GEOLOGICAL SURVEY OF WYOMING

PROCESSES FOR THE REDUCTION OF MAGNESIUM FROM DOLOMITE ROCKS AT GUERNSEY, WYOMING

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PROCESSES FOR THE REDUCTION OF MAGNESIUM
FROM THE DOLOMITE ROCKS AT GUERNSEY, WYOMING

SECTION I

NEW MAGNESIUM PROCESS - NEW MAGNESIUM AND ALUMINUM PRODUCTION - PRIOR ENDORSEMENTS - LATEST PROCESS MODIFICATIONS - MAGNESIUM BY FERROSILICON - OTHER PLANT SITE ATTRACTIONS.

Magnesium, fiery champion of the light-weight metals, has leaped from obscurity into commanding war-time significance. Present war widely differs from all of its predecessors. Current pattern of warfare is based on the superlative performances of magnesium more so than on any other metal.

Magnesium is the lightest of all metals now widely used in industry. It is only two-thirds as heavy as aluminum and less than one-fourth the weight of steel. In these days of unprecedented expansion in the airplane industry the demand for magnesium alloys approaching the strength of carbon steels increases by leaps and bounds. No metal can be too light for plane construction. Today, the plane most safely protected from either aerial or ground attack is the one soaring highest in the skies.

Most insatiable demand yet devised for magnesium is the manufacture of bomb types peculiarly adapted for airplane transportation. Present war had not started over a day or two before German planes released bomb-casings made of magnesium instead of common steel. The new metal increased the carrying capacity of foreign bombers upwards of 400%. The efficiency factor of the new bomb, however, was far more spectacular in another direction. Magnesium metal is often ignited by a common match. The magnesium bombs are the incendiaries that blaze into incandescent brilliance the moment they strike any material, inflammable or otherwise.

When World War II started, only one firm was producing magnesium in the U.S.A. Most of its output was likely purchased by camera enthusiasts for their flashlight bulbs. In the past two-year period magnesium production has been conducted on a far higher scale of expansion than that enjoyed by any other metal. Domestic output is still far behind current military demands. At least six or seven concerns are already producing the champion light-weight metal at seven or eight widely separated sites in the U.S.A. Some time will likely elapse before too much magnesium is produced in Wyoming, or say, at any other point in the western hemisphere.

Published figures already obsolete by sixty days accredited the Axis powers with the following number of magnesium plants:

Country	Number of Plants
Germany	5
Italy	5
France	4
Norway	1
Total	15

Above figures represent plants in operation instead of sites still on the drafting boards. No figures were published for Japan. At least one plant in California is now following the pattern of a works completed in Japan a year or two ago. Other Axis areas economically favorable for large-scale plant expansions would include Norway, France and Greece.

A serious error would be committed in presuming that the United States has already wrested domination in the growingly important magnesium field from the Axis powers. Latest figures published by U. S. Bureau of Mines indicate that Germany alone still produces over one-half the magnesium supply of the world. No room for discouragement should exist in Wyoming at this time. It is beginning to look as though magnesium could be produced as cheaply in Wyoming as any other point at least within the compass of the United Nations.

NEW MAGNESIUM PROCESS

Huge deposits of magnesium-bearing rocks have long been known to occupy broad areas in Wyoming. Until the past year no feasible process was perfected to handle the Wyoming type of material. A newly patented method is locally known as the Pidgeon or Canadian Ferrosilicon Process.

The so-called Pidgeon process is still too new or revolutionary in scope to be recorded in any reference book. Such an omission is, however, immaterial. So many variations and modifications are almost daily being incorporated into the process that descriptions filed a month ago may now be looked upon as hopelessly out of date. The best that can be offered on the method at this time are two summaries from a recent technical journal.

Towards the close of March the outlook for the Pidgeon process was along the following lines:

NEW MAGNESIUM AND ALUMINUM PRODUCTION

LARGE SCALE PRODUCTION of magnesium from two ferrosilicon processes has been decided upon by the War Production Board both as a means of minimizing dependency upon electric process power and to step up the national output sooner. This was announced at the end of February by Materials Director, W. L. Batt (now resigned), in disclosing that to meet the President's war-production goals aluminum capacity is being stepped up to 1,050,000 tons and magnesium to 725,000,000 lb. annually, with the deadline set for early 1943.

The increase in aluminum production over previous goals is 640,000,000 lbs., virtually all of which is to be located in metropolitan centers using high-cost steam-power reserve capacities. Exact sites had not been selected early in March, but New York, Philadelphia, and Boston seemed assured of large plants.

The increase in the magnesium sights is 325,000,000 lb., nearly doubling the previous goal, which in itself was more than ten times pre-war output. Six contracts for producing 175,000,000 lbs. of magnesium by an improved Pidgeon and the Union Carbide and Carbon ferro-silicon processes and 36,000,000 lbs. by the standard electrolytic process had been signed at the first of March. In addition to Union Carbide, other operators will be American Metals Co., National Lead Co., Ford Motor Co., Permanente Corp., and New England Lime Co.

Both the ferrosilicon processes to be utilized carry the endorsement of the National Academy of Sciences and both are independent industrial developments, Mr. Batt emphasized. The Materials Director pointedly omitted any mention of Secretary Ickes' recent claims of being able to produce the metal from Government-developed extraction methods.

* *

A large portion of the new construction, particularly aluminum -- is admittedly in the "white elephant" economic classification insofar as post-war operation is concerned-- this being particularly true of the aluminum works in high-cost power areas. In admitting this, Mr. Batt pointed out that WPB's requirements committee has now formally adopted the policy which has been followed for some time by the Government in war production -- that of counting dollar costs secondary to the amount of materials involved and the time required.

Engineering and Mining Journal
March, 1942, pg. 86.

Preceding analysis indicates that production capacity rather than production cost is now the deciding factor for the location of new plant sites in the light metal field.

Reduction of light metals from their tightly locked ores is chiefly an energy consuming process. The biggest expense is generally the cost of the power consumed. Coal mined in Pennsylvania would supply most of the power for the three large metropolitan centers suggested in the preceding clipping as sites for the light metal industry. Power rates for those great cities are commonly bracketed among the highest in the nation.

Nearest source of ore supply for the chief ports on the Atlantic seaboard would be central Arkansas. A rail haulage up to 1500 miles would be required to reach the new plant sites. The Arkansas supply has long been deficient for normal demands and the new works would soon have to rely on imported ore for their operations. The closest foreign ores would have to be mined in the steaming tropical jungles of British and Dutch Guianas. Their transportation would involve the chartering of extremely valuable cargo space for a 3000-mile ride over waters that still rank among the most hazardous on the high seas.

Production of the magnesium variety of light metals would be a vastly more simplified procedure in Wyoming. First of all, an exhaustless ore supply would have to be located. The next step would be a trifle more difficult. On the selected ore deposit itself, it would be highly desirable to spot a modern hydro-power plant already offering one of the lowest rate schedules in the nation. The Wyoming process also consumes fuel. That would seem to make the location problem even more formidable. Best location for a magnesium works would call for a town that already provides the dual ore deposit - powerhouse site, and, in addition thereto, a complete network of natural gas and crude oil pipeline systems.

One town in Wyoming already offers all basic fundamentals specified by the preceding demands. In other manufacturing lines, towns that approach the natural set-up at Guernsey are commonly looked up to as occupying the optimum or CAPITAL Sites of distinctive industries operating in the United States area.

Preceding quoted material is full of economic neologisms such as: "------ high-cost steam-power reserve capacities ----(benefits of)-works in high-cost power areas --- new construction admittedly in the 'white-elephant' economic classification insofar as post-war operation is concerned--- (policy) of counting dollar cost is secondary----etc."

Some of the preceding expressions do not yet appear in any available dictionary. Benefits of foregoing phraseology are doubtlessly better understood in eastern centers. The people at Guernsey, Wyoming, also want a light metal industry. Economically speaking, their language is contradictory to terms already outlined. Those taxpayers of Wyoming believe that the costly and growingly complex transportation problem could be eliminated only by building a plant at their natural focal point. No ships would have to be built to haul ore to Guernsey, nor would additional cars be required to carry coals to a town long ago piped with vastly more efficient gaseous and liquid fuels. In short, no magnesium plant belonging to the admittedly "white-elephant" category is wanted at Guernsey. At that point a "survival-of-the-fittest" style of works carries far more appeal at this time.

PRIOR ENDORSEMENTS

Main reason for selecting preceding summary for insertion in this report was the number and variety of endorsements it listed for the Pidgeon Process. Some of them are national in scope. It and subsequent notices record the household names of giant chemical, metallurgical, pigment, motor and quarrying corporations as now seeking contracts to produce tremendous quantities of magnesium for the government under the basic Pidgeon patents. Even more noteworthy is the precedent-breaking endorsement recorded by the National Academy of Science. From the philosophical angle no sanction could be higher than one direct from the U. S. Senate of Science, itself.

A few days prior to the date of the material previously inserted, Senator Harry H. Schwartz also endorsed this Pidgeon process. At that time a press release quoted him:

> "It is believed the ferrosilicon process for the reduction of magnesium from burned dolomite has reached a state of development where it is ready for commercial application."

In respect to plant sites over prospective Wyoming areas the Senator concluded:

> "Present comprehensive plans embrace broad areas in Wyoming which would contribute in one or several ways to plant operations."

At this writing no method yet devised for extracting magnesium from the Wyoming type of ore material seems to carry so wide a variety of endorsements as that of the Pidgeon Ferrosilicon process.

Other reasons could be filed for being personally prejudiced in favor of the Pidgeon system. All should remember that in the past two-year period no less than one-fourth billion dollars have been appropriated for the establishment of a sizable magnesium industry in this country. Most of those funds came out of the U. S. Treasury. Some of these outlays were merely devoted to financing the pipe-dreams of visionaries. Cries of excess profits running up to 4200% have also been recently aired. In another instance a person occupying one of the stellar roles in the federal service was accused of undue favoritism in awarding magnesium con-

tracts. The Pidgeon process is different. Its plants are far less elaborate. Such works could be built over suitable Wyoming terrain in jig time, or say, in periods ranging from 6 months to 1 year. Costing far less than undertakings already financed in competitive states, the local plants should be lss subject to charges of irregularities of the order filed against boosters and promoters of prior record.

Latest Modifications of the Pidgeon Process

The following synopsis was selected as giving the status of the Pidgeon Process in most succinct form as of April 25, 1942:

"Mg Via Ferrosilicon

"More details of the methods used for making magnesium by the ferrosilicon process have been announced recently. (See E. & M.J. p.33, March, 1942) Some information has also been released regarding the use of calcium carbide instead of ferrosilicon.

"Most completely described by its backers is the Pidgeon process as follows: 'The Pidgeon process for the production of metallic magnesium consists essentially in reacting burnt dolomitic lime with crushed ferrosilicon in an externally heated, sealed, metallic retort, which is kept under vacuum by means of vacuum pumps. The metal, 99.98 percent pure, is recovered in a solid dense crystalline mass, which is subsequently melted down under flux and poured into ingots. The crystalline masses may also be added direct to molten aluminum for the production of aluminum-magnesium alloys.'

"Variations of the processes to be employed by other companies, including Electro Metallurgical Co., use refractory retort, internal heating, and other important variations of the same fundamental principle. These variations make the process quite different than normal zinc metallurgy, from which much of the Pidgeon process technic has been adapted. It is important to note that all of these processes are of the batch type. But with large retorts which are used by some companies, a very substantial quantity of material can be produced per charge.

"Some experiments have been made in the United States on the use of calcium carbide as the reducing agent. No commercialization is yet planned, probably because of the larger power requirement. However, the carbide method is in use in Australia following the developments of Murex, Ltd. That process heats together finely ground carbide with calcined magnesite in a vacuum. The vapor of crude metal is condensed to a solid and then purified by melting under a suitable flux."
(Engineering and Mining Journal, April, 1942, pg. 42.)

Foregoing insert succeeds in recording the basic principles as well as describing the latest variations now in effect on the Pidgeon process. As such it necessitates the discard of all former narrations filed on the method. By the end of another month a similar rejection may likely be recommended for the citation immediately preceding.

Please note that all of Pidgeon's latest patents called for a batch type process conducted in vacuo. Its operations involve radical departures from orthodox smelting practice. Boiled down, the previously burnt dolomite rock is intermixed with ferrosilicon alloy in externally heated, sealed metallic retorts

which are kept under vacuums by means of vacuum pumps. At the temperature levels applied the powerful ferroalloy reduces the metal in the gaseous state which is subsequently liquefied and cast into merchantable ingots for the trade. It must be noted that ferrosilicon is the keystone of the original Pidgeon patents. That alloy, instead of hydropower, reduces the rock to the metallic state.

For conducting step No. 1. the calcination of the dolomite, as well as 2nd step, the heating of the burnt rock at high temperature in vacuo in steel retorts, the processors will never ask for a better heating medium than Wyoming natural gas. That wonder raw material has twice the calorific value of common gas as well as all other types of ordinary fuels. Of all heating agents it would best serve for continuous low-cost, straight-line reduction of magnesium metal directly from the rock supply of Wyoming. Merely having a huge ledge of dolomite rock in town is not sufficient groundwork for any given locality to enter into the magnesium industrial picture. It would be far better for the community rock-pile to be intercepted by the main pipeline system of an interstate gas corporation.

OTHER PLANT SITE ATTRACTIONS

In time Pidgeon plants will likely be in successful operation in communities that offered nothing more than a pipeline connection plus a liberal supply of rock. Competitive towns that could grant additional inducements may prove to be few and far between. Nevertheless, it must not be forgotten that the extraction of magnesium from a common limestone variety involves a tremendous consumption of energy. As stated before, the keystone of the Pidgeon Process is ferrosilicon. In some circumstances that ordinary looking material must pack and deliver energy equivalents akin to dynamite.

Basic minerals out of which ferrosilicon is fabricated are iron ore and quartz. Minimum cost reduction of the elemental product would demand a sizable iron mine as well as a first-class ledge of silica to be in sight of a hydropower plant.

Previous citation indicated that a tendency has arisen to substitute ferrosilicon with calcium carbide. Calcium carbide is also made out of limestone but out of a different variety from which magnesium is fabricated. The carbide process is also electrothermal in scope.

Later on one town in Wyoming will be accredited as having both kinds of limestone, a power house and both types of basic ferrosilicon minerals within its immediate environs. Such fully self-sustaining towns have the better background for low-cost production of magnesium and kindred military products.

More detailed descriptions on the ores, minerals, rocks, chemicals, fluxes, gaseous and liquid fuels and other forms of power producers available in or around the town of Guernsey will follow in the 2nd section of the report. All raw materials consumed by the Pidgeon process are present at that rather unusual point. To find consuming outlets for other multifold resources of the locality will not be an easy problem. Later it may be necessary to file summaries on patents of a competitive character to the Pidgeon process. Some of those rival methods would have to go into production if market outlets are to be provided for many of the raw materials abounding in the Guernsey area.

PROCESSES FOR THE REDUCTION OF MAGNESIUM FROM THE DOLOMITE ROCKS AT GUERNSEY, WYOMING

Section II

GUERNSEY DOLOMITES - MAP - ASSAYS - IMPURITIES - ROCK RESERVES - QUARRYING OPERATIONS - NORTH PLATTE RIVER - RAILROADS - HIGHWAYS - HYDRO POWER - MODERN FUELS - FERROSILICON - IRON ORE MINE - STEEL MILL PROSPECTS - NATURAL GAS - CRUDE OIL FUELS - OIL PROCESS ENDORSEMENT - PITTSBURGH PLUS - TRANSPORTATION SHORTAGES - CARIBEAN ORE SUPPLY PORTS - VARIOUS U. S. INDUSTRIAL AREAS - WYOMING REGION

WYOMING DOLOMITE DEPOSITS

During the past few months important discoveries of dolomite, chiefly in the rugged canyons near Wheatland, Thermopolis and Cody, were announced in the Wyoming press. Many other deposits of dolomite are also known to occur in Wyoming. Through the past several months investigations of these resources have been made by the U. S. Bureau of Mines at the request of Wyoming statesmen. None of the Bureau findings were available for this report. In the near future the Bureau will likely publish a bulletin on the outstanding dolomite deposits in Wyoming.

Present investigation covers the single ledge of dolomite that skirts the northern edge of Guernsey. It is possible that rock of slightly higher grade will soon be reported by the Bureau of Mines at one or two other points in Wyoming. It is doubtful if any of these deposits will lie so close to any municipality as the huge ledge at Guernsey. The Guernsey geography is even more favorable in other directions. In Wyoming only the Guernsey community can supply every raw material or form of energy consumed in the reduction of dolomite by the latest patented processes.

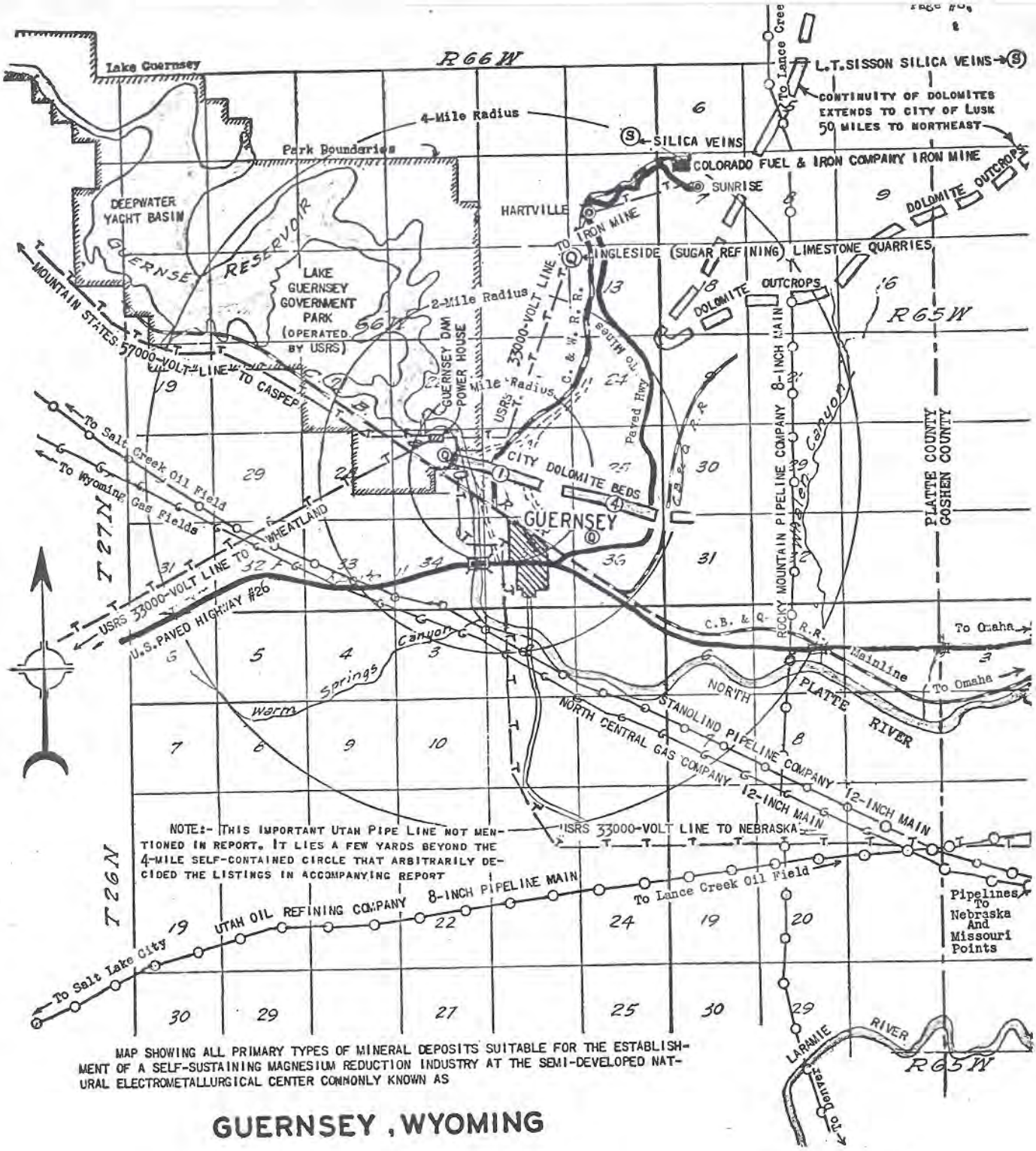
GUERNSEY DOLOMITE DEPOSIT

Several large ledges of dolomite outcrop in the vicinity of Guernsey. Only the deposit nearest town can be described. It is the pink limestone formation that skirts the northern edge of Guernsey. In that locality the steeply dipping beds outcrop here and there over a distance of 2 miles in an easterly-westerly direction. Owners have measured the widths of these exposures as much as 300 feet. In the river canyon and along cliff faces in the vicinity of Guernsey the beds have been eroded to depths of 150 feet and more.

MAP

A map of the area covered by this investigation is inserted on the following page. The dolomite ledge is drawn in red. Its central sector lies less than one-half mile north of town. The map also shows the 2-mile long ledge to be cut across or athwart by the following basic industrial potentials:

Largest River Channel in Wyoming
One High Voltage Transmission Line
One Railway Mainline
One Railway Spur
One Paved Highway
Two Common Roadways



MAP SHOWING ALL PRIMARY TYPES OF MINERAL DEPOSITS SUITABLE FOR THE ESTABLISHMENT OF A SELF-SUSTAINING MAGNESIUM REDUCTION INDUSTRY AT THE SEMI-DEVELOPED NATURAL ELECTROMETALLURGICAL CENTER COMMONLY KNOWN AS

GUERNSEY, WYOMING

MAP COVERS AN AREA CIRCUMSCRIBED BY 4-MILE RADIUS ON WHICH IS PLOTTED THE FOLLOWING FEATURES OF BASIC INDUSTRIAL AND RECREATIONAL GROUNDWORK THUS FAR DEVELOPED IN THE LOCALITY.

(1) HYDRO DAM AND POWER HOUSE OF USRS
(2) 4 HIGH POWER TRANSMISSION LINE INTERCONNECTIONS
(3) INTERSTATE NATURAL GAS PIPE LINE SYSTEM
(4) 3 CRUDE OIL ARTERIAL MAINS OF MAJOR PIPE LINE SYSTEMS
(5) NON-STREAMLINED FORMS OF TRANSPORTATION FACILITIES
(6) EASTERN SECTOR OF LAKE GUERNSEY STATE PARK

NOTES

Base map supplied by Wyoming Highway Department. Other data consolidated hereon were transferred from special State maps. Wide variations in scale precluded accurate plottings for several structures shown hereon.-CSD.

LEGEND

CITY OF GUERNSEY DOLOMITE BED *
CHEMICAL LIMESTONE QUARRIES
IRON ORE MINE AS INDICATED
USRS DAM & POWER PLANT AS INDICATED
NATURAL GAS PIPELINE MAIN
OTHER DOLOMITE BEDS
SILICA VEINS
PARK BOUNDARIES
HIGH TENSION TRANSMISSION LINES
CRUDE OIL PIPELINE MAIN
RAILROADS, PAVEMENTS, 2ND & 3RD CLASS HIGHWAYS AS INDICATED
*NOS. INDICATE ASSAY SAMPLE LOCATIONS

APPROXIMATE SCALE 5/8 INCH = MILE

EXACT SCALE SHOWN BY RADIAL CIRCLES

CHEYENNE, WYO.

JUNE 15, 1942

C. S. Dietz
MINERAL TECHNOLOGIST.

Distances from the dolomite ledge to other civic betterments, industrial improvements, natural resources, fuel, power and transportation facilities, are also indicated on the map by several radii. The list follows:

One Mile Radius
- City of Guernsey
- Guernsey Hydro Dam & Power House
- Limestone Quarry (Ca CO_3, Chemical Grades)
- *C. B. & Q. Mainline
- *U.S. Pavement, No. 26

Two Mile Radius
- Lake Guernsey
- 12-inch Natural Gas Pipeline Main
- 12-inch Crude Oil Pipeline Main

Four Mile Radius
- 8-inch Crude Oil Pipeline Main
- 16th Biggest Iron Ore Mine in USA
- Vein Deposits of Pure Silica

*Not included under preceding listing

Foregoing lists leave out no single item in the way of raw materials or preferred forms of fuels and power producers now known to be consumed by the Pidgeon Ferrosilicon Process specially designed for the reduction of magnesium from common dolomite rock. Should a location engineer be now seeking a plant site that had everything at a single spot he would be forced to look at the latest maps now available for the Guernsey, Wyoming area.

The citizens of Guernsey challenge any other vigorous community in Wyoming to produce a similar map. Their defy is not limited to the sovereign State of Wyoming, alone. Those good people are really curious to scan sketches of competitive geography of any point, particularly at a time when all inexcusable forms of highway, railway, seaway transportation are just about to vanish from off the map completely.

ASSAYS

For this investigation dolomite ledges were sampled at 5 points in the vicinities of both Guernsey and Hartville. These samples were forwarded to Victor Blanc, the well-known rare mineral analyst of Denver. A photostat of his triply checked analyses forms the next page. With his results Mr. Blanc also filed the letter report as follows:

April 14th, 1942

"Dear Mr. Houser:

I herewith transmit in quadruplicate from the results obtained on testing your five samples of Dolomite for Magnesium and its calculated equivalent reported in Magnesium Oxide and Magnesium Carbonate.

At your request sample No. 4 has also been tested for the True or fused Silica.

(Cont'd. on Page #11.)

V I C T O R B L A N C
CHEMICAL ENGINEER AND METALLURGIST
2851-55 Walnut Street
DENVER, COLORADO

Complete And Rare Metals Analysis A Specialty

April 14th, 1942

Mr. George O. Houser, Executive Manager
Department of Commerce and Industry,
State Capitol,
Cheyenne, Wyoming

PARTIAL ANALYSIS OF DOLOMITE

SAMPLES	DESCRIPTION OF SAMPLES	Mg %	MgO %	MgCO3 %	SiO2 %
No. 1	GUERNSEY--150' East of Gage Station. 200' Ledge steeply dipping to N.E.	11.57	19.14	40.03	
No. 2	WHELAN CANYON--Keystone Dam test facing.	10.34	17.11	35.78	
No. 3	HARTVILLE--East Side of pavement ½ mile south of Town.	10.86	17.98	37.60	
No. 4	L.T.SISSON--Mile East of GUERNSEY.	11.82	19.57	40.93	4.55
No. 5	L.T.SISSON--DOLOMITE	10.07	16.67	34.86	

Respectfully submitted,

(Sgd.) VICTOR BLANC.

Copy of Letter-
(Photostat Paper
Exhausted)

Samples No. 1 and 4 contain very little Iron. Samples No. 2, 3 and 5 show an appreciable amount of Iron, a little Alumina, Silica and Manganese.

These samples are true Dolomite deserving consideration. I think and hope that Periclase and Magnesite will be found in the vicinity.

The results are an average of three determination s made for Magnesium on each sample.

I thank you for your kind patronage, I am

Yours most truly,

Sgd. Victor Blanc."

Locations of foregoing samples are roughly recorded under the 2nd column in the photostat exhibit. Only the locations of samples, Nos. 1 and 4, are plotted on preceding map exhibit. It may be noted that those 2 samples approximately define the eastern and western extremities of the giant ledge of dolomite that lies directly north of the Town of Guernsey.

Remaining 3 samples were taken from other deposits situated at distances ranging from 1 to 5 miles from town. In the Guernsey district rock hauls of one-half mile or more must be looked upon as wasted effort. By all means both the quarry and plant reduction sites must occupy a single spot in that favored vicinity.

Highest analyses were recorded from the Town of Guernsey ledge. That deposit is of ample dimension to provide all necessary ore for the operation of a local processing plant. Sample Nos. 2, 3 and 5 yielded far less favorable returns. Further discussion of those inferior and more remote rocks is hereby eliminated from this report.

Victor Blanc reported the magnesium carbonate contents in both samples of the Guernsey ledge at 40.03% and 40.93%, respectively. For the theoretically pure mineral that content would have registered 45.60%. Analyst's returns therefore indicate that fully 90% of the huge rock ledge near the Town of Guernsey consists of the new type of magnesium ore. Other Wyoming localities may report rock slightly exceeding the Guernsey degree of purity. Chances are that those competitive ores would have to be hauled over long distances of steep and rocky canyon gradients. At Guernsey, however, the rock is already intercepted by suitable pavement and railway lines. The wear on rubber or steel-tired equipages ought to be considerably less within the urbane Guernsey environment.

IMPURITIES

All dolomite deposits visited on day of the examination contained visible amounts of free silica. In the preceding insert the true or fused silica content in the single tested sample is recorded 4.55%. That was the richer ore of the 2 samples taken from the Guernsey deposit.

More often newly patented processes are calculated for operations on pure ore exclusively. More will have to be said on this deleterious silica content later. Under a subsequent sub-head ways and means will be suggested for the elimination of the troublesome silica factor by the aid of such mineral reagents known to occur in yet unmapped sectors of the strikingly complete electrochemical basin in which the Town of Guernsey occupies a strategic stronghold.

Heretofore, Blanc records the presence of alumina, iron and manganese in the local dolomites. In the higher-grade Guernsey rock, the presence of the last two named metals would appear to be limited to inconsequential stainings.

In time complete analyses of the Guernsey dolomites may be on hand for further study and final opinion.

ROCK RESERVES

Nothing would be gained by calculating tonnage totals of rock contained in the Guernsey area. Such volumes are simply inexhaustible.

Only new process that has won a national medal for recovering magnesium from a hitherto unheard source of supply is the one that extracts the metal from common sea water. It appears that each cubic mile of ocean waters contains no less than 4,500,000 tons of magnesium, or say enough of the metal to meet current national demands for the next 50 years to come. The margin for success at Guernsey is even wider. There, each cubic mile of ordinary dolomite rock contains 200 times as much metallic magnesium as found in an equal volume of sea water.

Geological reports are no longer needed for the Guernsey area. The problem of extracting magnesium at that point is solely technological in scope.

QUARRYING OPERATIONS

Spotting low cost quarry sites would be a comparatively simple procedure in the Guernsey district. Most dolomites in Wyoming do not have the complete geology now available for the Guernsey deposits. The local area is mapped in U. S. G. S. publication, Hartville Folio, No. 91. An inspection of the topographic contours as well as the included photographs of typical cliff and river canyon scenery should convince the expert quarryman that limerock could be broken down and handled at an extremely low cost in the Guernsey area.

Preceding map disclosed that the Guernsey dolomite deposit is located in a region of unusual natural resources. In recent years important groundwork for large scale industrial expansion has also been completed by local taxpayers. Some of the distinctive features of the progressive community are itemized below:

NORTH PLATTE RIVER

The North Platte River has cut a scenic canyon directly across the western sector of the mapped dolomite ledge. This river is by far the largest stream in Wyoming. In the past 15-year period over $20,000,000 has been expended in the development of its power potential. Daily output of the power plants at Guernsey and Seminoe Dam approaches 60,000 h.p. Legislation has recently been introduced to develop 40,000 additional horsepower from the yet unharnessed flow of the stream.

Advantages of opening a quarry on the floor of the canyon at the point where the river cuts directly across the dolomite beds have already been referred to. Same position would also offer an ideal site for the magnesium works. At that dual location the river could be tapped for the unfailing supplies of fresh water requisite for the operation of complete industrial enterprises.

RAILROADS

Preceding map discloses that the Guernsey dolomite formation is cut near its western extremity by the Colorado and Wyoming railroad. Toward the eastern end the deposit is crossed by a spur leading off from the Chicago, Burlington & Quincy railroad, one of the leading granger roads of the nation.

When large scale quarrying operations are to be conducted at a reasonable cost, provision should be made beforehand for ample rail facilities. The particular deposit of limestone recommended for quarrying at Guernsey is already provided with adequate rail facilities. Nothing would be gained in selecting quarry sites many miles distant from the nearest railroad. In these critical times it might be impossible to procure the requisite steel priorities for such construction at any point in the Wyoming domain.

HIGHWAYS

Western sector of the Guernsey dolomite bed is crossed by 2 minor roadways in the positions plotted on the map. The eastern end of the deposit is intersected by the paved highway that leads to the iron mine. All 3 of these roadways branch off from U. S. Pavement, No. 26, which is Main Street in Guernsey.

Ample rail and highway networks already criss-cross the dolomite beds at Guernsey. In that community transportation of rock from quarry to processing plant and finished product to village depot would only involve fractional mile haulages. Mention has already been made of new light metal plants proposed for the great Eastern cities. At those points ores and power producing coals would have to be hauled hundreds and even thousands of miles. The town of Guernsey is already piped and wired with both fuel and power facilities. At Guernsey at least 99.44% of the transportation charges ruling for the "cost-no-object" style of new plants would be eliminated completely at the outset.

Guernsey not only has the nearest raw materials for processing magnesium rock. It possesses one more geographic advantage. Its raw dolomite ores lie considerably closer to the great consuming centers of the East than any similar rock supply found in Wyoming. Such an outstanding location would insure quicker deliveries on a metal product of which too much cannot be made at this time.

HYDRO POWER

The city dolomite ledge is also crossed by a 33,000-volt high tension transmission line. As indicated on the map the line leads off from the U. S. Reclamation Service dam and powerhouse site that is located at the western end of the dolmites. Crossing of these deposits is made 1/4 mile east of the powerhouse.

To catalog all improvements already constructed on the proposed magnesium ore supply would merely add confusion to this report. It is no longer possible to select any one point for the opening of a quarry. Every possible site is offset by a series of equally good checks and counterbalances. It would seem that existing high tension facilities would make ordinary cost sheets for the operation of electric drills and shovels look sick. Of course if copper cable is no longer procurable it would be essential to open quarry facings directly under the high tension line already in operation.

The map shows the powerhouse to be built at the foot of Guernsey Dam on south side of river at a point 1½ miles northwest of town. Taking photographs of such strategic structures is prohibited at this time. Such photographs, however, are matters of record in several out-of-print publications. Present writer inserted one in the bulletin "Electro-metallurgical Resources of North Platte River Basin" that was published 9 years ago by the former Geological Survey of Wyoming. It showed a modern structure in every detail.

After filing a few dimensions, foregoing publication stated that a goodly share of the local power development was then being used to operate the huge iron mine situated 5 miles north of Guernsey. Since that date output of the mine has expanded tremendously. It is possible that present demands consume all of the power generated at the Guernsey site itself. But since the date of the obsolete publication cited, the Reclamation Service has hooked up the Guernsey unit with several of their larger power plants that are constructed along the major river courses of the State. At this time inquiries on power volumes still available in the Guernsey area should be addressed direct to the U. S. Reclamation Service itself.

According to recently announced policies, the U. S. Reclamation Service stands ready to sell all of its power output generated in Wyoming to such strategic war mineral industries that may be established in the State from time to time. Exact situation now existing at Guernsey is not known to the present writer. It is possible that the local power unit is of sufficient capacity to take care of all magnesium rock quarrying operations that may take place at that point in the near future.

To reduce magnesium directly from local rock would demand greatly increased transmission from larger power plants of the Reclamation Service system to the Guernsey area. But the reducing agent of the selected Pidgeon Process is ferrosilicon. Use of that powerful re-agent -- "minimizes dependency upon local hydroelectrical facilities."

If the requisite ferro-silicon volumes are to be imported into Guernsey, no further hydro development would be essential at that point. But Guernsey is the one and only community in Wyoming in which ferro-silicon could be processed exclusively from local raw materials. If a fully self-sustaining, from A to Z, magnesium industry is ever to be set up within the logical Wyoming area, it would be essential to expand existing hydro power outlets at Guernsey, several hundred percent, right now. By this belated date hugh metropolitan centers, and, alas, less pretentious communities nearer home, are offering competitive attractions far too entangled to be set forth herein.

At all times the Reclamation Service offers exceptionally attractive power rates to all mineral industries intending to pioneer in the fertile Wyoming field. Consent to publish their present rate schedules was not obtained for this investigation.

The U. S. Reclamation Service is now known to have plans for the further development of the hydro potential along the North Platte River. If space permits a brief mention of their current designs will be made under a subsequent subhead entitled, Kortes Dam Hydrosite. (See Section III of this report.)

MODERN FUELS

Merely having lots of rock plus local power facilities is not sufficient justification for establishing magnesium processing plants in any given locality. In addition to these basic factors some of the latest patented processes frequently call for the immediate availability of both gaseous and liquid fuels in sizable volumes. At Guernsey, Wyoming more arterial oil and gas pipeline systems criss-cross one and another than at any other town in the entire Rocky Mountain petroliferous province.

dash of a debonair model, 1942 racing car. At Guernsey, Wyoming, only natural gas is a fit fuel to fire the preliminary calcination ovens.

Next step in the latest Pidgeon technic requires the consideration of thermal operations conducted at temperatures of far higher elevations than those utilized in the preliminary furnaces. Here the metal is not melted but actually converted to the gaseous form in --- "externally heated, sealed metallic retorts which are kept under vacuum by means of vacuum pumps".

On paper the Pidgeon approach appears to be classical in its simplicity. On actual operation it will likely prove tricky enough at several junctures. In Wyoming only fuel that could efficiently perform the volatilization of the metal would be natural gas. Lots of that "double-power" heating medium would have to be on tap at all times. Large scale operations would doubtlessly demand a major percentage of the pipeline capacity. As a matter of fact, most of the local gas production is on lands already owned by the federal government. So future exigencies might demand a sharing of transmission capacity, provided it would be deemed inexpedient to construct a supplemental common carrier into the Wyoming magnesium fields at this time.

CRUDE OIL FUELS

As yet no systematic study has been made of the industrial potentials locked up in the long exported gaseous and liquid fuels of Wyoming. By this time pipelines lead out of the state in all cardinal directions of the compass.

In only one town in the Rocky Mountain district do the main pipelines of two major oil companies cross each other. That town is Guernsey, Wyoming. One half mile south of Guernsey the Sinclair Oil Company long ago built the 12-inch line that carries crude eastward from the Salt Creek field to Freeman, Missouri. A few years ago the Rocky Mountain Company completed an 8-inch line from the Lance Creek field due south to Denver. The cross-over of the two interstate systems is effected at a point three miles east of Guernsey. It is these two lines that transport the production of the largest oil fields in Wyoming. Only the town of Guernsey has direct access to both of the long range sources of supply mentioned.

No fuel oil enters into the Pidgeon process, hereinbefore selected for operations at Guernsey. It is, however, used in a new plant in California that will receive later mention. Moreover, it seems to be an appreciable expense in one of the basic electrothermal processes recently proposed by federal agencies. A few descriptory passages on the latter method follow:-

> "The calcine is mixed in a rod mill with 23 percent low-ash carbon. The mixing is fed into an arc furnace automatically at a controlled rate and reacts to form magnesium vapor and carbon monoxide. These products issue at high velocity through an orifice into the shock cooling flue where they encounter an atomized spray of light fuel oil. Evaporation of a large part of the oil cools the furnace gas from 4,000 degrees F. to less than 350 degrees F. almost instantaneously.
>
> "The rate at which oil is supplied is so regulated that the unvaporized portion is just sufficient to form a fluid suspension of the metal condensate. This regulation is controlled automatically by the temperature of the cooled products. These comprise the finely divided solids, magnesium metal, magnesium oxide, carbon, silicides and carbides of the ore impurities; some liquid oil, oil vapor, carbon monoxide, and hydrogen and methane resulting from thermal dissociation of the oil".--

Page 47 - Mining Congress Journal-January, 1942

NATURAL GAS

The use of natural gas for various orders of future industries, logical for the Wyoming background, has been stressed by the present writer for many years past. A recent citation from an unpublished manuscript follows:

> "Everyone knows that electric power is the most highly perfected form of energy yet introduced to industry. Members of the Community Club are already aware of the fact that gas from their local fields possesses twice the thermal efficiency of the artificial variety. Its same ratal supremacy also applies to all other common fuels like coal, ordinary coke and so forth.
>
> The day is coming when a hydro basin barren of an exhaustless gas supply will be viewed pretty much in the light of an anachronism. In the future, manufacturing sites will be at spots that offer both of these increasingly important components of modern industry. The ideal heat and power combination provides the groundwork for the manufacture of the widest variety of cheaper and better products. If gas could be piped to the Niagara basin at the rates now prevailing in Green River, the standard of living would soon advance perceptibly in this country."
>
> Page 75- Preliminary Report on the Manufacture of Phosphate and Potash Fertilizers in the Electrochemical Basin at Green River, Wyoming - Dietz-1938

PIPELINE

Only one gas pipeline traverses the Guernsey area. Its gathering net connects producing areas in central Wyoming. Thence the 12-inch mainline trends eastward for several hundred miles to consuming centers within the western half of Nebraska. The North Central Gas Company is the owner of the line. Company virtually restricts all of its sales to points within the North Platte River Valley, an agricultural region of fabulous fertility.

Foregoing mainline intercepts no dolomite rocks - at least in the Guernsey environment. As indicated on accompany map, the pipeline passes Guernsey one-half mile south of town. The intervening distance to local rock pile is somewhat beyond the average travel that folks usually go for any basic commodity in the richly endowed Guernsey community.

PROCESS CONSUMPTION

In the yet unpublished flow sheets for the selected Pidgeon process, openings should be plotted at two points for the intake of high-power natural gas in sizable volumes.

First step calls for the complete calcination of the Guernsey rock. Some competitive communities might attept that operation with lime-kiln equipment of the pre-Revolutionary War pattern. During periods of Global war such primitive procedures must pass completely out of the picture. Coal or cordwood fired kilns are no longer possible. To expect them to take the place of straight-line continuously operated gas rotary ovens would be like asking Old Dobbin to deliver the

Foregoing process apparently involves a step completely eliminated by the more simplified technique of the Pidgeon approach. Instead of using fuel oil as a heating agent, the government investigators have that rather versatile commodity play the opposite role of a sudden refrigerant even in the incandescent atmospheres of roaring furnaces. Elsewhere, the resulting rapid condensation of the metallic magnesium gas is called the "shock cooling" treatment.

The author of the foregoing quoted material is H. A. Doerner, metallurgist in charge of magnesium investigations for U. S. Bureau of Mines. In 1936 the bureau sent Mr. Doerner to the Pacific Northwest presumably for the aim of developing potential power markets in a region in which federal agencies were rapidly completing the largest hydro works thus far built in America. To find an outlet for the excess capacities then looming on the horizon the creation of a large-scale magnesium industry in the richly endowed Pacific Northwest was first proposed. The picture looked promising. As a matter of fact only magnesium works now known to be operating in that area is the pilot plant of the Bureau previously referred to.

OIL PROCESS ENDORSEMENT

Magnesium processes designed by Government research workers have thus far received but little notice in the public prints. Only endorsement noted to date follows:

> "The Materials Director (Mr. Batt) pointedly omitted any mention of Secretary Ickes' recent claims of being able to produce the metal from government developed extraction methods."

Previous comment indicated that Mr. Batt personally preferred the Pidgeon process for heavy investments of federal funds at this time.

One reason why new federal processes do not always receive the sanction of academicians and other public-spirited societies may be due to pilot plants. Rather frequently such experimental stations are located in areas short of one or more of the basic raw materials that go into the original proposals. Such procedures often force the expert in charge to select a substitute that may be imported into the local area at a reasonable cost. So far as known, no pipeline franchises have yet been granted for transporting oil or gas from Wyoming fields to highly mineralized terminals inthe Pacific Northwest.

Like the Pidgeon process, the Bureau of Mines' "shock cooling" method does not seem to have passed the pilot plant stage. The only known fuel oil consuming process that is now getting ready to go into commercial production is located at Los Altos, California. A commentator reviewed last month's operations on that front as follows:

> "Magnesium production at the Permanente plant, near Los Altos, Calif., is proceeding in an experimental way only. One unit of a projected three-unit plant was built, but construction of the other two has been called off. Trouble from explosions has been experienced from the beginning, and weaknesses in the process must be corrected before a satisfactory yield of magnesium can be obtained. Experimentation will be continued and new sources of magnesium are being developed, but the prospect of success seems remote so far as immediate production on a commercial scale is concerned. An entirely new process-thermal reduction with ferrosilicon--is said to be under consideration.----"
>
> Engineering and Mining Journal--p. 84-May, 1942.

FERROSILICON

Foundation stone of the Pidgeon Process structure is ferrosilicon. In reality, that highpower admixture unlooses adequate energy to extract the champion light-weight metal from nothing more important than ordinary looking limestone rock.

Ferrosilicon is likewise a product of the electric furnace. Ingredients of the furnace batch are silica or quartz, iron filings and common charcoal. In the Guernsey area all three of the latter prerequisites are also present in either the finished form or else in the raw state subject to spot conversion at a low cost. The State of Wyoming is big enough for only one fully self-sustaining town of the Guernsey order.

It must not be forgotten that the Pidgeon process is an out-and-out Canadian invention. Large scale development of the method would augment the prosperity of our northern neighbor in several directions. In her sub-Arctic areas are a number of potential hydro basins. In such industrially barren latitudes ferrosilicon could be made at exceptionally low costs. Today, Canada would thus appear to be able to ship out substantial volumes to her excess water power in the canned ferrosilicon form. In time such packages of potential dynamite would reach the United States. In this country such imports would make the reduction of magnesium feasible in dolomite areas hundreds of miles distant from the nearest known terminals of high voltage transmission lines.

Already this country must rely on Canada for approximately 99% of its supply of at least one metal that is indispensable in the military arts. Incidentally, most ferro alloys consumed by the U.S.A. are still made from foreign ore supplies. It would be more reassuring and inspiring if political and commercial control of the ferrosilicon industry would remain at home right at the outset. Greatly increased demands can be predicted for that now seasonable product. Furthermore, it may not be too late to arrange for expanded domestic production of magnesium reducing alloys even in times of International blockade irregularities.

In a bulletin published 9 years ago, a potential electrometallurgical basin in Wyoming was referred to as an area of amazing economic self-sufficiency for the manufacture of several precious steels and ferro alloys that now largely enter into military wares. As the less valuable ferrosilicon alloy was omitted from the prior lists, its fabrication from previously accredited raw materials can be considered at this time.

Iron Ore Mine

No steel mills are yet operating in the Guernsey area. If finished steels were available locally, a good share of the ferrosilicon demanded by the national magnesium industry could readily be processed from the abundant supplies of both iron ore and silicon mineral now known to occur in the immediate Guernsey neighborhood.

Preceding map insert shows the location of the Sunrise Iron Mine of the Colorado Fuel and Iron Company. It is plotted 4 miles dur north of the Guernsey dolomite ledge. That is a considerable distance to go for any form of raw material in the local assemblage area.

Less than 5 miles east of the mine is plotted a huge seam of water-white silica mineral. This rock has recently been filed on by L. T. Sisson, widely known mining man of the locality. Original intention of Mr. Sisson was to sell the local deposit to the rapidly expanding glass industry. Similar deposits of lesser dimen-

sions were also noted within a few rods of the iron mine itself. At only one point in Wyoming do both basic minerals of the ferrosilicon process actually occur side by side in sizable volumes.

The Sunrise Iron Mine is one of the giant producers of the nation. Its output for 1941 totalled a full 1,000,000 tons. In ranking magnitude, the Sunrise mine is the 16th largest producer in the U.S.A.

Steel Mill Prospects

Output of the giant Sunrise mine already greatly exceeds all iron ore demands of the domestic ferrosilicon industry. But never before has this country uttered a louder cry for more and more steel. To replace losses of present submarine campaigns some authorities have recently calculated that total production of the steel industry must be hopped up an additional 10,000,000 tons for each remaining year of the war. A sizable percentage of that expansion might be produced at a smaller outlay in Wyoming than in any other state at this time.

Some economists do not seem to take in the entire picture in their vision. To market 10,000,000 additional tons would more likely mean a total increase of 12,500,000 tons. A good share of that excess 25% calculation would have to be consumed in the construction of additional steel railway cars, steel ships and other forms of transportation machinery used by the industry itself.

At this time the State of Minnesota produces 90% of the iron ore output of the country. Most of the production travels 1300 miles by rails and boat to points in the Pittsburgh area. If the record output of today is to be augmented, an additional 10,000,000 tons in finished products, up to 60,000,000 tons of additional ore, fuel and flux raw materials, would have to be annually carried over a transportation network already quite congested. It is possible that all the steel needed for the new rolling and floating stock would more than offset the paper clips, hairpins and similarly rationed items produced in this country for the next several years. At one point in Wyoming an additional 250,000 tons of steel could apparently be produced without the construction of a single gondola, boat or truck at this time.

The three ingredients that form the blast furnace mix of the steel industry are iron ore, limestone flux and coke fuel. In the Guernsey area limestone and iron ore commonly contact one another. Two kinds of limestone, however, occur within that favored locality. One type is suitable for the reduction of magnesium. The other is the high-grade metallurgical variety. For many years the latter type has been locally quarried solely for refining beet sugar in the premier producing provices of the Rocky Mountains.

For complete elimination of two quite common long-hauls from the steel picture, the present writer suggests that the next blast furnace be constructed in the Guernsey area. At this time care should be exercised in selecting a furnace site at a point where a bed of high analysis iron ore actually approaches a ledge of chemical pure metallurgical limestone within a distance of one mile. As the output of high-cost electric furance steels must continue to balloon from month to month, foregoing furnace site ought to be intercepted by a high tension transmission line.

Coking coal is the 3rd and final ingredient that goes into the blast furnace. Like most states, that type of fuel simply does not occur in Wyoming.

Before fuel oil systems can be sanctioned for operations in the Wyoming field it would seem that considerable experimental work would also have to be performed in this locality. It appears that these oil cooling plants have been subject to a continuity of detonations ever since their completions, in California as well as in regions still under the spell of the Axis powers. Until the explosion frequency factor is cut down considerably, it is certain that such plants never will receive a license to operate in Wyoming. Present sponsors of the California process seem to be exercising sound judgment in converting their works for operations under the Pidgeon ferrosilicon patents. That process was previously suggested as the safest procedure for adoption in the Wyoming magnesium field.

Today, natural gas appears to be the preferred fuel for use in the new magnesium industry. Magnesium ores in the State of Washington are twice as rich as those found in Wyoming. That State also has the biggest hydro works thus far built in the world. The Pacific Ocean forms its western boundary and that body of water contains the greatest volume of the generally preferred magnesium mineral known. In spite of all of those outstanding advantages no sizable magnesium industry seems to have gained a foothold in Washington to date.

Until rather recently the Dow Chemical Company was sole and exclusive producer of magnesium in this country. Until January 21, 1941, the output of the nation was obtained from a few salt wells in Michigan. On that day the first magnesium was poured and shipped from Unit No. 1, of Dow's huge ocean-side plant. This was the first time that magnesium metal had been extracted in commercial quantities from common sea water.

To achieve their widely heralded goal the pioneer company went down to Texas. Had they selected a site in the State of Washington, plenty of sea water as well as ore from 300 to 400 times as rich, and the cheapest power in the country, would have been available in literally limitless volumes. But the Gulf region offered an even more powerful attraction. It had cheap gas. For evaporating sea water, as well as for conducting various other procedures in several magnesium operations, nothing can take the place of the cleanest and most versatile fuel.

Perfect picture for the location of a magnesium works, especially tailored to fit the Wyoming configuration, calls for 3 basic industrial potentials to be available in sizable volumes at a single spot. They are:

Cheap supply of reducible ore.
Cheap supply of natural gas fuel.
Cheap supply of hydroelectric power.

Only one or two states can offer all 3 of the foregoing attractions. Number of communities in Wyoming that already enjoy all of these prerogatives can also be counted on the fingers of one hand.

All 3 of the foregoing factors are now present in or around the town of Guernsey. Within a few miles of the city limits the more important types of raw materials consumed by processes other than those listed under selected Pidgeon patents are likewise known to be available in appreciable volumes.

In time to come, Guernsey, Wyoming might also be looked upon as a logical location for conducting original pilot plant investigations of more than local significance within the currently popular magnesium field.

But every day in Cheyenne long strings of cars wend their way northward 336 miles from the blast furnaces at Pueblo, Colorado to the iron mine near Guernsey, Wyoming.

Both sets of the widely separated properties are owned by the Colorado Fuel and Iron Co. For 40 or more years past iron ore traveled in one direction and only car empties were routed on the trip back home. Today, economists insist that every cubic inch of precious cargo space be utilized to the utmost in the transportation of badly needed war goods. Preliminary calculations of present writer indicate that national steel output could be augmented an additional quarter of million tons annually without the use of any new transportation equipment. To do that task it would be essential to use the empty ore cars to haul coke from the Pueblo producing district directly to the iron ore mine in the strategic Guernsey area. Only by making such 100% usages of available equipment could all 3 ingredients of the blast furnace be assembled at the strategic Guernsey focal point without the investment of a single dollar in additional rolling stock.

PITTSBURGH PLUS

Not iron ore but local-coke production sanctioned the site of the steel mills at Pueblo. Future invasion of the steel industry into Wyoming would call for the complete overhaul of economic laws long ago established. Nevertheless, citations for such overturns are already a matter of record in the steel industry itself. Quite a few years back the U. S. Steel Corporation erected a large works at Duluth, Minnesota. The ore is obtained from the local mining ranges and all of the coke used by the plant is hauled in the corporation's own ore boats that formerly returned empty from Pennsylvanian and other ports on the lower lakes. Obviously, such a novel transportation idea works severe handicaps on competitive concerns. It enables Big Steel to lay down its products at Pittsburgh costs at a distance of more than a 1000 miles from former points of manufacture.

Between wars "Pittsburgh Plus" is frequently utilized as a political issue over wide sections of the country. So far as known, no one in Wyoming has ever heard of a Guernsey Plus cost structure. Nevertheless, such an arrangement might permit steel to be sold at slightly lower levels throughout the Wyoming country. Moreover, any elimination of the 336-mile haul that now separates mine and mill would perceptibly widen Company's local marketing area in the direction now defined by radii leading from the Pueblo, Colo., and Duluth, Minn., competitive focal points.

For many years the huge iron mine at Guernsey was called upon to produce all domestic ore mined west of the Mississippi. Some 10 or 12 years ago another subsidiary of Big Steel further encroached on logical markets for Wyoming ore by opening a steel industry in an adjoining state. Considerable expansion has likewise transpired at that point. A private communication recently received from a Washington source commented as follows:-

> "----and Provo (Utah) gets its ore 200 miles (away)----. At Provo, as you may well know, Uncle Sam's O. P. M.- R. F. C. built two additional blast furnaces, etc., at a cost of $35,000,000 and turned them over to Columbia Steel Company for the duration, after which the United States will sell them to the highest bidder. Columbia will doubtlessly be the high bidder. It doesn't look like there is an immediate prospect for development of iron ore or pig iron plants----."

A few days can make a big difference. Since the foregoing lines were received the demand for ship plate and other steel shapes has materially increased throughout the United Nations. Present clamor for more and more steel is now so loud that many more costly blast furnaces will have to be built even in crossroads communities hitherto unsuspected as containing any spark of inherent industrial intangibilities.

TRANSPORTATION SHORTAGES

A prior citation told a story of the new light metal establishments to be set up in several of the larger eastern cities. It was later alleged that ore supplies for these plants would involve exceptionally long sea and overland hauls. Since date of citation the transportation problem has not visibly improved in this country. Trend of the situation is indicated by the headlines. A selection of such material follows:

CARIBBEAN ORE SUPPLY PORTS

Any Old Hulk Takes to Sea.
Cargo Rates Up 500%
Cargo Space More Valuable Than Platinum.
Insurance Companies Suspend Rates.
Woolworth Co. Unable To Make Shipments To Its Cuban Stores In Over 3 Months.
Foreign Ore Boats Sunk. More Ore Must Be Shipped From U. S. Interior Points.

VARIOUS U.S. INDUSTRIAL AREAS

Railroads Are Groaning With Traffic.
Battle Royal Raging Between WPB And Transportation Czars Over Freezing of Steel for Further Construction of R.R. Cars.

WYOMING REGION

Interstate Trucks Must Return With 75% Cargo-Load Minimums.
Lack of Steel Suspends Construction On Vital $10,000,000 Air Base At Casper.

Never before can a more sorry spectacle be recalled for the transportation world. If the present break-down is to continue much longer, it might be necessary to call for a reorganization over wide sections of the American industrial scene. In some instances former industrial citadels act more like liabilities than national assets during moments of supreme united effort.

Little good would result by repeating grave transportational miscalculations of a more primitive period. Hauling raw ores half way across a continent never was an easy task in either peace or war times. So after all Brooklyn might not be the right town to erect costly light metal plants. The magnesium problem might be better solved by building the plant at a self-sustaining and self-consuming site even if such dual balancing focal-points approached New York no closer than Wyoming.

At Guernsey, Wyoming, the difference between streamlined and horse-and-buggy transportation is exemplified daily in an impressive manner. At that point Hydro power (White Coal) is generated and conveyed over high power transmission lines in an uninterrupted manner. There pipelines convey liquid and gaseous fuels 7 days a week, also with 100% efficiency ratals, 24 hours per day. At the same time long train loads of iron ore also pass thru town only to return a few days later from coking-coal fields as solid strings of empty cars. Over that 700 miles of travel, a method of 50% efficient transportation is still in vogue. A prior headline indicated that such transportational anachronisms have already been outlawed for the common carriers traveling over the public highways of this sovereign state.

These days much is heard about shortages alleged to be existing in the raw materials, consumer goods, finished products fields, and the like. Thus far considerably less has been said about transportation shortages. In some special instances utilization of available empty space could be instrumental in turning out more steel. If that additional metal would be used to augment sundry forms of existing transportation facilities, it is possible that present stocks of sugar, coffee, gasoline and other popular commodities, could be distributed in a more liberal manner than the volumes now doled out to the average householder.

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PROCESSES FOR THE REDUCTION OF MAGNESIUM FROM THE DOLOMITE ROCKS AT GUERNSEY, WYOMING

Section III

CALCIUM CARBIDE - CHEMICAL LIMESTONE DEPOSITS- COKING COAL SUBSTITUTES - PETROLEUM COKE- HYDRO POWER - KORTES DAM SITE - SYNTHETIC RUBBER SITES- OTHER INDUSTRIAL APPLICATIONS - PERMISSIBLE SILICA - FLUORSPAR - NITROGEN GAS WELL - TECHNICAL STAFFS - CONCLUSION

Preceding two sections described all raw materials and power potentials consumed in the reduction of magnesium from one of the newest ore types. All of those essentialities have heretofore been mapped as occurring within a 4-mile radius of a prospective plant site located at Guernsey, Wyoming.

It was originally intended to confine the scope of this report to the exceedingly small self-contained area previously circumscribed. But after all the town of Guernsey occupies only a dot on the map of the North Platte River Valley. Hereinbefore, the latter geographic subdivision has been regarded as a natural hydro basin in which a wide variety of ores, minerals, raw chemicals and several types of fuels are distributed in a prolific manner. It would seem that descriptions of a few of these more remote materials can be made without reflecting undue discredit on the Guernsey area.

Mention has already been made of the modifications that the Pidgeon ferrosilicon process has been constantly undergoing since its basic patents were issued. Some of these improvements and revisions call for materials not present in the limited area previously mapped. In recent months a number of processes of a competitive character have also been devised. Some of these systems also call for raw materials not found in the town of Guernsey, but known to be present here or there in the North Platte Valley, itself. As a rule only small quantities of the more distant minerals or chemicals would have to be shipped to Guernsey. The local area, however, is quite able to supply the bulk of the materials consumed in any process that receives consideration herein.

A portion of the remaining space will therefore be devoted to native resources lying beyond the 4-mile zone. To cover all the required deposits the next zone would have to be plotted 144 miles from the Guernsey focal point. All of those resources lie westward from Guernsey and all are confined to the North Platte valley sector of the far wider 2nd zone.

CALCIUM CARBIDE

An earlier insert released information on the substitution of calcium carbide for ferrosilicon as a "new" reducing agent for the Pidgeon modified process.

At Guernsey it would be quite inconsequential if calcium carbide or ferrosilicon provided the requisite chemical energy for the reduction of magnesium. In a pinch both calcium carbide and ferrosilicon could be processed at the Guernsey site by the use of local raw materials. Only reason for excluding calcium carbide from the hitherto 4-mile prescribed limit is that a better fuel will be available for the manufacturing process from other points in the North Platte basin.

Calcium carbide is made by treating a good grade of lime with natural or artificial coke in the electric furnace. No coke is now being made at Guernsey. But the best variety of limestone for burning in the entire river basin is obtainable from quarries now operating within a mile or two of Guernsey. For conducting the preliminary calcination, Guernsey is already provided with the widest assortment of gaseous and liquid fuels thus far available for any Wyoming community.

Major expense for the conversion of lime into calcium carbide is the volume of power consumed in the electrothermal treatment. At Guernsey power rates are no higher than at any other point in Wyoming. Source of the coke supply is far less significant. One ton of that fuel would suffice to treat 8 tons of the local limestone. Suffice to state that only logical location for the requisite carbide plant recently proposed for latest Pidgeon Process operations in the Rocky Mountain area would naturally be at Guernsey,Wyoming. More than one variety of lime is present at the latter focal point. The industrial potentials for making calcium carbide at Guernsey cannot be surpassed at any competitive point in the major hydro basins recently developed in the west by several federal agencies. None of them seem to contain deposits of coking coals.

Thus far no one has come out flat-footedly and stated just why calcium carbide is preferred to ferrosilicon for the reducing agent in the Pidgeon Process. It takes considerable more power to process carbide than the cheaper ferrosilicon admixture. Ulterior motives might be suggested. In truth and in fact, carbide could be processed at a price in every one of the giant hydro projects recently completed in the Pacific Coast sector of the U. S. A. In none of those vast tributary areas is there a single iron mine producing a million tons of ore annually. The Guernsey area is different. It is quite able to offset by itself all attractions offered by competitive basins. It is the only area in which both ferrosilicon and carbide can be made at a single point from the use of local raw materials, save a spot coke supply. The latter discrepancy applies equally as well to all remaining hydro basins in the West.

These days much is heard of critical power shortages throughout the nation. If energy consumption exponentials must be cut down to absolute minimum levels it would be cheaper to process the premier reducing agent, ferrosilicon, at the eitherway, optional site located at Guernsey, Wyoming.

DEPOSITS OF CHEMICAL LIMESTONES

Greatest number of quarries now actively engaged in producing the purest grades of chemical limestones in the Rocky Mountain West have long been located in or near the town of Guernsey. On the preceding map insert such quarries are plotted north, east and west of town. These workings are usually opened in pure beds of limestone that are 50 or more feet in thickness.

Output of the Guernsey quarries has generally been sold to the sugar beet industry. The rock is so good that competitive quarries as far as 300 miles away from Guernsey have been forced to close down in times past. In recent years the Guernsey rock has been shipped to sugar refineries in Wyoming, Nebraska and Colorado.

Ingleside Limestone Company, a subsidiary of the largest beet sugar refining concern in U.S.A., is now operating the major quarry in the district. At the present time a crew of 25 men are working in the quarry that is located 3 miles north of Guernsey. In the coming fall season various refinery units of the beet sugar cor-

poration will use the run-of-mine product to precipitate calcium saccharate from the impure gooey sucrose solutions yielded by the beets under their first impulses with the machinery in the refinery. That highly purified snow-white mineral segregation is readily converted to the soluble sugar crystals of commerce. In short the Guernsey lime-rock is already the keystone of the sugar refinery business. For the conversion of earthy beets into the glistening sugar that once decorated the bowl on the household table, only the finest and purest of limestones could possibly pass the rigid specifications of the food industry. It goes without saying that the high analysis rock of the Guernsey community will likewise be found plenty good enough to process calcium carbide therefrom at any additional point it may be shipped to in the Rocky Mountain regions.

At this time a number of towns in Wyoming would be glad to have a magnesium works in their midst. But some of those sites are known to have only one variety of limestone. For the establishment of a completely unified magnesium industry it would be better for Wyoming communities to offer two kinds of limestones. One variety should contain the metal itself. From the rarer and purer variety a chemical would have to be processed of sufficient power to reduce the metal contained in the basic No. 1 type. In the average limestone country these two extreme varieties do not always appear - side by side.

Unfortunately, space will not permit the mention of all chemical lime quarries so far opened within the potentially industrial Guernsey district. One of the most interesting workings plotted on the map is the old Fowler quarry. It is located on the main line of the C. B. & Q. RR at a point only a few hundred yards south of the federal powerhouse. It would seem that the foregoing bus bar site occupies the most strategic position of the lot. For operating expansions during periods of severe labor bottlenecks, and resulting equipment scarcities as well as generally rising prices for raw and finished goods, no community is better qualified for relegating overhead on rock handling development to the bottom floor levels than Guernsey, Wyoming.

For making calcium carbide, power and rock supplies generally represent 95% of the expense picture. For arriving at the rock-bottom processing cost, the citizens of Guernsey defy any community in Wyoming to match the dual Bus Bar-Quarry Site notated in the paragraph next above.

COKING COAL SUBSTITUTES

Nearest substitute that Guernsey could offer in the way of coke would be charcoal. Primary source of the latter product would be the several forests now standing on the highly mineralized geological conformation on which the town of Guernsey is built.

In purity and calorific value common charcoal is usually superior to ordinary natural and artificial cokes. It, however, does not possess the firmness generally demanded for metallurgical operations. For entry into the carbide furnace the charcoal would likely have to be briquetted beforehand. All of that would be added expense that probably never will be justified in the Guernsey region, except in periods of transportation shortages of severities hitherto unimaginable. As a matter of fact, a far superior coke has long been manufactured at other points within the main river valley.

PETROLEUM COKE

Unfortunately, the richly endowed North Platte River Valley is also devoid of common coking fuels. Already the petroleum industry has acquired a strong foothold in that natural electrometallurgical basin. By this time the large oil refineries at Glenrock, Casper and Parco turn out appreciable volumes of the superior fuel known as petroleum coke.

No literature is on hand on the use of petroleum coke in making carbide. On the face of things it would seem to have superior merits for processing the topmost grades of calcium carbide. Available analysis indicates an ash content of only 0.21% for the Casper coke. That figure is less than 10% of the ash generally present in common coal cokes. If the Casper coke were united with the hygenic, chemical limes of the Guernsey country it is certain that an exceptionally high-grade product would result from the electrothermal treatment.

Use of the Casper coke should produce even more efficient results from another angle. Its B.T.U. rating has been determined at 15,350. That figure is over 1000 points higher than the theoretical value obtainable from the ignition of Tiffany diamonds of the first water in similar testing apparatus. In fact the domestic markets for petroleum coke never did reach appreciable magnitudes. In Wyoming the first application of the new high-power fuel frequently succeeded in melting the irate customer's cookstove.

From Guernsey the nearest oil refinery is 92 miles to the westward at Glenrock. The largest refineries in Wyoming are at Casper. That city is 20 miles west of Glenrock. Like Guernsey both refinery towns are on the North Platte River. All three communities are also mainline towns on the C. B. & Q.RR.

HYDRO POWER

Calcium carbide is just one more high cost chemical that it would be impossible to produce too much of at this time. Spot availabilities of the high power product would help to attract a number of key military industries to this State. Present facilities for processing carbide are, however, rather limited. Most of the power produced at the Guernsey Dam is already sold. Worst of all, only an auxiliary transmission line leads into that town. Thus far the 117,000 V. high tension line leading from the main Seminoe Dam of the Reclamation Service interconnections does not approach Guernsey nearer than 70 miles.

Mention has already been made of the bulletin - "Electrometallurgical Resources of The North Platte River Valley" - published by the former State survey 9 years ago. Sole idea of that publication was to request immediate construction of the Seminoe Dam in order that a reasonable variety of now indispensible military products could be processed in Wyoming by that comparatively early date.

As late as 9 years ago all old timers predicted that power output from the Seminoe Dam would become a drug on the market. To offset that belief the following opinion was expressed in the Prefatory Statement of the bulletin:

> "According to (technological) calculations the proposed volume of thermal energy (50,000 h.p.) could not begin to reduce the hugh dowry of ferro-alloys and complemental chemicals that have long remained unexploited in the Wyoming sector of the North Platte valley."

In subsequent passages it was repeatedly urged that the entire power output of proposed dam be delivered intact to one or two huge deposits of rare minerals long known to occur in the local hydro basin. Those suggestions were offered in order that military steels could be processed on the spot in Wyoming even at that time.

Publication of the State bulletin proved to be a colossal misculation in every respect. Within a very few months after its appearance the power project was approved for construction. Its completion occurred in 1939, or only a few months prior to the first outbreak of World War II.

Instead of delivering the entire power output of the dam to only one or two of the strategic military deposits, previously calculated as being capable of consuming the last kilowatt of energy that would ever be generated at the site, all of that power is now being retailed in piddling amounts to 10,000 outlets in 3 states. A goodly share of those customers reside under a network of transmission lines recently built by the Rural Electrification Administration. It is doubtful if all of those really satisfied customers will ever consent to give up electrical installations of a scope long unobtainable over the more remote areas of the several states so invaded.

Requests have recently been received from residents of the North Platte Valley as to the possible defense value of divers other minerals long known to occur in their respective neighborhoods. Many of these inquiries concern deposits that had to be omitted from the bulletin of 9 years ago. Instead of trying to cover the entire valley, most of the material in this supplemental paper must necessarily be confined to one spot on a single ore deposit widely distributed throughout the local hydro basin. The selected ores are a new source of the metal magnesium. At this particular moment it would be well to remember that magnesium production is being conducted on a far higher scale of expansion than that enjoyed by any other metal.

To turn out appreciable tonnages of the champion light-weight metal for the rapidly expanding aviation industry calls for the consumption of tremendous quantities of energy somewhere up and down the production line. Instead of clarifying, the power situation along the North Platte seems to become more and more misty from year to year. At this time no one seems to know just how much of the developed potential will ever be made available for war industrial outlets.

In the bulletin of 9 years ago no type of local ore deposits was recommended for exploitation without first pointing out a specific source of power supply. It might be well to follow along the same footsteps today. In these days of stress and strain no large electrometallurgical concern would be justified in making huge plant investments in Wyoming, or elsewhere, without being assured beforehand of a definite and unvarying power supply. In short, if new kinds of ores are to be exploited in the North Platte Valley, it would be well to develop supplemental and still unmolested sources of power supply in that hydro basin today. Present status of the most promising site remaining on the stream follows:

KORTES DAM SITE

The only noteworthy step recently taken towards supplemental power development along the North Platte was the Congressional bill introduced by Senators O'Mahoney and Schwartz on April 21, 1942. The measure called for an appropriation of $3,000,000 to construct the Kortes Dam. That dam is located on the North Platte

River at a point only 2 miles below the recently completed Seminoe Dam. The capacity of the proposed plant was rated at 30,000 kilowatts, or say, 40,000 horse power. At that time Senator O'Mahoney stated that the object of the bill was:

> "---a part of a program for more power to promote mineral development in the State---."

To establish a sizable electrometallurgical industry at Guernsey, this report recommends that the preceding hydro-works be completed, and that its entire power output be transmitted to that village for the processing of either one or both of the following finished products in that vicinity at the earliest practicable date:

(1) Calcium Carbide
(2) Ferrosilicon

Either one or both of the preceding products could be processed completely from the various types of minerals and rocks hitherto catalogued as occurring in exhaustless quantities in or around the town of Guernsey.

Insatiable demands have recently arisen for both preceding products, chiefly for the reduction of the lightest metal thus far utilized by the constantly growing airplane industry.

Either one of the foregoing high-power products could be used for spot reduction of the light metal magnesium from the dolomite rocks occurring in the self-sustaining Guernsey locality. In time sizable volumes of the preceding powerful reducing agents could be shipped from the key plant at Guernsey to various other towns in Wyoming, also recognized as containing incalculable volumes of common dolomite rock within their respective environments. At such points magnesium could also be fabricated after first treating the local rock with either one of the Guernsey brands of chemical products, previously suggested.

In the manuscript written 10 years ago it was explicitly recommended that all of the proposed power potential of the North Platte be conveyed to two local deposits of strategic war minerals. At this time it will cost nothing to file another prediction. It is now suggested that any power potential remaining under the preceding stream be developed and forthwith delivered in its entirety to a single site in the town of Guernsey. On this more critical occasion, domestic demands currently ruling for either one of the two finished products, previously enumerated as: calcium carbide and ferrosilicon, are of sufficient dimension to consume by itself all of the kilowatts capable of being generated by a dozen hydro works of the magnitude hereinbefore set down for the proposed Kortes Dam Site.

SYNTHETIC RUBBER PLANT SITES

In the present analysis calcium carbide is rated slightly higher than ferrosilicon. That edge may merely be of temporary duration. A year ago a number of progressive cities entered a race to procure synthetic rubber works for their respective communities. At least one of the entries was noted as being from the Rocky Mountain Petroliferous Province. Many of those friendly contestants offered plenty of oil but few of them spent much time in discussing local hydro potentialities.

In her preparation for warfare Germany is still frequently regarded as the equal of any foreign power. In our relative positions toward rubber the Axis members do not yet seem to be suffering shortages more severely than our own. In Germany available raw materials for fabricating her top stocks of synthetic tires are largely confined to limestone and coal. Geologists still record the occurrences of such materials in Wyoming. In addition thereto, the oil reserves left in the State appear to be of sufficient magnitudes to stage a sizable industrial campaign.

The most distinctive U. S. consummation to date in the domestic elastic field is a chloroprene synthetic. Old magazine advertisements indicate that it:

> "does practically everything natural rubber will do but which resists the deteriorating effects of oils, chemicals, sunlight, heat, ozone, and aging, far better than Nature's own product."

Since the foregoing domestic discovery was given to the world the patent holding company has been testing out its own wares for heavy duty tire work in local oil fields. It is not the cheapest tire made, but in these days plenty of customers can be found willing to pay a fair price for just one rubber tire. The preceding product was, however, good enough to draw a $40,000,000 spot from the $600,000,000 initial allocations recently appropriated to underwrite a worthwhile synthetic rubber manufacturing program in this country.

Incidentally, intermediate materials utilized in making chloroprene are acetylene and hydrochloric acid. All Wyoming welders know that they roll out their own acetylene gas the moment they permit common water to come in contact with calcium carbide. Next time a western village is brave enough to file an application for entry into the rather involved synthetic rubber field it might as well include beforehand a thoro-going study of the home-town calcium carbide output. It still seems that the hydro angle enters into the production picture of the foregoing commodity in a fairly large way.

On too many past occasions industrial magnates have given Wyoming the complete "run-around". At times local booster clubs display a spirit of disinterestedness against hydro development within their respective communities.

OTHER INDUSTRIAL APPLICATIONS

Most folks are acquainted with many of the commoner uses for calcium carbide in the Wyoming country. Today some of it is also being consumed on a volume basis in new ship-yards as well as in lesser defense areas where welding or cutting operations are being conducted on a fairly large scale. Other outlets of a semi-military scope have been reviewed in past writings.

As said before, calcium carbide is just one more of those ultra-modern, high-power commodities of which too much cannot be produced at Guernsey, or at any other Wyoming point equally receptive to basic hydro development at this time.

PERMISSIBLE SILICA

Nothing seems to be published on maximum percentages of silica that may be present in dolomites reducible by the Pidgeon Process. Volatilization operations conducted in vacuo may be expected to demand ores free of almost all contaminants right at the outset.

The richest dolomite sampled in the Guernsey area was previously recorded to carry 4.55% silica. Ability of the district to provide rock more free of that impurity was not ascertained on the day of the examination. The only mineral deposit occurring in the local valley that might be used for eliminating silica in the Guernsey dolomites would be fluorspar.

FLUORSPAR

No sizable deposits of fluorspar are known to occur in Wyoming. The nearest one of magnitude within the local hydro basin is located 6 miles south of the Wyoming state-line at Northgate, Colorado. These deposits were purchased by prominent Cheyenne residents late last year. Production on a volume basis is expected early this summer. To ship mineral therefrom to Guernsey would involve 151 miles of travel almost entirely over paved roads.

At elevated temperatures the common mineral silica seems to develop strong acid characteristics. Under such conditions the following equation should record the potential fluorspar reaction:

$$SiO_2 + 2CaF_2 = SiF_4 + 2CaO$$

At what temperature such a reaction would begin is a matter that cannot be verified in Cheyenne at this time. If it is below 1500° F the silica in the Guernsey rock could be eradicated in the first step of the Pidgeon process. That procedure calls for the complete calcination of the dolomite limestones. To volatilize all of the silica would require the mixing of 175 pounds of fluorspar with every ton of Guernsey rock put into the calcination ovens. The addition of the spar would increase the lime content in the final calcine. Such a condition would have been looked upon as an efficiency factor a few years back.

The spar reaction would also yield silicon tetrafluoride. That compound entered into the smoke screens used in the last war. It could also be readily converted into pure silica, a basic material for making ferrosilicon. Present day experimentation on halogen compounds indicate that the fluorspar break-down could be greatly stimulated by placing a small amount of sulphur in the furnace admixture.

NITROGEN GAS WELL

The latest raw chemical reported in the quite complete natural laboratory commonly known as the North Platte basin is the element nitrogen. According to an analysis of the U. S. Geological Survey the gas was finally found in the Wyoming area in the hitherto unprecedented 100% pure form. A recent issue of a weekly smart chart reported the local discovery in the following terse style:

> "Unique Well
>
> "The stuff that came whooshing up out of the newly drilled well was -- believe it or not -- pure nitrogen. It may be, reports Nebraska Geologist Harold J. Cook in SCIENCE, the first nitrogen well ever struck. Drillers were hunting water on an eastern Wyoming ranch, when, at a depth of only 156 ft., gas whistled up.
>
> No less than 78.03% of the air is nitrogen - which is used as a constituent of many explosives and fertilizers - but a well yielding undiluted nitrogen may prove useful. This one has been

capped until its uses can be explored."
Time-April 13, 1942.

In the meanwhile similar announcements on the rather unusual find in Wyoming appeared in several scientific journals.

The foregoing well was brought in on the properties of Senator William H. Cross. His main holdings are along the North Platte near the mouth of La Prele Creek. The latter point lies 80 miles west of Guernsey.

The element nitrogen generally has limited applications in the metallurgical field. It is used in making the nitrides of some metals. Now and then that ordinarily harmless gas is doubtlessly utilized as an inert atmosphere for conducting several metallurgical techniques far too involved to set down herein. Moreover, no military uses have thus far developed for the nitride of magnesium.

To date the Wyoming type of "wind" gas has got into only one of the innovations so far devised for extracting light metals from the Guernsey order of rocks. It is the electrothermic process that bears the name of its entrepreneur, Dr. F.J. Hansgirg.

A good description of the nitrogen plants and other units of the Hansgirg chain appeared last year in the September issue of a leading chemical journal. In 2 sentences it succeeded in mentioning the interwoven relationship existing between 3 basic materials of the Wyoming type utilized by the process, to-wit:

> " -- An important part of the Hansgirg process is the provision of accessory equipment and facilities. For example, a cooling oil system is required to remove excess heat from the reduction furnaces' electrode glands and from other equipment such as the electrostatic agglomerator. Nitrogen produced by burning the oxygen out of air with natural gas is used for purging apparatus during shut-down periods.----"

Editor of the magazine predicted a brilliant future for the big Permanente Magnesium plant then approaching the production stage under the Hansgirg patents at Los Altos, California. At that time the human dynamos behind the works were contemplating the sponsoring of a tremendous expansion program not only at the home-town site, but also throughout the ore-rich, power-rich Pacific Northwest. But production had barely got under way until plenty of bugs developed along the assembly line. Such discrepancies caused the plant to close down intermittently for repairs or alterations. Worst of all, several days before the chemical journal appeared, a goodly section of the plant went up into the sky through explosive forces created by an internal detonation. Since then the technical sponsor of the project, Dr. Hansgirg, has been put into jail on FBI charges.

So far nothing has been noted in the papers as to the exact cause of the explosion. One thing is certain -- the safest spot to stay in one of those new-fangled Hansgirg works would be the nitrogen plant itself. If applied in liberal quantities and duly protected from foreign contaminants, the inert nitrogen gas could not possibly form explosive mixtures, whether or not it was manufactured in California or merely escaped in the 100% pure form from an unique well in distant Wyoming.

Just suppose Dr. Hansgirg had selected the Wyoming locale for his original plant. Only that engineer's dream-site could naturally supply adequate protection from plant explosion hazards. It is apparent that little time would have been lost before the vastly more logical Wyoming site had a direct pipeline connection with the new "wind" well located in the North Platte hydro-basin. Long ago that consummate natural laboratory was seemingly designed for the operation of all sorts of magnesium works thus far synchronized to the current cycle of invention. All can see that it may cost technical sponsors of future enterprises many more pretty pennies as long as they will refuse to make any personal investigations of the perfect mosaic that Wyoming can alone present for the safety-first manufacture of magnesium metallic products.

TECHNICAL STAFFS

Total investment in the preceding magnesium works was coolly recorded at $20,000,000 in a late issue of a news weekly. A good share of preceding funds was advanced by federal war agencies. Mastermind behind the entire plan was Dr. Hansgirg, himself. Moreover, few people can comprehend the magnitude of the technical staff organizations necessary to man a modern magnesium works of the first water. Supplementing Dr. Hansgirg was an army of technicians, consultants, conferees, engineers, chemists, physicists, geologists, and the like, numbering all told 180 men by the peak of the first explosion.

Now and then new industries invade the Wyoming field. In the past the benefits accruing from such movements were mainly calculated from the payroll angle. In the future it would be well to consider the proprieties of such invasions from vastly higher vantage points.

Expanding production in the future may largely rest on the activities of industrial research organizations. Take going concerns, for instance, now operating in the Wyoming field. Technical staff members for most of them can be counted on the fingers of one hand. Such limitations of brain power do not necessarily apply to corporate bodies recently organized for intensified operations in the new magnesium field. Suffice to state, that the arrival of an army of 180 scientific specialists would be a landmark in the history of any youthful industrial region contemplating expansion within the new and ever alluring light metal field.

Much investigational work remains to be done by suitably equipped task forces of the build-up previously referred to. The industrial potentials of the average Wyoming community still remains mostly unexplored. For an example, take the North Platte Valley. Merely to catalog the tremendous deposits of ores, minerals, chemicals, salines, alkalis, fuels, fluxes, and even now, the great gobs of non-explodable gases and equally harmless ubiquitous rocks, hereinbefore suggested for entry into the larger electric furnaces of the period, might prove to be a fairly formidable undertaking by itself. To attempt to correlate the industrial interrelationships existing between the several materials previously grouped for the local hydro-basin would likely occupy the spare times of sizable armies of specialists for many years to come. In fact it is doubtful if sundry forms of deposits still lying dormant in the local hydro-basin ever will see the light of day until studies along the mass-attack lines previously suggested are well under way.

CONCLUSIONS

The new policy of the National Academy of Science in examining certain processes for reducing magnesium from new ore types is hereby endorsed. Hereinbefore, the final selection of the Academicians has been firmly adhered to as the process also best adapted for geological conditions generally prevailing throughout the Wyoming magnesium field.

The reduction of magnesium by the process previously sanctioned may likely prove feasible at several widely separated localities in Wyoming in which heavy concentrations of dolomite rocks have long been a matter of public record.

In the Wyoming sector of the North Platte basin, partially covered by present investigation, the town of Guernsey seems to have the tempo, the speed and stamina that it takes to cross the finish line far in front of the procession in the Grand March now being run for all-around leadership in the rapidly advancing New Light Metal Age. Only at that natural focal point could completely integrated industrial operations be conducted in the new magnesium field.

C S Dietz

C. S. DIETZ
MINERAL TECHNOLOGIST

Cheyenne, Wyoming
June 15, 1942