561,347	24,443,374
Vermilion	.....	.....	.....	.....	.....	.....	.....	.....
Cuyuna	851,567	218,081	658,341	19,633	179,443	401,411	.....	2,328,476
Fillmore County Dist.	230,425	.....	.....	.....	.....	.....	.....	230,425
Minnesota	15,250,110	1,232,210	5,498,934	3,250,257	808,006	401,411	561,347	27,002,275
1907-1953								
Mesabi	280,545,282	14,199,833	25,182,752	18,077,957	2,036,306	2,776,212	1,039,342	343,920,828[4]
Vermilion	4,743	211,059	.....	.....	.....	.....	.....	215,802
Cuyuna	11,656,699	1,071,911	2,218,954	39,801	4,821,262	9,323,464	.....	29,554,225[4]
Fillmore County Dist.	2,364,446	.....	.....	.....	.....	.....	.....	2,364,446
Minnesota	294,571,170	15,482,803	27,401,706	18,117,758	6,857,568	12,099,676	1,039,342	376,055,301[4]

(1) In some cases accurate separation of classes is impossible and estimated figures have been used. "Other" gravity concentrates are those produced by various methods other than jigging or hi-density that are in addition to the usual washing treatment. This includes the concentrates made from the undersize product of the hi-density plants, abrasive grinding, etc.

(2) Includes sinter, nodules, and other types of agglomerates except those made from magnetic taconite concentrate.

(3) Includes magnetic taconite concentrates whether or not agglomerated.

(4) Includes roasted magnetic concentrates from Mesabi Range and sinter-dried concentrates from Cuyuna Range.

Authority: Compiled by the Mines Experiment Station.

TABLE NO. 18

SUMMARY

1953 MINE SHIPMENTS OF LAKE SUPERIOR IRON ORE BY RAILROADS TO UPPER LAKE PORTS AND ALL RAIL

(Gross Tons — Railroad Weights)

Range	To Upper Lake Ports	All Rail	Total	Percent of Total
Mesabi	73,978,707	1,974,508	75,953,215[1]	76.70
Vermilion	1,472,738	140,417	1,613,155	1.63
Cuyuna	3,676,469	38,215	3,714,684[2]	3.75
Fillmore County		230,425	230,425	0.23
Total Minnesota	79,127,914	2,383,565	81,511,479[3]	82.31
Gogebic	4,581,776	221,773	4,803,549	4.85
Marquette	5,391,062	180,440	5,571,502	5.62
Menominee	4,658,534	2,502	4,661,036[4]	4.71
Total Michigan & Wisconsin	14,631,372	404,715	15,036,087[5]	15.18
TOTAL — U. S. RANGES	93,759,286*	2,788,280	96,547,566[6]	97.49
Canadian Districts				
Michipicoten	793,424	391,381	1,184,805	1.20
Steep Rock	1,300,874	503	1,301,377	1.31
Total — Canadian Districts	2,094,298*	391,884	2,486,182	2.51
GRAND TOTAL — U. S. and CANADA	95,853,584* (a)	3,180,164 (b) (c)	99,033,748	100.00

* The difference between these tonnages *to* upper lake ports and the tonnages shipped *from* upper lake ports (Season 1953 statement of Dec. 7, 1953) are accounted for by ore left in docks at beginning and at end of season.

(a) Includes 16,840 tons Canadian ore left in dock.

(b) Includes 5,159 tons (U.S. and Canadian) ore lost in transit.

(c) Includes 8,302 tons transported via truck.

NOTE: Manganiferous ore, containing 5% or more manganese, included in totals, as follows:

(1) Includes 32,141 tons—Mesabi
(2) Includes 1,067,444 tons—Cuyuna
(3) Includes 1,099,585 tons—Total Minnesota
(4) Includes 68,083 tons—Menominee
(5) Includes 68,083 tons—Total Michigan
(6) Includes 1,167,668 tons—Total—All U.S. Ranges

Stockpile—(S.P.)

Source: The Lake Superior Iron Ore Association, 1400 Hanna Bldg., Cleveland, Ohio, May 25, 1954.

TABLE NO. 19

1954 RAIL AND LAKE FREIGHT RATES ON IRON ORE

In Effect on April 15, 1954

	Rates Per Gross Ton
Rail Freight Rates from Lake Superior Mines to Upper Lake Ports*	
Eastern Marquette Range to Marquette, Mich.	$0.8775
Western Marquette Range to Marquette, Mich.	.9447
Marquette and Menominee Ranges to Escanaba, Mich.	1.1463
Gogebic Range to Ashland, Wis.	1,1463
Gogebic Range to Escanaba, Mich.	1.7511
Mesabi and Vermilion Ranges to Duluth and Two Harbors, Minn., and Superior, Wis.	1.1799
Cuyuna Range to Duluth, Minn., and Superior, Wis.	1.1799
Note: Above rates include dock handling charge of $0.1495 per ton.	
Lake Freight Rates from Upper Lake Ports to Lower Lake Ports*	
Escanaba, Mich., to Lower Lake Michigan Ports	1.19
Escanaba, Mich., to Lake Erie Ports	1.43
Marquette, Mich., to Lower Lake Ports	1.67
Head of Lake Superior to Lower Lake Ports	1.83
Note: Above rates include unloading charge of $0.23 per ton.	
Charges on dock ore, per ton:	
Rail of vessel to stock-pile	$0.3565
Stock-pile to car	.23
Storage per month	.01
Rail Freight Rates from Lower Lake Ports to Consuming Districts*	
Lake Erie Ports	
To Valley's District, Canton and Massillon	1.6279
To Midland, Steubenville, Weirton and Neville Island	1.8743
To Pittsburgh and Wheeling Districts	2.1207
To Monessen, Pa.	2.2215
To Johnston, Pa.	2.3447
To Virginia District	3.3415
Toledo	
To Jackson and Hamilton, Ohio	1.7511
To Ashland, Ky. and Portsmouth, Ohio	2.2663
Cleveland	
To Jackson, Ohio	2.0759
To Ashland, Ky., Hamilton and Portsmouth, Ohio	2.2663
Ashtabula, Conneaut and Erie	
To Riddlesburg, Pa.	2.9271
Buffalo and Erie	
To Lehigh and Schuylkill Valleys, Pa.	3.1847
To Sparrows Point, Md.	3.1847
Buffalo	
To Troy, N.Y.	2.3559
To Everett, Mass	3.2519
To Riddlesburg, Pa.	3.1847
Chicago to Granite City, Ill.	2.1991
Note: Above rates include handling charge from rail of vessel to car of $0.1495 per ton.	

(Continued on next page)

TABLE NO. 19 — Continued

1954 RAIL AND LAKE FREIGHT RATES ON IRON ORE
In Effect on April 15, 1954

	Rates Per Gross Ton
All-Rail Freight Rates from Lake Superior Mines to Consuming Districts*	
Cuyuna, Mesabi and Vermilion Ranges	
To Duluth, Minn.	$1.1312
To Cleveland, Lorain, Valley's District, Canton and Massillon	6.9404
Mesabi and Vermilion Ranges	
To Chicago District	4.256
To Pittsburgh and Wheeling Districts	7.3104
To Johnstown, Pa.	7.5104
Cuyuna, Gogebic, Marquette and Menominee Ranges	
To Granite City and East St. Louis, Ill.	3.6176
Fillmore County, Minn.	
To Granite City and Chicago District	3.0016
Gogebic, Marquette and Menominee Ranges	
To Chicago District	3.304
To Cleveland, Lorain, Valley's District, Canton and Massillon	5.1744
To Pittsburgh and Wheeling Districts	5.7232
To Weirton, W. Va.	5.4544
To Johnstown, Pa.	5.9248
All-Rail Freight Rates from Northern New York to Consuming Districts*	
Port Henry and Lyon Mountain, N.Y., to Pittsburgh, Pa.	3.7408
Clifton Mines to Clairton, McKeesport and Pittsburgh	3.7408
Benson Mines to Pittsburgh and Aliquippa	3.3712
Rail Freight Rates from Canadian Mines to Lake Superior Docks and Consuming Districts	
Steep Rock, Ont., to Port Arthur, Ont. (Includes handling charge of $0.15 per ton from cars to vessel.)	1.35
Jamestown, Ont., to Michipicoten, Ont. (Combined rail and dock charge.)	0.575
Michipicoten Range to Sault Ste. Marie, Ont.	1.76
Rail Freight Rates on Foreign Iron Ore Arriving at U. S. Docks to Consuming Districts*	
Baltimore, Md.	
To Donora and Monessen, Pa.	2.6992
To Pittsburgh District	2.8112
To Butler, Pa.	2.9232
To Wheeling District	2.9792
To Cleveland, Lorain, Canton and Massillon	3.2592
To Ashland, Ky., Columbus, Portsmouth and Jackson, Ohio	3.3712
To Hamilton and Middletown, Ohio	3.5952
To Detroit, Mich., and Toledo, Ohio	3.9312
To Buffalo, N.Y., Warren and Portsmouth, Ohio	3.0352
To Chicago	6.1712
Philadelphia, Pa.	
To Warren and Youngstown, Ohio	3.0352

* A Federal Transportation Tax of 3%, effective December 1, 1942, applies to all railroad and lake transportation and dock charges, except for dock handling from vessels to dock stock-piles. This tax does not apply to handling at private docks, nor to any Canadian rail or dock charges.

Source: Minn. Mining Directory, 1954.

TABLE NO. 20

LAKE ERIE BASE PRICES OF IRON ORE* AND VALLEY PRICES OF BESSEMER AND NO. 2 FOUNDRY PIG IRON AT DATE OF ORE BUYING MOVEMENT

Season	Date buying movement	Old Range Bessemer	Old Range Non-Bessemer	Mesabi Bessemer	Mesabi Non-Bessemer	High Phosphorus	Bessemer Pig Iron	No. 2 Foundry Pig Iron
1930	April 1, 1930	$4.80	$4.65	$4.65	$4.50	$4.40	$19.00	$18.50
1931	April 15, 1931	4.80	4.65	4.65	4.50	4.40	17.00	17.00
1932	June 3, 1932	4.80	4.65	4.65	4.50	4.40	14.50	14.50
1933	June 7, 1933	4.80	4.65	4.65	4.50	4.40	16.00	15.50
1934	May 21-26, 1934	4.80	4.65	4.65	4.50	4.40	19.00	18.50
1935	April 23, 1935	4.80	4.65	4.65	4.50	4.40	19.00	18.50
1936	April 1, 1936	4.80	4.65	4.65	4.50	4.40	20.00	19.50
1937	Mar. 8, 1937	5.25	5.10	5.10	4.95	4.85	24.50	24.00
1938	May 23, 1938	5.25	5.10	5.10	4.95	4.85	24.50	24.00
1939	May 3, 1939	5.25	5.10	5.10	4.95	4.85	21.50	21.00
1940	April 16, 1940	4.75	4.60	4.60	4.45	4.35	23.50	23.00
1941	April 17, 1941	4.75	4.60	4.60	4.45	4.35	24.50	24.00
1942‡	April 10, 1942	4.75	4.60	4.60	4.45	4.35	24.50	24.00
1943‡	.....	4.75	4.60	4.60	4.45	4.35	24.50	24.00
1944‡	.....	4.75	4.60	4.60	4.45	4.35	24.50	24.00
1945‡	.....	4.95	4.80	4.70	4.55	4.55	25.50[1]	25.00[1]
1946‡	.....	5.45	5.30	5.20	5.05	5.05	27.00[1]	26.50[1]
1947	Jan. 25, 1947	5.95	5.80	5.70	5.55	5.55	31.00	30.50
1948	Mar. 27, 1948	6.60	6.45	6.35	6.20	6.20	40.00	39.50
1949	Dec. 30, 1948	7.60[2]	7.45[2]	7.35[2]	7.20[2]	7.20[2]	47.00	46.50
1950	Jan. 26, 1950	8.10	7.95	7.85	7.70	7.70	47.00	46.50
1951[3]	Dec. 2, 1950	8.70	8.55	8.45	8.30	8.30	53.00	52.50
1952[3]	July 26, 1952	9.45	9.30	9.20	9.05	9.05	55.50	55.00
1953[3]	Feb. 12, 1953	10.10	9.95	9.85	9.70	9.70	55.50	55.00
1953[3]	July 1, 1953	10.30	10.15	10.05	9.90	9.90	55.50	55.00
1954[3]	.....	10.30	10.15	10.05	9.90	9.90	57.00	56.50

* Based on following analysis: Bessemer 51.50% Fe(Nat.) and 0.045% Phos.(Dry); non-Bessemer 51.50% Fe(Nat.)

‡ Prices controlled by the U. S. Office of Price Administration.

(1) Maximum per gross ton, established by U. S. Office of Price Administration.

(2) 6% increase in dock unloading charge of $0.18, or $0.0108, added to buyers' account, effective January 11, 1949.

(3) Iron ore prices subject to adjustment for changes in ore transportation and handling costs from mines to rail of vessel at Lower Lake ports, including rail, dock and vessel charges and transportation taxes thereon, as follows: 1951 and 1952 prices by the amount of any change after December 1, 1950; Feb. 12, 1953, prices by the amount of any change after December 31, 1952; July 1, 1953 and 1954 prices by the amount of any change after June 24, 1953.

Source: Minn. Mining Directory, 1954.

TABLE NO. 21

CARGOES OF LAKE CARRIERS IN MINNESOTA WATERS AT THE HEAD OF THE LAKES

1953 total arrivals in the Duluth Superior Harbor	5,698
1953 total coal cargoes	528
1953 total coal and limestone	3
1953 total autos and coal	27

A more detailed tabulation of vessel arrivals and departures classified by commodities carried is shown below:

Kind of Cargo Carried	No. of Vessels—1953
ARRIVALS	
Automobiles only	292
Autos and coal	27
Coal and limestone	3
Coal or coke only	528
Gasoline and/or oils	44
Grains or screenings	173
Limestone and salt	3
Limestone or cement only	100
Miscellaneous	0
Paper pulp	3
Passengers	11
Salt	6
Sand	16
Steel, including scrap	8
Twine	1
Without cargo	4,483
TOTAL ARRIVALS	5,698
DEPARTURES	
Crude Oil	226
Grains and/or flaxseed	344
Iron Ore	4,771
Merchandise	7
Miscellaneous	0
Molasses	1
Passengers	11
Scrap Iron	27
Steel, except scrap	10
Without cargo	296
TOTAL DEPARTURES	5,693
GRAND TOTAL	11,391

Taken from report published by The United States Engineer Office at the Head of the Lakes in the issue of *Skillings Mining Review* for January 2, 1954.

TABLE NO. 22

MINNESOTA IRON ORE AD VALOREM TAXES, 1914 TO DATE

	Ad Valorem Taxes			
	State	County	Local	Total
1914-1915	$ 2,422,416	$ 2,649,422	$ 8,863,364	$ 13,935,202
1916-1920	7,525,564	11,743,432	50,899,138	70,168,134
1921	1,203,473	3,040,145	13,941,538	18,185,156
1922	1,161,288	2,951,031	14,299,181	18,411,500
1923	2,298,710	3,300,036	14,056,522	19,655,268
1924	1,682,383	3,143,135	13,910,838	18,736,356
1925	2,149,882	2,984,651	13,436,296	18,570,829
1926	1,458,007	2,912,173	12,897,499	17,267,679
1927	1,972,268	3,167,651	12,202,463	17,342,382
1928	1,347,033	3,129,570	12,367,746	16,844,349
1929	1,592,537	3,290,144	12,369,019	17,251,700
1930	1,366,684	3,262,329	12,456,632	17,085,645
1931	1,883,194	3,382,985	11,351,038	16,617,217
1932	1,959,006	3,201,138	10,697,346	15,857,490
1933	2,643,812	3,247,220	10,691,097	16,582,129
1934	2,762,996	4,059,152	10,843,984	17,666,132
1935	3,062,746	3,931,227	10,329,856	17,323,829
1936	2,798,071	4,459,946	10,754,161	18,012,178
1937	2,024,419	4,009,528	11,235,620	17,269,567
1938	2,004,850	4,123,766	10,126,596	16,255,212
1939	1,953,413	4,601,422	9,876,487	16,431,322
1940	1,810,014	4,374,856	9,394,986	15,579,856
1941	1,507,775	3,951,242	9,105,236	14,564,253
1942	1,451,024	3,506,085	8,286,928	13,244,037
1943	893,996	3,677,474	8,728,633	13,300,103
1944	662,625	3,462,913	8,351,732	12,477,270
1945	1,019,654	3,291,772	8,276,887	12,588,313
1946	1,026,087	3,714,909	7,991,773	12,732,769
1947	888,768	5,125,429	7,909,331	13,923,528
1948	914,255	4,823,156	7,520,417	13,257,828
1949	1,141,709	5,195,204	8,564,674	14,901,587
1950	1,355,673	6,105,424	9,104,857	16,565,954
1951	1,145,406	5,881,887	10,213,820	17,241,113
1952	1,157,664	6,799,912	10,763,665	18,721,241
1953	1,600,346	7,499,418	11,940,167	21,039,931
TOTAL	$63,847,748	$147,999,784	$413,759,527	$625,607,059

Source: Department of Taxation.

TABLE NO. 23

COMPARISON OF AVERAGE TAX PER TON OF PRODUCTION
MINNESOTA AND MICHIGAN

	MINNESOTA				MICHIGAN		
Year	Ad Valorem	Occupation	Royalty	Total	General Property	Corporation Tax	Total
1940	$.323	$.132	$.023	$.478	$.1525	$.0094	$.1619
1941	.228	.132	.029	.389	.1296	.0079	.1375
1942	.189	.118	.031	.338	.1134	.0032	.1166
1943	.193	.097	.028	.318	.1197	.0085	.1282
1944	.192	.097	.029	.318	.1520	.0102	.1622
1945	.201	.101	.028	.330	.1527	.0153	.1680
1946	.256	.131	.027	.414	.2135	.0126	.2261
1947	.232	.161	.028	.421	.1546	.0075	.1621
1948	.204	.181	.029	.414	.1491	.0058	.1549
1949	.270	.260	.040	.570	.1868	.0070	.1938
1950	.249	.289	.029	.567	.1818	.0073	.1891
1951	.221	.335	.035	.591	.1908	.0089	.1997
1952	.280	.328	.037	.665	.2609	.0101	.2710
1953	.266	.383	.044	.693	.2434	.0250	.2684

Source: Minnesota Commissioner of Taxation.
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