

SUPPLEMENTAL REPORT
ON THE SUPREMACY OF SOUTHWESTERN WYOMING
AS A SITE FOR
LARGE-SCALE CHEMICAL OPERATIONS *

New Railroad Booklet - Map - Complete Depository of Fertilizing Minerals - Other Raw Chemicals - Low Cost Acid Supply - Potash Research Progress - Diversified Solid Fuels - Liquid and Gaseous Fuels - Hydro-Electrical Resources.

Accessibility - Local Market Demands - A Modern Agricultural Industry - Sales Plan - Relative Importance of Rocky Mountain District - Huge Totals Paid for Beets - Map of Sugar Beet Industry - Other Market Outlets - Conclusion.

A year ago the Wyoming Geological Survey published Bulletin No. XXI, on the mineral resources of the State.

Within its 194 pages an attempt was made to consolidate the findings appearing in over 200 geological publications that are of record on the varied mineral deposits found in Wyoming. Manifestly, a publication so condensed did not prove entirely satisfactory to those recipients who have since requested more authentic information on certain types of mineral deposition occurring in this State.

The bulletin was presented as an industrial evaluation on the sundry metallic and non-metallic minerals, raw chemicals, diversified fuels and other primary power producers peculiar to the Wyoming depository. Therein, academic discussions were largely replaced by simple economic expressions that mainly pointed out the variety of products that could be made cheaper in Wyoming than elsewhere. Apparently, no other state has yet published a similar inventory of its minerals, chemicals, solid, liquid and gaseous fuels and other forms of dormant wealth in the correlated manner undertaken in recent handbook.

From requests lately received it would seem that the recent bulletin aroused considerable interest both here and abroad. At present, the most frequent requests now reaching this bureau generally call for bibliographical references, chemical analyses, maps of the chemical deposits as well as for information on local market demands for products that could be made directly in Wyoming. Unfortunately, the recent bulletin did not have space for the consideration of some of those most important items.

New Railroad Booklet

Since the State bulletin was issued, the Union Pacific Railroad published its Industrial Circular No. 5, under title of "Fuel and Raw Material Resources of Wyoming Tributary to Union Pacific System." A copy of their valuable

* J. G. Marzel, State Geologist, 1930. (Author probably C. S. Dietz)

booklet is attached hereto as a part of this report.

The railroad publication provides information on some of the more glaring items omitted in the State bulletin. Its 20 pages record analyses of the major chemical and fuel deposits described in the late Wyoming bulletin. Moreover, the margins on its pages left room for the insertion of the main bibliographical references available on these deposits of sundry fuels, raw chemicals and complete mineral fertilizers that are located on the railroad in southwestern Wyoming. Should the reader desire additional information on a particular deposit reference should be made to the bibliographical notations now inserted in the supplementary bulletin of the railroad company.

Map

The printing of a Wyoming map that would show the locations of all the chemical, mineral and fuel deposits is a procedure far too costly for the bureau to finance at this time. A map of Wyoming, however, appears on inside cover of the railroad booklet attached hereto.

Unfortunately, the chart only shows the locations of the oil and gas fields as well as the boundaries of the vast coal basins situated in this State. Accordingly, for this report the locations of the principal phosphate, potash and nitrogenous beds as well as the deposits of salines, alkalis and other chemicals and minerals are superimposed on the fuel map of Wyoming as published by the railroad company.

Complete Depository of Fertilizing Minerals

A glance at the map shows that huge deposits of phosphate, potash and nitrogen bearing minerals all occur within the extremely favored southwestern Wyoming area. Outside of Wyoming an occurrence of all three of the major mineral elements consumed by plant life is unknown within a single locality. As a rule such vital materials are found at widely separated points. In Wyoming all occur on top of the greatest coal basin known to the nation. Later, it will be pointed out that the direct association of all three fertilizing minerals with every sort of fuel supply is an unsurpassable economic factor in the manufacture of super strength, triple salts at lowest possible cost.

Other New Chemicals

Moreover, atop of the great basin of assorted fuels also occur large deposits of important saline and alkali compounds some of which can be locally utilized in the production of fertilizing salts. Take for instance, sodium carbonate which is second only to sulphuric acid in production importance in this country. At Green River City large beds of the natural salt underlie the city at shallow depths. At that division point for two leading railway lines the manufacturer can set up his plant on top of these largest deposits of America's second most useful chemical compound. For maps and authentic descriptions of this and other Wyoming deposits of raw chemicals the reader is respectfully referred to the bibliography cited on page 19 of the railroad circular hereto attached. More extended descriptions of these salts as well as on the Wyoming triumvirate of fertilizing minerals likewise appear in the state bulletin published a year ago.

Low Cost Acid Supply

Another economic factor not yet mentioned in existing publications is the accessibility of southwestern Wyoming to low cost acid supply. The proximity of this region to the Great Salt Lake in Utah is described on the page that is inserted on back inside cover of accompanying railroad circular. As cited thereon, the huge copper smelters now operating in that district could soon supply all acid demands that may originate in the adjoining Wyoming area at an exceptionally low cost.

Potash Research Progress

The potash deposits of southwestern Wyoming all occur in an immense flow of leucite lava. Its average potash content of 10% is the highest reported in leucite rock.

During 1929 two Federal bureaus started to expend the sum of \$200,000.00 with the view of devising means to extract the potash content on a commercial basis. As the solution will involve an energy consuming process, all agree that the local chemical and dynamical laboratory offers the greatest promise for the exploitation of rich potash silicates in a successful manner.

A report on the scope of this research work appears in the 1930 review of the Wyoming mineral industry recently published by this office. A copy of this review can be had on request.

Diversified Solid Fuels

On accompanying railroad map the Wyoming coal basins appear in dark horizontal line shadings. A glance at the map discloses that fully 80% of the 25,000 square miles, that comprises southwestern Wyoming, is one huge coal field.

Elsewhere coal basins of this magnitude do not exist. Conservative estimates of geologists already place its solid fuel content at 665 billion tons. However, space on the map only permitted the location of a seam 85 feet in width as well as a horizontal bed 30 feet thick suitable for low-cost stripping operations, and also, the famous bone coal seam 8 feet wide that contains 2.3% ammonia alum. Should the latter bed ever show good fuel values, it may also serve as the natural source of supply for combined nitrogen in the district.

Airport Rock Springs, located 15 miles east of Green River, is the Coal Capitol of the Rockies. Its chief claim to fame rests on its ability to mine coal at continually decreasing costs. At present 55% of total output is from mines completely mechanized, and engineers estimate that within five years all the coal of the district will be mined and loaded wholly by literally laborless mechanical operations. Largely due to this spirit of progress, the President of the Union Pacific Coal Company stated in January that for its size, population 10,000, Rock Springs is now the most prosperous city in the United States.

Liquid and Gaseous Fuels

A glance at the map further reveals that nearly all important points in southwestern Wyoming are already connected with oil and gas lines.

At Rock Springs is the Baxter Basin gas field. Last September this huge reservoir and two smaller fields of the locality were connected with Salt Lake and other important Utah cities by a 334-mile pipeline system that cost \$18,000,000.00 to complete. On accompanying map this new network, that now extends across the natural Wyoming laboratory, is plotted in red.

Included in accompanying exhibits are two recent newspaper clippings. One of these shows that Idaho municipalities are now protesting the entrance of this cheap gas supply into their state. The other reports a movement now on foot to pipe the Wyoming gas to distant metropolises in the Pacific Northwest. In my opinion, much of this efficient fuel of twice the calorific value of best arti-

ficial gases should remain for future industrial expansion directly within the combined chemical laboratory and power house that so largely goes to form southwestern Wyoming as a whole.

In modern industry the use of gas is constantly playing a more important role. Elsewhere gas wells already supply large chemical works with the basic hydrocarbon molecules from which a wide range of costly organic compounds are built up when united with acetylene. Some of these new synthetics include the latest solvents used in major industries as well as the newest motor coolants and also acetone the foundation of the present rayon industry. Already an acetylene plant is being built in Wyoming to utilize cheap gas in the manner described.

On the other hand, in addition to its ability to synthesize with other radicals, it now appears that even more powerful forces can be yielded from natural gas, itself, when its molecules are broken down into simpler units. In this connection the following extract is taken from page 656 of the November, 1929, issue of "Chem. & Met":

"Now, however, there looms on the horizon the possibility of a more efficient exploitation in which natural gas becomes the raw material for large-scale chemical synthesis. By a simple cracking process the methane will yield hydrogen and ethylene. The latter may some day serve as the basis for producing synthetic acetic acid or even ethyl alcohol. Hydrogen is the more costly of the raw materials for ammonia synthesis, and it is reported that the German nitrogen industry plans to establish a plant in the Monroe area to take full advantage of this economical source."

For producing hydrogen under the proposed less expensive process it is doubtful if any region should attract more attention than the extremely favored southwestern Wyoming area. In addition to lowest cost gas supply the local chemical and dynamical laboratory also offers huge deposits of high-grade phosphate beds and rich potash lavas that could be directly combined with hydrogen made ammonia for the manufacture of the more powerful fertilizing salts. Obviously, the ideal mosaic that is southwestern Wyoming will soon attract the more progressive chemical industries. As matters now stand even the largest of present organizations would likely be lost in the immensity of the local caldron.

Hydro-Electrical Resources

On accompanying map a hydro-electrical site is also plotted directly on the Green River. According to United States Geological Survey Water Supply Bulletin No. 469, this site is situated in Utah eight miles south of the Wyoming boundary. From the central railway and industrial city on the Green River in Wyoming the distance to the proposed site is 44 miles. When completed, the back-water will extend over this entire distance in Wyoming.

In regard to the site the following extract is taken from the Federal publication:

"The Flaming Gorge power site is at the dam site for the Flaming Gorge reservoir, in northeastern Utah. The elevation of the low-water level of Green River at the dam site in Horseshoe Canyon is 5,825 feet. By constructing a dam to elevation 6,050 for storing to elevation 6,040 feet, the reservoir capacity would be 3,130,000 acre-feet. The storage capacity between the 6,000 and 6,040 foot contours would be 1,210,000 acre-feet, or sufficient to equalize the flow of the river at this point and insure a minimum flow of 2,700 second-feet. By constructing a 3-mile tunnel at elevation 6,000 feet an effective head of about 290 feet could be obtained. With a head of 290 feet and a flow of 2,700 second-feet, 71,000 brake horsepower could be developed."

A view to the entrance of this famous gorge appears in Vol. II in King's Geological Survey of the 40th Parallel. Due to the precipitous slopes of the rock-ribbed box canyon site, cost of development would be comparatively low. Moreover, when Wyoming and Utah entered the Colorado River Compact of the Government it was generally understood that the development of the local site would be one of the first improvements completed on the great interstate river system. As soon as sizable industrial demands for power originate in the locality, sentiment for the development of the big hydro project will likely be expressed in this State.

To some engineers a hydro-site of preceding magnitude directly within the heart of the Wyoming Wonder Valley is merely looked upon in the light of surplus baggage. It is admitted that on completion the proposed hydro-plant would meet an extremely stiff form of competition. For directly within the natural power house of Wyoming are also an overlapping series of colossal coal seams as well as the largest reservoir of natural gas of high calorific value known in entire Rocky Mountain region. From this huge bin of diversified fuels limitless supplies of steam could likewise be produced at the lowest possible cost. Manifestly, the

Wyoming valley can offer little inducement for private capital to construct a superfluous hydro plant therein. However, as soon as Federal agencies complete this development, primarily for dual irrigation and flood control measures, the far-seeing industrialist already established in the local laboratory would be first to reap the advantages of the lower power rate so provided.

Herein, mention of the big hydro site was only made to show that within the matchless Wyoming area not one but every method will be open for the progressive concern to make complete and concentrated fertilizer products. If ordinary soluble treatment is objectionable, perhaps the huge beds of 80% tri-calcium phosphate of the district could best be volatilized to pure acid form by the patented electro-thermal method now operating in Alabama in a big way. If either the mining of the ammonium coated coals or the production of hydrogen by natural gas dissociation should likewise prove disappointing, the highly versatile manufacturer could still resort to the old-style fixation process for his nitrate requirements. In fact, solely due to the superlative range of processes feasible for operation only within the consummate local depository, the writer was forced to pen the not yet universally accepted chapter in Bulletin No. XXI, entitled, "A Brief Resume on The Economic Resources of the Green River Valley."

Accessibility

From correspondence recently received an impression seems to prevail that the southwestern Wyoming valley is a part of one of the more remote, isolated and backward localities of America. Nothing could be further from the truth. As a matter of fact, the district is traversed from end to end by the Main Street of the Nation.

From Pony Express days to mail by airplane, the central arterial route of the Green River valley was always selected for every style of communication first inaugurated from coast-to-coast. Other types of "first and best" transcontinental services are now provided by the Union Pacific mainline, the Lincoln Highway, as well as by the main trunk lines of the telephone and telegraph companies.

At present, Airport Rock Springs, the most progressive city of the valley, is distant 20 hours from New York and 10 hours to the largest Pacific

Coast seaports. Already, twice daily service is provided in each direction over this pioneer air route of the nation. Moreover, to take care of continually increasing traffic demands an extra passenger service will be added to this shortest and most direct airline on May 1st.

CHAPTER II.

LOCAL MARKET DEMANDS

Another grave omission in Bulletin No. XXI was failure to include a survey of immediate market demands for mineral fertilizer products directly within Wyoming as well as in all the states that form its boundaries.

A year ago, when publication was received from the press, it was still generally contended that with the possible exception of nitrates the comparatively new soils of the Rocky Mountain region still contained their original rich contents of fertilization minerals. Exhaustive studies and tests conducted by the progressive sugar beet industry during past summer conclusively demonstrated serious deficiencies of phosphate minerals in agricultural lands that have long passed as the pride of Wyoming. Since then the leaders in the sugar industry lost no time in performing similar tests in the adjoining states. According to their latest findings an annual expenditure of \$3.00 per acre in phosphates will return the grower as high as \$30.00 extra in beets not only in Wyoming but also in all adjoining states in which is confined the entire sugar beet industry of the Rocky Mountain region.

Naturally, the highly important economic discoveries of the beet industry have already been duly broadcasted in the Press. In the jacket attached hereto is a considerable number of clippings selected from leading newspapers within the past two-month period. Space within this report will not permit an adequate digest of the diverse messages conveyed by these clippings. However, should they fall within the hands of a manufacturer of fertilizers, long compelled to deal with rather skeptical schools of agriculturalists, he will have good reason to deserve a far more intelligent degree of receptivity already awaiting products of proven merit directly within the up-and-coming Rocky Mountain Area.

A Modern Agricultural Industry

The Rocky Mountain beet sugar industry is a new enterprise and as such its open-minded devotees are not overburdened with matters relating to long established traditional policies. The type of clippings selected for the enclosure plainly discloses that in this area the powerful refining interests, in lieu of the fertilizer manufacturer, performs the work of breaking down the sales resistance offered on part of the grower. As an example, the most recent clipping from the Denver Post (Feb. 9) tells about the "Dynamic Mass Meetings" that a leading sugar company is now sponsoring in 65 different Wyoming, Colorado and Nebraska towns for the object of driving home the idea of using phosphates on beet lands that lay tributary to its numerous refinery sites.

In the last decade other missionary work performed by the costly demonstration trains of the progressive refining company increased the beet yield 2.3 tons per acre throughout its extensive territory. Without the use of phosphates and other fertilizers the Rocky Mountain beet yield is already three tons per acre higher than that of the balance of the nation. With the use of phosphates alone the refiners hope to step-up present 12-ton yield to 16 tons per acre during coming summer season. At \$3.00 per acre that desideratum would involve an investment of over \$1,300,000.00 in phosphate for this year. In addition to Wyoming, Colorado and Nebraska, another clipping shows that a second large sugar refiner is also preaching the 16-ton per acre doctrine for this season in the heavy producing states of Utah and Idaho.

Sales Plan

At places the financing of fertilizer sales on long term installment plans appears to work a hardship on the manufacturer. Apparently, in the select Rocky Mountain area such unsound practices are entirely obviated. One of the clipping enclosures describes the sales plan now in vogue. In short, out here the powerful refining interests buy phosphate in the spring and supply it direct to the grower who makes payment when the beets are sold to the company in the following fall. Manifestly, this new western procedure is far less complicated than practices that may still prevail in either the less organized or the more generalized styles of agricultural communities.

Relative Importance of Rocky Mountain District

The following tables disclose the importance of the Rocky Mountain district in comparison to the entire beet industry of the Nation:

American Sugar Beet Industry

Acreage and Production Statistics as Recorded by Table 310 on page 875 of 1928 Yearbook of U.S. Department of Agriculture

Table I Rocky Mountain District for 1928			Table II All Remaining States for 1928		
State	Acrea	Production	State	Acrea	Production
Nebraska	88,000	1,023,000 tons	Ohio	38,000	281,000 tons
Montana	29,000	262,000 "	Michigan	65,000	428,000 "
Wyoming	45,000	487,000 "	Wisconsin	8,000	74,000 "
Idaho	26,000	285,000 "	California	52,000	633,000 "
Colorado	179,000	2,322,000 "	"Other States"	57,000	562,000 "
Utah	53,000	623,000 "			
*South Dakota	6,000	60,000 "			
Totals	426,000	5,062,000 Tons	Totals	220,000	1,978,000 Tons

*Totals included under "Other States" in Yearbook.

Rocky Mountain Acreage - 66% National Acreage.

Rocky Mountain Production - 72% National Production.

When 1930 figures are available the 72% production of national total recently accredited to Rocky Mountain district will be greatly augmented by application of phosphate and other advanced practices. No other climate is better adapted for growing sugar beets than that of the highland plains which surround the Rockies. At present no agricultural industry is in more wide awake hands or is controlled on a more scientific basis than the beet industry of the Rocky Mountain states. For these and other reasons some local optimists already predict that the day will soon be here when the production percentage rating of the Rocky Mountain beet industry will approach the parity long enjoyed by the cotton industry of the South.

Huge Totals Paid for Beets

One of the clippings selected for the enclosure stresses the fact that the pioneer refining company operating in Wyoming, Colorado, Nebraska and Montana celebrated its twenty-fifth anniversary in January. During the ceremonies an executive announced that his company had already paid the sum of \$377,658,687.00 to the growers of sugar beets in four states mentioned. Manifestly, single clients of the preceding girth do not lag above the horizon of the chemical world on every day of the week.

Map of Sugar Beet Industry

On outside cover page of railway circular is a map on which the area of the Rocky Mountain sugar beet industry could be superimposed for this report. Thereon, the locations of the 55 sugar refineries now operating in entire district are inked in red.

A glance at the map suffices to disclose that the area of the Rocky Mountain beet industry is confined wholly to Wyoming and to each one of the six states that form its complete boundaries. As now established, Wyoming is thus correctly plotted as the "Heart" state for the comparatively new industry.

For the map, a 350-mile radius circle was plotted from the central point of Green River City, Wyoming. Within this selected radius is confined all of Wyoming, and also, 52 of the 55 sugar refineries operating in entire Rocky Mountain region.

From the mentioned focal point an inner circle of 75-mile radius was also plotted in green. This inner circle delimits the outer boundaries of the vast chemical and dynamical laboratory of Wyoming in which is compacted its greatest basin of diversified fuels, its largest hydro-site, and also, all of its potash lavas, its high-analysis ammonium coals as well as a large share of its enormous stores of rich phosphate rocks. Moreover, as indicated on the map, the huge laboratory, in which is stocked all raw materials and ingredients that enter into the manufacture of all dynamic foods consumed by plant life, happens to be strategically located in the geometric center of the great Rocky Mountain beet industry firmly delimited and established by this day.

Other Market Outlets

By itself the entire beet industry can only make slight drafts on the enormous supplies of vitalizing forces still reposing undisturbed within the consume and inimitable storehouse of plant foods that is centrally located in Wyoming. For other agricultural pursuits the Wyoming depository likewise occupies an advantageous location of some importance. For the 15 years last past shipments of raw phosphate rock have been annually made from the Wyoming district to the citrus lands in California. Had the phosphates been shipped in costly soluble form, the deliveries to those distant points could have been expanded many times.

Directly bounding and overlapping the Rocky Mountain beet industry are other forms of agricultural endeavor that now rest on solid economic foundations. The new cotton industry of the West is now established in Arizona and New Mexico, the two states that form the southern boundary of local beet industry. For those highly productive areas as well as some cotton lands in both Texas and Oklahoma, the Wyoming depository should logically develop into the most accessible source of supply for high-analysis plant-food concentrates.

In Federal Statistical Reviews, Nebraska and South Dakota are classified as a component part of the Rocky Mountain Sugar Beet District. On other agricultural atlases these two great commonwealths always appear in that group of 15 upper Mississippi Valley states that bear the label - - - "THE BREADBASKET OF AMERICA."

Just how soon the wheat and corn growers within the two states that form the eastern boundary of Wyoming will see the light in applying labor-saving mineral foods on their lands is manifestly an economic issue on which no forecast can be filed by this bureau. However, should demands originate in the wide enveloping grainbelt with the Wyoming degree of unexpected suddenness, due thanks would have to go to the phosphate deficiency discoveries of scientists employed by the highly modern beet sugar industry that is now so firmly entrenched in its incomparable Rocky Mountain stronghold.

Conclusion:

The manufacturer of phosphates who first sets up a works inside of the huge natural laboratory of Wyoming will find local markets awaiting the products of his plant in every cardinal direction. Should higher power salts be made at that central focal point, the open territory would now embrace the greater half of the United States.