VOL. X SEPTEMBER, 1920 No. 9

COLORADO SCHOOL OF MINES MAGAZINE

THE COLORADO SCHOOL OF MINES ALUMNI ASSOCIATION, PUBLISHERS, GOLDEN, COLO.

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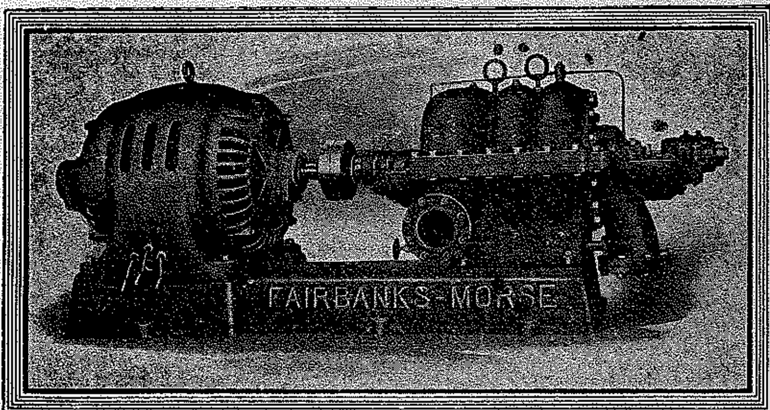

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COLORADO SCHOOL OF MINES MAGAZINE

Published every month in the year, at Golden, Colo., by the Alumni Association of the Colorado School of Mines.

C. ERB WUENSCH, '14, EDITOR.

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CONTENTS

Gulf Coast Salt Domes

By Albert G. Wolf, '07.

The economic importance of Gulf Coast salt domes was first recognized when enormous workable salt deposits were discovered in some of them in Louisiana. Later, sulphur was discovered in a dome at Sulphur, La., and was first successfully extracted by the Frasch process in 1894. The production of sulphur there soon became so great, and the cost so low, that the Sicilian sulphur mines, previously the largest producers of sulphur in the world, practically ceased to export to the United States. Now the Gulf Coast deposits supply the greater portion of the world's sulphur. Neither of these discoveries, however, created any general public interest in salt domes. It remained for the completion of the Lucas gusher, by Capt. A. F. Lucas, on Spindle Top, a salt dome near Beaumont, Texas, to bring these domes into the limelight. This gusher came in January 10, 1901, making 75,000 barrels of oil a day, and creating intense excitement in the oil world. As fast as rigs could be procured, all the more prominent domes were drilled, and many of them developed into large oil-producing fields.

At the present time, two of these domes supply us with considerable salt, and others have practically an inexhaustible supply for the future. Three others, one in Louisiana, and two in Texas, produce the majority of the entire world's sulphur supply; many of the others are adding materially to the oil production of the United States. Undoubtedly many more domes are still to be discovered beneath the flat coastal plain.

In view of their economic importance, and despite the fact that much has been already written about these coastal domes, the writer believes that a general description of them, including their distribution, origin, structure, and mineral production, will be of interest to some of the readers of the Colorado School of Mines Magazine. The subject is so broad that only a brief treatment can be given to each subdivision. A bibliography, which, though quite incomplete, is appended for those who wish to make a detailed study of these peculiar structural formations.

Gulf Coast Topography and Distribution of Domes.

The domes here discussed lie within a belt not over 75 miles wide, extending inland from the Gulf of Mexico, in the states of Louisiana and Texas, and from west of the Mississippi River to the Rio Grande. The width of this belt is indicated in Fig. 1 by the distance between the Gulf shore and the arbitrarily drawn, heavy dot-and-dash line, and the portion of the belt shown contains all the important domes, at least those found to be of importance to date.

Most of this belt is an extremely flat coastal prairie. Except where streams have cut down to an elevation approximating sea-level, forming banks, the untrained eye can scarcely distinguish any change in elevation. The river "valleys" are broad, and but slightly lower than the rest of the surface. These are called "bottom lands" or "river bottoms," and are easily distinguished by a change in vegetation, especially in an increased growth of Spanish moss on the oak and other trees.

It is no wonder, therefore, that in a country so flat, more or less circular or elliptical, elevations 10 feet to, in one case, 85 feet, above the general surrounding level, should be called "mounds," "ridges" and "big hills." These are the Gulf Coast salt domes, and are the chief topographic feature of the region.

After a number of domes had been discovered, it became evident that they were located along northeast-southwest lines roughly parallel with the Balcones fault and along intersecting parallel lines, as shown in Fig. 1. In this figure the broken lines are hypothetical fault lines, not exposed on the surface on account of the deposition of later sediments, and believed to be formed by subsidence in the pitching trough of the Mississippi Embayment area. The round spots represent the principal salt domes. This regular distribution is now generally accepted as indicating some relation between the domes and the main structural features of the coastal belt.

One other topographical feature in this belt is the "wave ridges." These are long, low, narrow elevations, more or less parallel to each other and the shore line, occurring from near the coast to many miles inland. They were formed by wave action along some former or the present shore line. Some "wildcatting" is done on ground where these occur by people not acquainted with their purely surficial character.

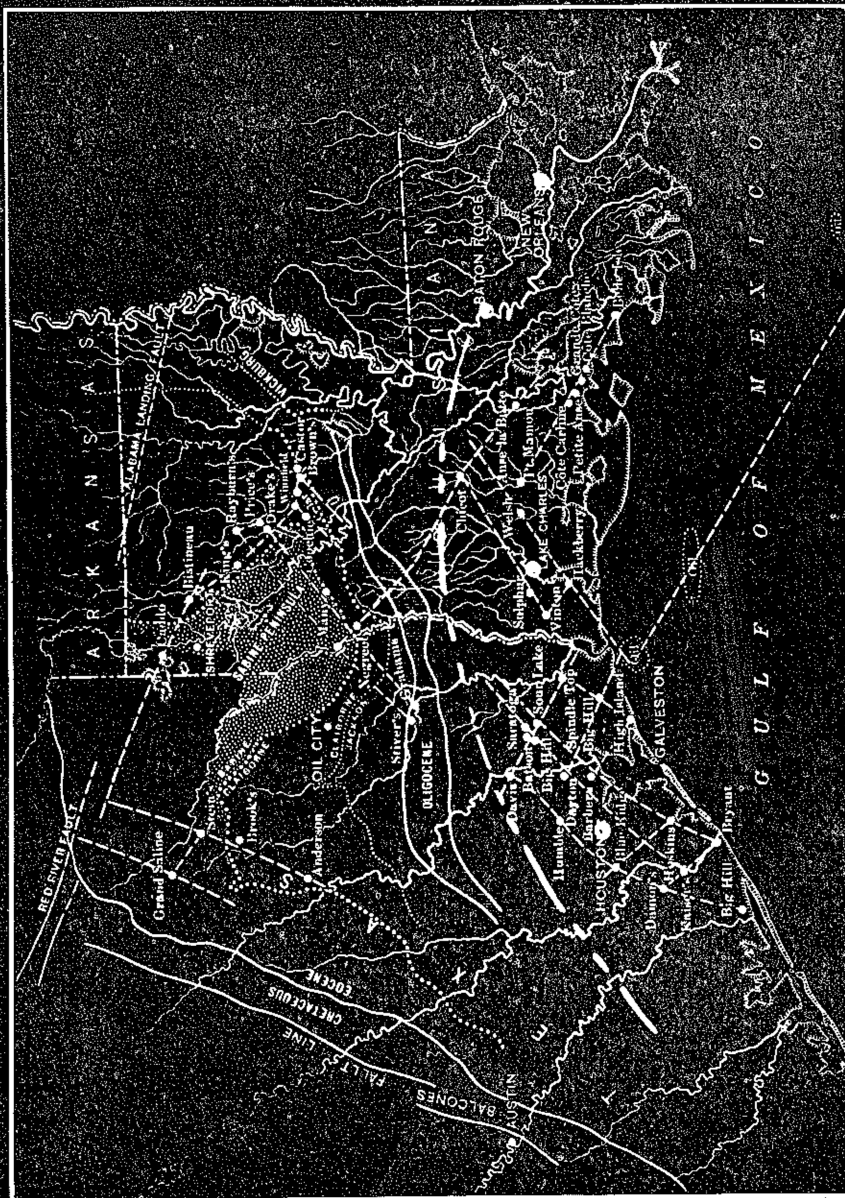


FIG. 1.—Map showing Distribution of Salines and Alignment of Domes in Mississippi Embayment Region.
Bulletin No. 7, Louisiana Geological Survey

Surface Indications of Domes.

The chief surface indication, generally speaking, is the abrupt change in elevation. In an otherwise perfectly flat country, a dome, even if only eight or ten feet high, is quite noticeable to the trained eye if an unobstructed view can be had. The drainage, also, is a good indicator of high ground. Sometimes the bending of two streams or "bayous" around a certain area will indicate higher ground that might not otherwise be noticed. Radiating streams will also show this. The surface of any elevation is liable to be covered with sandy soil or yellow sandy clay in sharp distinction to the "black land" of the "bottoms."

All salt domes, however, do not show as an elevation on the surface. One in South Texas is indicated by a salt lake, the bottom of the lake being rock salt. The surface over one in Louisiana is a salt marsh. Where domes have been found under flat or marshy ground, some indication was usually given by gas or oil seepage, and subsequent drilling proved the existence of a dome.

Surface indications of domes, then, may be summarized as change in topography (a visible dome), arrangement of drainage, change in soil, salt lakes, and gas, oil, salt water and sulphur water seeps. Gas, oil, salt water, sulphur water, gypsum, salt or native sulphur found in drilling wells are also indicators.

Structure of Domes.

The structural features may be divided into four parts; the salt core, the cap rock, the overlying sediments, and the abutting sediments. In a few cases the overlying sediments, or both the cap rock and overlying sediments are absent. Overlying sediments, for the most part, consist of unconsolidated Quaternary strata of sands, gumbo (with or without boulders), beds of marine shells, clays, etc., with some sandy shales and thin beds of harder clay shales or other rock called "shell" by the drillers (meaning a shell of rock, not a stratum of shells). Some of the Tertiary sediments may occur above the cap rock. All these strata are gently arched. The abutting Tertiaries have been broken through by the salt core and bent upward at angles of 30 degrees to almost vertical.

The intruded salt core is more or less circular or elliptical in horizontal cross-section, with radii varying from one-eighth of a mile to one mile. Its top slopes in all directions, the dip increasing rapidly toward the flanks. The depth to which the salt extends is not known. In some domes, salt is known to extend below 3,000 feet, and at Humble one well penetrated salt to a depth of 5,410 feet before it was abandoned. In different domes the salt varies from a hard crystalline to a loose crumbly texture.

Immediately above the salt core, between it and the unconsolidated sediments, is the cap rock. This consists of any or all of the following: gypsum, anhydrite, dolomite, and limestone, the latter in places being altered to marble or calcite. Usually gypsum or anhydrite is next to the salt. This capping extends only a little or no distance beyond the top of the salt plug, and its formation must have been contemporaneous with or later than the salt-plug intrusion, as no equivalent strata in the series of original sediments of the Gulf Coast can be found. The depth at which the cap rock occurs varies from a few feet below the surface in some domes to 1,200 or more in others.

Origin.

The possible origin of these domes has been discussed at length by various geologists, and is still a moot-point. Most of the earlier theories were based on the idea that the salt deposits were formed contemporaneously with or just in advance of the building up of the sediments in which they occur, but, generally speaking, that was before the true structure of the domes was known. Now, almost all geologists, who have studied them, agree that these deposits are secondary to the surrounding sediments. However, the thermal spring theory, advanced by Edward G. Norton (Trans. A. I. M. E., January, 1915), still has some adherents.

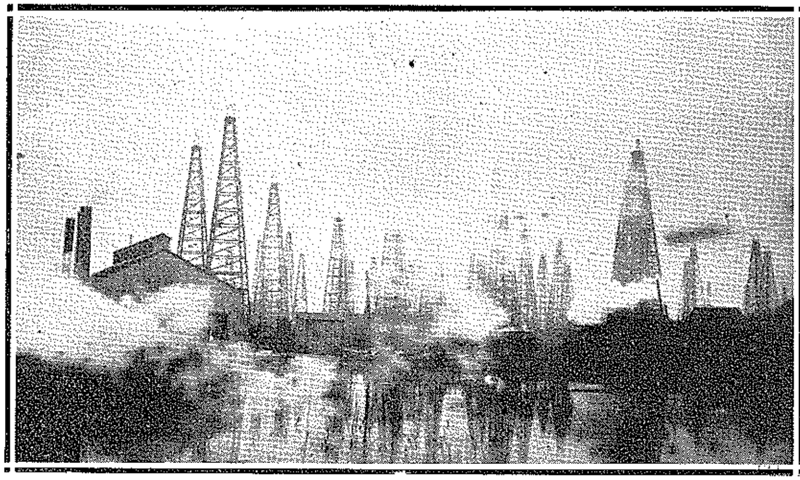
In arguing for or against any theory, two points must be taken into consideration—the cause of the uplift and the source of the salt. The uplift forming the domes is attributed variously to gas pressure from below, hydrostatic pressure, isostatic movements, growing salt crystals, volcanic plug intrusion, doming of a salt stratum and overlying strata by a laccolith, and the intrusion of the salt itself either in a molten condition or a semi-plastic condition. The introduction of the salt is also variously ascribed to ascending magmatic waters, ascending artesian waters, and in the case of salt intrusions, to offshoots from deep-seated, underlying salt beds.

In selecting the most plausible theory, all the characteristics of the domes must be taken into consideration, namely, the arching of the overlying sediments, the puncturing and bending up of the now abutting sedimentary strata, the size and shape of the salt plug, the nature and extent of the cap rock, and the distribution of the domes in more or less regular lines along the coastal belt. In addition, it must be remembered that no igneous rock (except a little volcanic ash of unknown source) has ever been found in this coastal belt although hundreds of wells have been drilled over 3,000 feet deep and several over 4,000 feet with at least one over 5,000 feet.

The theory best conforming to the majority of these characteristics, I believe, is that of intrusion of salt in a semiplastic condition from a salt bed at great depth, the impelling force being lateral or compressive thrust supplied by the weight of the sediments along an overloaded sea coast. The lateral pressure is a result of the downward pressure. This theory is described at length by G. Sherburne Rogers under the title "Intrusive Origin of Gulf Coast Salt Domes," in Economic Geology, September, 1918 (printed by permission of the Director, United States Geological Survey).

The distribution of the domes has already been discussed under that heading, but it may be added that the Balcones fault (Fig. 1) is the most important structural feature of Central Texas. It extends from the Rio Grande to the Red River in a southwest-northeast direction, showing for hundreds of miles as a distinct escarpment. It was formed by the subsidence of the Gulf Coastal plains to the southeast of it.

Little progress has been made in evolving a satisfactory theory for the formation of the cap rock, which plainly does not belong to the series of unconsolidated sediments overlying and surrounding it. The suggestion has been made that the anhydrite may have been lifted with the salt, as anhydrite occurs with bedded salt deposits, but that would not account for the gypsum, calcite, limestone, dolomite and sulphur, all or some of which occur in the capping of every salt dome, unless, of course, the salt core comes to the surface. If the formation of the salt is considered secondary compared to that of the surrounding sediments, then the formation of the cap rock may reasonably be considered Tertiary, and its deposition due to circulating solutions.



A Gulf Coast Oil Field.

ECONOMIC MINERALS CONTAINED.

Oil.

Oil, when present, may occur in three different parts of the dome structure; in the cap rock, in the loose sands above the cap rock, or in the abutting strata below the level of the cap rock. In one dome it may occur in only one of these parts, while in another in all three. There is no regularity. In one instance, at Belle Isle, La. (A. F. Lucas, "Possible Existence of Deep-seated Oil on the Gulf Coast," Trans. A. I. M. E., September meeting, 1918), a small quantity of oil was found in the salt itself. In possibly one-half the present known salt domes on the Gulf Coast, no oil has been found.

On a new dome drilling for oil is usually done on the top, followed later by deeper holes on the flanks. The oil wells that are drilled to the oil-bearing strata, above the cap rock and in the cap rock, vary in depth from 500 feet to 1,200 feet. Some may be shallower. Those on the flanks are from 1,200 up to 3,500 feet. There are few, if any, producing oil wells on the Gulf Coast at the present time much deeper than that. The area in which oil is found also varies greatly. If oil is in or above the cap rock only, the area may be restricted to a few hundred acres, while if found in the flanks, it may embrace several square miles. It, however, rarely extends a distance exceeding a radius of two miles from the center of the dome.

Oil in quantity in a coastal dome was first discovered by Anthony F. Lucas, when he completed the No. 2 Lucas well on Spindle Top, a few miles south of Beaumont, Texas, January 10, 1901. This oil was in the porous limestone capping. The well came in as a tremendous gusher from a depth of a little over 1,100 feet, and flowed at a rate estimated to be 75,000 barrels daily. Most of the salt-dome oil formations carry a heavy gas pressure, and the first wells drilled, or in some cases many of the wells, no matter what the life of the field may be, make a large initial production. The "top flow," however, rapidly subsides, and in a comparatively short time the wells must be pumped. After the Lucas gusher was brought in most of the easily recognizable salt domes were soon drilled. Several made good oil fields, producing millions of barrels each to date, while others are still being drilled in hope that oil will be found.

The total oil production from the Gulf Coast, that is, the coastal salt domes of Louisiana and Texas, during the year 1919 was 24,207,620 barrels of 42 gallons. The coastal oil varies in specific gravity and analysis from place to place, but averages about 21° Bé. It has a high sulphur content, and an asphaltic base.

Sulphur.

Some sulphur is present in most of the Gulf Coast domes, but in only a few is it in commercial quantity. When present, it occurs in the cap rock of the salt. This cap rock, as already stated, may consist of any or all of the following: limestone, calcite, gypsum, dolomite or anhydrite. When the sulphur is present in large amounts it usually occurs as filling the cavities of a very porous limestone or calcite, and with some of it scattered through the underlying gypsum or anhydrite.

As the cap rock is limited in extent, it can readily be seen that the possible lateral extent of a sulphur field is more restricted than that of a dome oil-field. In thickness, the sulphur-bearing stratum varies in different domes and in the same dome from a few feet to over one hundred feet, and in grade from a fraction of 1 percent in the underlying gypsum to almost pure sulphur in the better part of the lime-sulphur stratum.

The origin of the sulphur is an unsolved question. According to Lindgren ("Mineral Deposits"), sulphur is "undoubtedly derived from gypsum through the reducing action of organic matter, by way of calcium sulphide and hydrogen sulphide." This is in reference to sulphur deposits in gypsum in general. Lucas ("Possible Existence of Deep-seated Oil Deposits on the Gulf Coast," (Trans. A. I. M. E., 1918), claims that the formation of sulphur from the reduction of gypsum at moderate temperatures can not be substantiated in the laboratory, where a temperature of many hundreds of degrees centigrade is necessary. He contends that the presence of hollow tubular, or worm-shaped, concretions of pyrite suggest their formation by hot, rising sulphur gases. Small quantities of galena, sphalerite, chalcopyrite, etc., found in some of the domes, indicate connections with igneous forces. Kennedy (Trans. A. I. M. E., 1918, p. 1145), suggests that instead of the sulphur being formed by reduction of the gypsum, it may be possible that the gypsum was formed by the alteration of limestone by sulphuric acid, this acid having been found in some domes, and SO_2 being one of the most common of volcanic emanations.

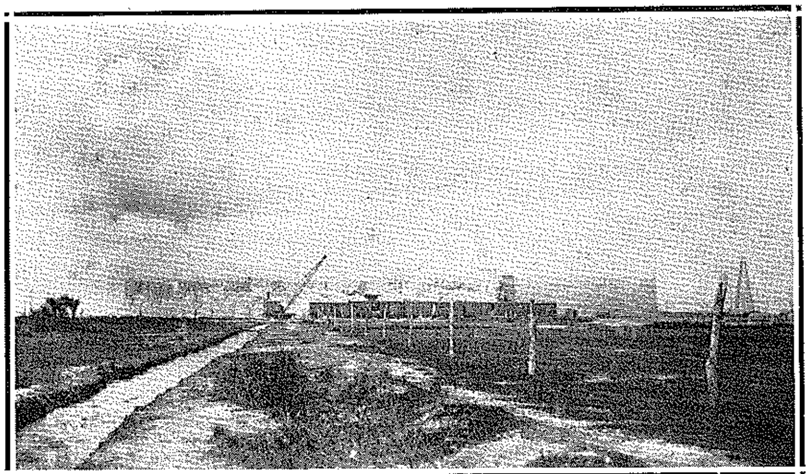
It is stated that sulphur was first discovered in the Coastal domes in wells drilled for oil at Sulphur, La., in 1869. Attempts were made to reach this sulphur deposit by shaft sinking, but after loss of life, due to hydrogen sulphide (and possibly carbon monoxide and dioxide) emanating from the sulphur zone, this was abandoned. Later, the problem was attacked in another way by a chemist named Herman Frasch. This method consisted of melting the sulphur in the ground by hot water, and pumping the sulphur out in a liquid state. His first patent was applied for October 23, 1890, and the first sulphur was produced by his method in the autumn of 1894.

The process requires a steam-boiler plant of large capacity, say 1,000 hp. or more, together with super-heaters, pumps and air compressors, and in addition, an enormous water supply is needed. Holes are drilled to the cap rock of the sulphur-bearing stratum by the rotary method, cased, and then continued into the sulphur. The water is raised to a temperature of over 300° F. in the super-heaters, and pumped into the drill-holes under pressure of about 100 pounds through a second line of pipes. The sulphur melts and collects at the bottoms of the holes, from where it is raised to the surface by air lifts.

In the sulphur business the term "cap rock" does not mean the entire capping of limestone, gypsum, etc., above the salt, as has already been described, but only the barren rock between the unconsolidated sediments and the sulphur-bearing stratum. A good cap rock is necessary to the economic production of sulphur by this process, for without it, the hot water will be dissipated throughout the loose sediments, and only a small part of its heat energy will be expended in melting sulphur.

On the surface, the sulphur is pumped into vats made of 2-inch plank, well braced, and built up as the level of the sulphur rises. These vats vary in size, but are usually quite large, being one hundred or more feet wide, several hundred feet long and thirty to fifty feet high. When completed, a single vat may contain a quarter-million tons of sulphur in one solid block. After the sulphur is solidified, the vat walls are torn down, the sulphur is drilled, blasted with dynamite, and loaded onto railroad cars by steam shovels.

Only three companies have been equipped to produce sulphur by the Frasch process—the Union Sulphur Co., Sulphur, Calcasieu Parish, Louisiana; Freeport Sulphur Co., Freeport, Brazoria County, Texas; and the Texas Gulf Sulphur, Gulf, Matagordo County, Texas. On Fig. 1, Freeport is marked Bryan, and Gulf, Big Hill. I have no figures showing the total production for the year 1919, but a very rough estimate would be between 3,000 and 6,000 tons daily. At the present time the market quotation is $18 per ton domestic, and $20 export, so it can be seen that this is no insignificant industry. While the value of the oil produced from coastal domes may exceed that of the sulphur, the sulphur produced is of much more importance to the United States than either the oil or salt because by far the larger percent of the production of both oil and salt in the United States is made from territory other than coastal domes, while almost all the sulphur comes from these domes. It should be added here that none of the domes from which sulphur is being produced have made any great quantity of oil.



100,000 Tons of Sulphur in One Block. Note Comparative Sizes of Sulphur Vat, and Steam-Shovel, and Box Cars.

Salt.

The only salt being produced from coastal domes is mined as rock salt at Grande Cote (Weeks Island) and Petite Anse (Avery Island), both in Louisiana. On these domes the salt cores are found at comparatively shallow depth, at 91 feet in one case, and 330 feet in the other.

The methods of mining have been described in other publications: "The Avery Island Salt Mines and the Joseph Jefferson Salt Deposit, Louisiana," by A. F. Lucas, Engineering and Mining Journal, Vol. XII, pp. 463-464, 1896; and "Salt Mines of Avery Island," by Henry Romeyn, Mines and Minerals, Vol. XX, pp. 438-439, 1900.

The Department of the Interior does not publish separate statistics on Louisiana's salt production, but shows it to be sixth among the states in quantity and in value. All of this, however, did not come from the Coastal domes.

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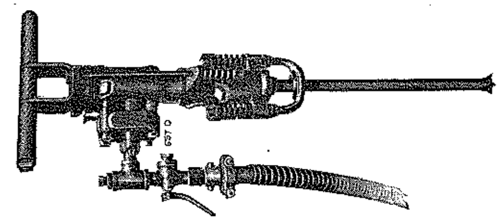
A NEW TYPE OF AIR DRILL.

The development of pneumatic mining and quarrying tools has been so rapid, and their performance latterly so efficient, that it is but natural they should now be regarded as having reached such

And yet, notwithstanding this popular notion, The Denver Rock Drill Manufacturing Company, which has for quite a number of years been amongst the forefront in rock drill progress, has recently developed a new type of light mining and quarrying drill which, it is claimed, marks an advance in the progress of air drill manufacture that has seldom, if ever, been equalled by any single achievement.

This new type of drill is built in three models, known respectively as Models NA-90, NRW-93 and NRD-95; the first named being a "dry" Auger Drill, especially designed for work in coal, iron and other soft formations; the second, a combination "wet" and "dry" rock drill efficiently serviceable in all kinds of rock and under all conditions, either above or below ground; and the last named, a "dry" rock drill particularly adapted to work in wet shafts or where out-of-door conditions prevail.



One of the "Nineties."

All three drills are extremely light, so that they can be easily carried about, and each is operated by one man alone.

They are built throughout of the very best steels compounded and with the utmost precision.

While most Waugh Drills are of the valveless type, the "Nineties" are equipped with an entirely new type of spool valve, having a positive action, which is exceedingly simple and efficient.

The rotation mechanism is of unusually strong design, and stresses in both teeth and pawls have been reduced to a minimum.

Lubrication is effected by pulsations of air which gradually feed the oil from a reservoir at the side of the cylinder into all parts of the machine.

The manufacturers state that comparative tests conclusively prove these "Ninety" drills to be much superior, more powerful and more efficient, at all pressures, than other drills of their general type and weight, and express themselves as feeling gratified at being able to make such a substantial contribution to cost reduction and stimulation of production in mining and quarrying at a time when

Investigation of the Fundamentals of Oil-Shale Retorting*

By Martin J. Gavin,† and Leslie H. Sharp.‡

Those of the oil-shale operators in this country who are sincerely attempting to make a real industry out of oil-shale developments, are anxious to obtain fundamental data on the retorting of oil-shale; particularly as regards the effect of certain variable factors in the process of retorting on the quantity and quality of products yielded from oil shales when they are subjected to destructive distillation. From careful examination of a considerable number of suggested processes for treating oil shales and the conflicting ideas on which they are designed, it seems probable that accurate information of a fundamental nature is highly essential to the successful establishment of an oil-shale industry in this country.

Accordingly, the United States Bureau of Mines, in co-operation with the State of Colorado, is undertaking to furnish some definite and impartial information of this type through investigations now under way at the University of Colorado, Boulder, Colo.

A retort for the distillation of oil from oil shale has been designed and installed, together with the necessary auxiliary equipment for controlling and determining variable factors of distillation, and for recovering and determining the quantity and quality of the products yielded from the shales. The retort is of such a nature that conditions of retorting can be accurately and completely controlled, and varied at will. It is not designed as a commercial retort, but only for research purposes. A testing laboratory with equipment necessary for the examination of the shales, physically and chemically, and the products yielded by them, has also been fitted up.

The material used in the investigations is oil shale obtained from the DeBeque, Colorado, shale field. It yields on distillation in the Bureau of Mines testing apparatus, about 42 gallons of oil to the ton, and is therefore a fairly representative sample of the shales that probably will be first worked in Colorado. The shale used will be as uniform as possible in character and oil yield, and will all be obtained from the same seam at the same point, in order to avoid the introduction of unnecessary variable factors in the tests and to render results strictly comparable.

Effort will be made, as far as the equipment and capital at hand makes possible, to determine the effect of the following variable factors in retorting on the quality and quantity of the products produced from this shale.

1. Rate of heating to a definite final temperature.
2. Thickness of the shale layer in the retort.
3. Size of individual particles of shale.
4. Vacuum or reduced pressure.
5. Various pressures above atmospheric.
6. Steam atmosphere at various pressures and temperatures.
7. Other atmospheres, such as carbon dioxide, carbon monoxide, hydrogen, illuminating gas, etc.
8. Actual temperature reached.

In each case the rate of formation of products and the total time necessary to bring the retorting process to completion will be determined.

It is doubtful whether all these determinations can be made satisfactorily with the limited personnel and equipment available for the year, but it is hoped that sufficient valuable data may be obtained to be a real contribution to the present knowledge regarding oil shales and to justify a continuation and expansion of the work. As far as possible the effect of each variable will be taken up by itself, and thoroughly studied before passing on to another.

Carefully conducted work along the lines above indicated should be of value in giving information on the following points:

1. Are oils of different qualities formed from shales consecutively as their boiling points are reached, the so-called "fractional education theory," or does the shale yield a single, more or less uniform crude oil throughout the course of the distillation?
2. If the fractionation above mentioned takes place, to what extent does it progress, and hence to what extent may economies be introduced in refining shale oils, if the various fractions are directly recoverable from the retort?
3. The time necessary at a given temperature to effect complete distillation of the shale and the quantity and quality of products so produced.

* Bureau of Mines Investigations (in co-operation with the State of Colorado).

† Refinery Engineer, Bureau of Mines.

‡ Chemical Engineer, State of Colorado.

4. The effect of steam and other atmospheres in retorting—
   (a) In forming undesirable emulsions with the oils;
   (b) In preventing the formation of undesirable hydro-carbons, such as olefins, diolefins, and acetylenes in the oils;
   (c) On the recovery of the nitrogen of the shales as ammonia or other nitrogen containing compounds;
   (d) On the combustion or utilization of the carbon remaining after the oil has been distilled, to provide combustible gas for retorting;
   (e) On quality and quantity of gas formed;
   (f) On heating efficiency of the retort;
   (g) On capacity of the retort, that is, time of completed distillation under most favorable conditions.
5. What is the most favorable size of shale to retort?
6. What quality and quantity of finished products may be expected from shale oil?
7. How are the nitrogen and sulphur of the shale distributed in the products, and how may they best be removed or prevented from forming?
8. Physical and chemical constants of the shale and products, particularly those of value in the design and operation of commercial plants, will also be determined. Work is under way on the determination of specific gravity, weight per unit volume when crushed to different sizes, heat of combustion, specific heat, heat of conductivity and chemical analysis of the shale, and specific and latent heats of the crude oil and its various distillation products.

Summarized, the purpose of the investigation is to determine, with scientific accuracy, the conditions of retorting oil shale to produce the highest yield of the best products.

It is realized that these conditions when so determined may not be applicable in their entirety to large-scale retorting operations, but the work should indicate what the best conditions actually are and these can be applied to large-scale work in so far as practical commercial considerations permit. If fundamental work on oil-shale retorting is to be done at all, it must be conducted on such a scale and in such apparatus and equipment as will enable conditions to be regulated at will and controlled accurately; otherwise the results will be of little value.

The apparatus being used has been designed especially for the work by the writers, with the assistance of L. C. Karrick, junior refinery engineer of the Bureau of Mines, and after consultation with many engineers interested in, and in many cases, working on, oil shale. The retort proper is a cast-iron, externally-heated, horizontal, rotary, cylindrical retort, designed to insure even distribution of the heat through the shale charge during treatment. Its capacity is approximately 75 pounds of shale at a charge. The retort is gas fired. Stuffing boxes, designed to function without leaking at high temperatures, enable stationary inlet pipes and outlet pipes to be connected to the retort. The inlet pipe carries the pyrometer, and permits the introduction of steam or various gases. The outlet pipe leads to a two-stage condenser, the first stage being cooled by air or hot water, and the second by cold water. From the condenser the gases are forced through oil and water scrubbers by a small rotary pump. The oil scrubber is for removing and uncondensed light oils, and the water scrubber for removing ammonia from the uncondensed gases. Manometers at various points permit the regulation of pressure in the retort and in the condensing and scrubbing system. The pyrometer system is also so equipped that an automatic temperature control can be used if this seems desirable.

The ends of the retort are well insulated and the whole set in a fire-brick furnace, from which it may be removed easily. The retort is rotated by a five horsepower electric motor through a belt and worm-gear drive.

It is felt that the work is almost to be considered pioneer work in the scientific investigation of oil shales. A material is being dealt with regarding which little is known, both as to methods of treatment and its products. For these reasons the Bureau of Mines invites suggestions or criticism of a constructive nature as to the conduct of the work. It is hoped that results can be presented to the public as rapidly as obtained through the various trade journals. The completed work is to be the subject of a bulletin of the Bureau of Mines.—U. S. Bureau of Mines, Reports of Investigations.

The electric soldering iron, when compared to the type heated in a gas flame, or fuel burning muffle, exhibits improvements, both in operation and convenience which should make its adoption in garages, shops and for plumbers, etc., a matter for serious consideration. Its superiority lies in its convenience in handling, safety in application, and economy of time and material.

TECHNICAL REVIEW

GENERAL.

Smoke Litigation in Salt Lake Valley. By Ernest E. Thum. (Chem. Met. Eng., June 23, 1920.)

In a judicial decree handed down by Federal Judge T. D. Johnson, February 21, 1920, the American Smelting & Refining Co., located at Murray, Utah, and the United States Smelting Co., at Midvale, Utah, are allowed to resume smelting operations. Fourteen years ago there were seven smelting plants in operation in the State of Utah, with no provision made for the recovery of fumes and dust, as a result of which there was no little damage done to the large area surrounding each of the smelters. A suit was brought by 409 farmers, which resulted in a judicial decree enjoining several of the smelting companies from continuance of operations with ores containing over 10 percent sulphur. The Murray Company erected a bag house in order to eliminate solid particles from the gas, in line with the contention that the damage was done by compounds of sulphur and arsenic which condensed on particles of soot and settled to the ground. This company was thereupon freed from the litigation, but the United States Smelting Co. did not fare so well, the injunction against them being confirmed by a higher court, necessitating a shutting down of their plant. However, upon introduction of the new Sprague process of introducing zinc oxide into the smoke, removing all cause of crop injury, this plant was allowed to reopen. Lack of space prevents the introduction of very interesting reports in connection with the experiments carried on by investigators employed by the companies, and it may be said that these reports are well worth the trouble of hunting up and reading. R. W. P.

Sulphur Dioxide as Factor in Salt Lake Smoke Problem. By G. St. John Berratt. (Salt Lake Mining Review, June 30, 1920.)

An average of one hundred and seven determinations during December and January showed 0.15 parts per million of sulphur dioxide; an average of 215 determinations during March showed 0.01 parts per million of sulphur dioxide. Tests up to three thousand feet above the city showed only a trace. The concentration is highest on smoky days, in the morning, and in the business district. The combustion of fuel in the city is in great part responsible for the sulphur dioxide present. J. A. H.

METALLURGY.

Milling and Flotation Processes. By Thomas Varley. (Salt Lake Min. Rev., June 15, 1920.)

The most important factor in choosing a treatment for an ore is the number of minerals present and their relation to each other. Free-milling ores may contain three minerals but these are easily separated from the gangue by reasonably coarse crushing. Complex ores are those in which the minerals are closely associated and finely disseminated through the gangue. Flotation was introduced into the United States in 1911, and has been used ever since for separating complex ores. Differential flotation takes advantage of the fact that some minerals will float under given conditions while others will not. J. A. H.

Conveying Systems. By John S. Watts. (Canadian Min. Jour., June 18, 1920.)

When the receiving and sending points are not fixed, the choice of a conveying system depends especially on the nature of the load, and of the floor surface. If these points are fixed, the choice may depend on a variety of conditions. For conveying vertically upward, some type of elevator or chain elevator is used. For inclines of 20 degrees or more, bucket or chain elevators are preferable. If the incline is less than 20 degrees belt conveyors are used. The best horizontal conveyors are buckets, vibrators, rubber belts or screw conveyors. Conveying downwards may be done by a steep chute, a chute with rollers, a vibrating chute, or a hydraulic flume. The Wabana Iron Mine, at Bell Island, Newfoundland, disposed of ashes by loading them on the large cakes of ice which drift out to sea every spring. When the material is to be conveyed at varied inclinations in the same plane, the preceding systems may be used, with some limitations. To transport fine material under any combination of preceding conditions, a blower, and air tight pipe can be used. J. A. H.

MINING.

A Study of Electric Detonators. By Carl T. Long and Hubert L. Pascoe. (M. & S. P., June 19, 1920.)

This paper is a preliminary report on a study of detonators being made in the University of California. The current enters the detonator through a copper wire and passes through a platinum-iridium bridge having a resistance of 300 ohms per yard. They carry a current of 0.70 ampere without breaking. Oscillograms showed the time of detonation and its increase in speed, the variation of power required, and the decrease in power as the bridge wire heated. The temperature at detonation varied widely. The conclusions were that detonators should be connected in parallel, and that three wires should be used for firing delay-action exploders. J. A. H.

Design of Two-Bucket Aerial Tramway. By Douglas Lay. (E. & M. J., June 19, 1920.)

This article describes the construction of an inexpensive and satisfactory type of two-bucket tramway. It is operated with one brake sheave at the upper terminal, a flat-bottomed bin with loading chutes, another sheave at the discharge terminal, and a tripping device. The grade should be such that the bucket is not moving by momentum when it reaches the lower terminal, as this increases the difficulty of dumping. J. A. H.

Concreting the Chief Consolidated Shaft at Eureka, Utah. By R. D. Gardner. (E. & M. J., September 4, 1920.)

At the Chief Consolidated Mine two thousand feet of shaft were simultaneously sunk and concreted in soft monzonite porphyry. The greater part of the work consisted of an eight-inch wall of reinforced concrete supported every hundred feet by a concrete collar which extended into the rock for five feet on every side. Concrete was mixed in a tower and conveyed to the shaft by separate hoists. In spite of an average flow of one hundred gallons of water per minute, the completed shaft was sunk at the rate of 61 feet a month. J. A. H.

Gold Dredging—Actual Recoveries Compared with Estimates. By W. H. Gardiner. (E. & M. J., September 11, 1920.)

The author discusses the accuracy of churn drilling and gives numerous examples taken from practice. His conclusions are as follows:

1. Drill results high when gold is fine.
2. Estimates check recovery if gold is heavy, ground compact, and if there is little clay.
3. Drill results high if ground is loose and water pressure high.
4. Drill will give low results in loose ground where gold is irregularly distributed. C. E. W.

Wealth in Utah—Colorado Carnotite Fields; Mining This Ore is "A Poor Man's Game." By Henry M. Adkinson. (Salt Lake Min. Rev., June 30, 1920.)

The writer hopes that an exposition of the value and accessibility of carnotite will stimulate prospecting in this field. The value is from \$80 to \$160 per ton, or equivalent to from 4 to 8 oz. of gold. The fields contain about 6,000 square miles in Colorado and Utah, most of which has not been prospected at all. The climate is desirable, the mountains being open for eight or nine months a year. The ore occurs as a replacement product of trees which grew when the sandstone beds of the McElmo formation were being laid down. This sandstone is white and about one hundred feet thick. Large companies develop claims by diamond drill holes at regular intervals. One such claim was bought for \$150 and has already produced \$250,000. The ore was discovered in 1895 but was not considered valuable until two years later, when its radium content was discovered. This radium occurs in a ratio of 1:100,000,000, and is used medicinally, and in the manufacture of luminous paint. Present indications are that the demand for the ore will increase. J. A. H.

The Testing and Application of Ventilating Fans. By Walter S. Weeks. (M. & S. P., July 3, 1920.)

The efficiency of a ventilating fan is rated on the static head and on the velocity head it produces. Fans are tested by running the fan at constant speed and calculating the pressure and velocity of the air as it passes through an opening which may vary in size. The "equivalent orifice," of the mine is the opening which will produce a resistance equal to the friction which must be overcome in a given mine. The approximate opening of a regulator in a mine door is figured in the same way. Additional pressure must be supplied to make up for any increases in velocity which may take place. High-pressure fans to be required to ventilate drifts and tunnels while they are being driven. J. A. H.

OIL.

The Petroleum Industry of Russia. By Eugene M. Kayden. (E. & M. J., June 19, 1920.)

The Russian Petroleum Industry began

when the production was 85,200,000 barrels. The four oil fields of Baku, namely, Balakhan, Sabounch, Roman, and Bibi-Eibat, reached their maximum since. The Grozny oil fields have increased their production about five hundred per cent in the last twenty years. The Surakhan oil field is the most productive of the new territories. J. A. H.

Oil and Gas in Montana. By J. P. Rowe. (E. & M. J., August 28, 1920.)

Up to January, 1919, only one pool of commercial oil had been found in eighteen years of drilling. Since then several wells have been brought in, and it is thought that the chances of finding oil are good where structures are favorable in formations above the carboniferous, dikes and faults being absent. The Birch Creek-Sun River areas has about 750 miles which may contain oil or gas. The anticlines north of Deep Creek have been eroded below the carboniferous and are therefore no indication of petroleum. Wells have been drilled on the borders of the Blackfoot Indian Reservation, where there are favorable anticlines, but without success. North-Central Montana has possibilities. J. A. H.

THE OIL SHALE INDUSTRY.

By Dr. Victor C. Alderson

Published by Frederick A. Stokes Co., New York. Illustrated, 162 pages. Price $4.00.

Copies may be secured through the Colorado School of Mines Alumni Association.

This is the first book of its kind to appear in America relative to the shale oil industry considered in its numerous ramifications. The author has endeavored to present in non-technical language a general description of the industry as a whole so as to enable those interested to ascertain the true status of the American oil shale industry at the present time. He discusses the petroleum industry and includes numerous statistics to show its precarious situation and draws conclusions regarding the outlook for the oil shale industry. In order to substantiate his conclusions, the writer enters into a non-technical discussion of the nature, origin and distribution of oil shales in various countries of the world, especially those of Scotland, and compares them to our own shales. He includes numerous details in the history of the oil shale industry. He then discusses the numerous details involved in establishing the oil shale industry in America. This includes in 1871, when the first well was drilled, and reached its highest point in 1901, a discussion of the mining of the shale, its retorting and the subsequent refining of the shale oil. It is very difficult to discriminate between the authoritative and the unreliable information that is available at the present regarding the technic of the retorting and refining. The author does not describe any particular process, but he gives some of the results that have been obtained by those who have really done some experimental work. He has endeavored to present the best that is available, but in spite of all precautions much of the data is still in moot-point because of the lack of standardized methods in comparing results and of the inadequacy of the research done to date. These results, however, contain food for thought, that is indicative of the general tendencies and possibilities of the industry in the light of the work that has been done to date. Other chapters in the book include miscellaneous data relative to the economic and legal features, the opinions of technical authorities, and is concluded by a general resumé of the significant features of the industry in its present state. A bibliography is appended. C. E. W.

GEOLOGY.

The Ore Deposits of Mexico—IV. By S. J. Lewis. (M. & S. P., July 3, 1920.)

The true contact deposits in which the igneous origin of the ore-bodies can be conclusively demonstrated are practically identical with those in which the igneous origin can be deduced only by analogy. This suggests a common origin for all those ores. Hot mineral springs in the neighborhood of some deposits prove the existence of deep-seated magmas. J. A. H.

The Ore Deposits of Mexico—V. By S. J. Lewis. (Min. & Scientific Press, September 11, 1920.)

In this article the author describes the ore deposits in igneous rocks. His introduction is replete with a discussion and interpretation of the various physical-chemical phenomena involved in vein formation and ore-deposition. He then describes various mines in the Zacuaiapan District, and makes numerous references to specimens found, indicative of the various geologic phenomena of ore deposition. There are numerous illustrative sketches. C. E. W.

DISCUSSION

Bartlesville, Okla.,
Box 432, Sept. 21, 1920.

Editor—Dear Sir:

It was with disappointment that I received the last issue of the C. S. M. Magazine and again failed to find any statement of facts, or discussion, as to why the Bureau of Mines had decided to move the experimental station away from Golden. Reports of this action were printed in the technical journals throughout the country more than two months ago, together with criticisms of the school authorities. Two issues of the magazine have been printed since that time, without mention of the incident, except for an eight-line paragraph in the current issue. I believe that the Alumni of the school are entitled to all the facts in this case, and that the only way they can obtain them is through the Alumni Magazine. By ignoring the matter entirely the Magazine can give only the impression that the action of the school authorities was indefensible, and that the statements in the technical journals were all correct. Don't construe the above to mean that the Magazine must defend the action of the school authorities, regardless, but instead that it should state all the facts and base its editorial policy accordingly.

I cannot help but believe that the majority of the Alumni who subscribe to the Magazine do so for the purpose of keeping in touch with the school and obtaining the latest news. For the last year or more the Magazine has given most of its space to technical articles, both original and reprints. There can be no criticism against the choice of these articles nor their excellence. But most of the Alumni subscribe to, or read, at least two technical periodicals, and I feel sure would rather see the Magazine give more space to news of the school and discussion of school conditions. Many of us are in localities where we can not get accounts of Mines' victories and defeats on athletic fields, and would, I know, appreciate more detailed accounts of all games in which Mines takes part. It is true that by the time the Magazine is printed this news is usually stale to the Miner in the vicinity of Golden, but it is not stale to the Miner in distant parts of the States and in foreign countries. He'd far rather read a detailed account of the Mines-Boulder game, or of the latest scrap between Mines and D. U. than read the best technical article written.

I respectfully suggest that we make the Mines Magazine a magazine for Mines' news. Please accept this in the spirit in which it is written, that of constructive criticism. Sincerely yours,

HAROLD C. PRICE, '13.

Your points are well taken. I appreciate your sincerity in the matter, and that you are prompted by motives which have the welfare of our Alma Mater at heart. I realize that to the loyal Alumni members the attitude of the Alumni Association may have appeared decidedly weak. The reason no replies were made to the editorials to which you refer (in the E. and M. J., and Mining and Scientific Press), are twofold: First—Since the revival of the Alumni Association in January, 1919, it was recognized that if the alumni association was to functionate harmoniously it would have to pursue a neutral policy because of the diversity of opinion amongst its members relative to the affairs of the administration. It was felt that by taking no part in the discussion that eventually the ill feeling which existed in the Association would subside. Second—Unfortunately, the removal of the Bureau of Mines, and the investigation by the American Association of University Professors, took place during the editor's absence in Central America. The acting editor, Mr. Robert M. Keeney, did not feel that he should change the policy that he was instructed to follow, and hence no refutation of the charges were made.

However, since I have returned, I have realized that things have come to a head and that it will be necessary for the Alumni to co-operate in making an honest effort to ascertain the facts in regard to both affairs in order to uphold the school in the eyes of the mining fraternity. I am unable at this time to discuss, editorially, the status of these two occasions, because to do so would bring the Alumni Association in conflict with the administration (the Board of Trustees). It is planned to have an alumni meeting in Denver as soon as due and proper announcements can be made. At this time it is planned to discuss the policy of the Alumni Association in regard to all its activities as outlined in its Constitution.

I am thoroughly disgusted with the attitude of most of the graduates toward the Association, and unless they are willing to support it by contributing articles, personals and paying their dues, it may as well be discontinued. I have tried to keep up the standard of the Magazine so as to enable us to secure advertisements, and therefore have emphasized the technical articles rather than devote too much space to school news and local gossip.

I am aware that most of our members feel as you do regarding the technical matter in the Magazine. They enjoy the personal items best of all, but in order for the Magazine to be a credit to the school it must have some semblance of a journal becoming to a technical institution.

I trust that our members will enter into this discussion so that the Association shall succeed in getting the support necessary to make it capable of attaining the objects set forth in its Constitution.

EDITOR.

PERSONALS

'83.

Mail addressed to William B. Milliken, Ipoh Perak, Federated Malay States via China, has been returned marked "addressee dead." Who can furnish us with further details?

'95.

Carl R. Davis, formerly Gen. Mgr., Brakpan Mines Ltd., Brakpan, Transvaal, South Africa, is Consulting Engineer for The Consolidated Mines Selection Co., Ltd., Johannesburg.

'97.

John Gross has been transferred from Fairbanks, Alaska, to Rolla, Mo., where he will be located as metallurgist for the new Bureau of Mines station.

H. B. Starbird is now at 820 Story Bldg., Los Angeles. He recently left the Silver King of Arizona Mining Company, of Superior, Ariz., owing to suspension of operations.

J. N. McLeod is now at Escandido, California.

'01.

J. M. Bradley, of Florence, Colo., was a Golden visitor recently.

'02.

W. Ray Cox is now residing at 494 E. 54th Street, North, Portland, Oregon.

G. Montague Butler, Dean of the School of Engineering and Director of the Arizona Bureau of Mines, was a visitor in Golden recently.

'04.

Scott H. Sherman, recently of 326 E. Palm Lane, Phoenix, Arizona, has moved to Asientos, Ags., Mexico.

'05.

Evaristo Paredes is General Manager for the Cia Minera La Soledad y Anexas, Culiacan, Sinaloa, Mexico.

Joseph O'Byrne and Mrs. Dorothy Foss, of Golden, were married on August 8th at Golden. Mr. O'Byrne is Professor of Descriptive Geometry at the School.

'07.

Albert G. Wolf was a visitor in Golden recently. He is field engineer and geologist for the Texas Gulf Sulphur Co., of Gulf, Texas. He has had exceptional opportunities to study the sulphur, oil and salt deposits of the Gulf Coast region. He is the author of the splendid article on the "Gulf Coast Domes," which appears elsewhere in this issue.

'09.

C. B. Hull is with the Butte and Superior Co., Butte, Mont.

'10.

Geo. T. Geringer is located at Aroroy, Masbate, Philippine Islands.

'11.

Roy F. Smith is at present making mine examinations for the Empire Zinc Co. in the northwest. He recently completed a three months' geological survey of their properties in the Kingston District, New Mexico.

'12.

Nelson S. Greenfelder, sales engineer for the Hercules Powder Company, has been transferred from the Denver office to the company's main office at Wilmington, Delaware.

'13.

Mr. and Mrs. C. F. Oram announce the arrival of a seven and one-half-pound baby girl on September 7 at Keota, Colo.

Edward Cowperthwaite was a visitor in Golden recently. He journeyed here from Florence, Colo., to participate in the Mine Rescue contests, which were held in Denver during the week of September 9 to 11.

'14.

C. Erb Wuensch has returned to Golden from a four and one-half months' geological examination trip to Salvador, C. A. He has again resumed the Alumni Association work which Robert M. Keeney attended to during his absence.

James W. Pearce, recently of Inspiration, Arizona, is located at Patagonia, Arizona.

John H. Turner, of Eastland, Texas, is visiting in Golden.

S. Z. Krumm, who recently resigned as assistant professor of metallurgy at the Colorado School of Mines, has gone to Cleveland, Ohio, to accept a similar position at the Case School of Applied Science.

'15.

Ulysses H. Berthier and Miss Mary Damerel Aves were married at Houston, Texas, on Saturday, September 11th, Mr. and Mrs. Berthier will be at home after October 5th at Smelter No. 2, Monterrey, Neuvo Leon, Mexico, where Mr. Berthier is superintendent of the lead refinery of the Cia Minera de Penoles. They were visitors in Golden on September 16.

Chas. A. Rogers is in charge of the underground mining and churn drilling of the Chile Exploration Company, Chuquicamata, Chile, South America.

L. L. White is superintendent of the San Marcos Mine, a subsidiary of the New York, Rosario and Honduras Mining Co. at Sabana Grande, Honduras.

'16.

Frank E. Briber was discharged from the Walter Reed Hospital, Washington, D. C., July 1st, and has returned to his old position at Bingham Canyon, Utah, where he is engineer at the Highland Boy Mine.

Frank J. Wiebelt has left the Hanover Bessemer Iron & Copper Co. of Fierro, N. Mex., to accept the position of engineer and assayer for the Yellow Pine Mine at Goodsprings, Nevada.

Murray E. Garrison is in the Producing Department of the Standard Oil Co., Bakersfield, Calif.

'18.

Mr. and Mrs. Wm. F. Jones, of Cold Springs, Okla., are rejoicing over the arrival of a son, born July 15.

'19.

T. B. Romine has resigned his position of mining engineer with the A. S. & R. Co. at Angangueo, Michocan, Mexico. He is now assistant geologist with the Midwest Refining Co., with headquarters in Denver.

Mifflin Butler is temporarily at Casper, Wyoming.

'20.

Ernest B. Bunte and Miss Emma Engle of Annapolis, Md., were married in Washington, D. C., on September 3.

Fred A. Lichtenheld is with the Bureau of Mines, Casper, Wyoming.

OBITUARY.

'06.

Franklin Luther Barker died of smallpox at his home at Pei Yang University, Tientsin, China, on June 9, 1920. He had been Professor of Mining at the University for the past five years. Previous to coming to China, from 1908 to 1913, he was Professor of Mining at the University of Oregon.

Mr. Barker was forty-nine years old at the time of his death. He is survived by his wife and two sisters.

EX-MINES NOTES.

'09.

Paul Neer is manager for the West End Opoteca Mines, at Opoteca, Dept. de Comayagua, Honduras, C. A.

'14.

Alonzo Valenzuela is engaged in the operation of a sugar plantation and general merchandise business at Comayogua, Honduras. Valenzuela left Mines in 1911 and finished his mining engineering course at the Michigan School of Mines.

'18.

John H. Rabb, Jr., and Miss Dorothy Hicks, of Denver, were married on June 8 in Denver. They will reside at Anheim, in southern California, where Rabb is associated in business with his father.

School News

REGISTRATION, SEPTEMBER 18, 1920.

Freshmen	150
Sophomore	123
Junior	88
Senior	53
Post Graduate	10
Total	424

THE EDUCATIONAL AMENDMENT.

The following is the substance of the proposed educational amendment which is to provide for an additional assessment not to exceed one mill, in order to uphold the standards of the institutions of higher learning in the State of Colorado:

Be it Enacted by the People of the State of Colorado:

That Article X, Section 11, of the State Constitution be amended to read as follows:

Section 11. The rate of taxation on property for state purposes, shall never exceed four mills on each dollar of valuation; Provided, however, that **in the discretion of the General Assembly** an additional levy of not **to exceed one mill** on each dollar of valuation may from time to time be authorized for the erection of additional buildings at, and for the use, benefit, maintenance, and support of, the State Educational Institutions; provided, further, that the rate of taxation on property for all state purposes, including the additional levy herein provided for, shall never exceed five mills on each dollar of valuation, unless otherwise provided in the Constitution.

The institutions that will benefit by this are: University of Colorado, Agricultural College, Colorado School of Mines, State Teachers' College, and the Colorado State Normal School.

Vote **YES** for this Amendment. Everyone recognizes that no business can be run on the same outlay of capital as it did two years ago. Neither can you live on the same income. Therefore, every loyal citizen of Colorado must support this Amendment so that the schools can functionate properly, by getting increased revenue.

The School of Mines faculty for the coming school year is as follows:

Victor C. Alderson, President; A. E. Bellis, professor of physics; Ralph W. Boyd, chemist, department of metallurgical research; C. Desmartin, instructor in modern languages; Clark B. Carpenter, assistant professor of metallurgy; Harold F. Crooks, assistant professor of geology and mineralogy; Major G. C. Dobson, U. S. A., professor of military science and tactics; Arthur J. Franks, instructor in chemistry; Harold W. Gardner, professor of civil engineering; Ralph Glaze, director of athletics; George W. Correll, professor of mathematics; Lester S. Grant, professor of mining; W. E. Hale, assistant professor of mathematics; Joseph S. Jaffa, professor of mining law; J. H. Johnson, instructor in geology and mineralogy; R. M. Keeney, director of department of metallurgical research; A. P. Little, professor of electrical engineering; Albert H. Low, professor of chemistry; Jas. H. Morse, professor of mechanical engineering; Will V. Norris, assistant professor of chemistry; J. F. O'Byrne, professor of descriptive geometry; I. A. Palmer, professor of metallurgy; L. D. Roberts, associate professor of chemistry; James Underhill, associate professor of mining; Edw. W. Wiegman, Capt. E. O. R. C., instructor in military science and tactics; F. M. Van Tuyl, professor of geology and mineralogy; J. C. Williams, assistant director of department of metallurgical research.

Prof. W. H. Schoewe, assistant professor of geology, has resigned to accept a similar position at the University of Kansas.

At the meeting of the board of trustees of the School of Mines, held last Thursday, Harold W. Gardner was elected professor of civil engineering. Professor Gardner is a graduate of the University of Illinois and took a post-graduate course at the University of Illinois. He has had thirteen years of teaching and many years of practical experience. For some time he was in charge of civil engineering at Cooper Union, New York, and has taught in the University of Illinois and Kansas University. For some time he was at the head of the mathematics department of Iowa Wesleyan College. G. W. Correll was elected professor of mathematics. He is a graduate of Ohio Wesleyan and did post-graduate work at Ohio State College and the University of Chicago. He has taught mathematics for many years and in recent years has been head of the mathematics department at DePauw University. W. P. Hale, recently the head of the mathematics department of Broaddus College, West Virginia, will be assistant professor of mathematics. Prof. L. D. Roberts has been advanced to the position of associate professor of chemistry.

TRADE NEWS.

The Jeffrey Manufacturing Company, of Columbus, Ohio, have recently issued the following new catalogs: "Mine Locomotives," No. 263. This new catalog fully illustrates and describes the Electrical and Mechanical features of their complete line of Mine Locomotives including the "Armorplate" type of Main Haulage Locomotive, and Electric Gathering Locomotives of the Cable Reel, Crab Reel, Combination Cable and Crab Reel, and Electric Storage Battery Types.

"Jeffrey Storage Battery Locomotives for Mines," No. 312. This catalog fully illustrates and describes other important features of Jeffrey Storage Battery Locomotives for Mining Service, including Motor Equipment, New Style Journal Box for Inside Wheel Type Locomotive, etc., and also contains illustrative photographs of Electric Gathering Locomotives of the Standard Cable Reel and Crab Reel Types. Copies of these may be obtained by addressing the company at Columbus, Ohio.

ATHLETICS

By Ralph C. Maxwell, '23.

Mines Football Schedule for 1920.

October 16—Mines vs. Utah Aggies at Logan, Utah.

October 23—Mines vs. Colorado Aggies at Fort Collins.

October 30—Mines vs. University of Wyoming at Denver.

November 6—Mines vs. Denver University at Denver.

November 11—Mines vs. University of Colorado at Denver.

November 25—Mines vs. Colorado College at Colorado Springs.

FOOTBALL OUTLOOK.

Football practice at the School of Mines commenced September 8 and is being pushed as rapidly as possible in order that the team may be in shape for the first game, which takes place October 16 at Logan, Utah, where the Ore Diggers will meet the Utah Aggies. The first conference game will be played against the Colorado Aggies at Fort Collins, October 23, at which time it is extremely probable that the Conference championship will be decided. Mines will play its first game in Denver, November 6, when it meets the University of Wyoming in an exhibition contest.

Captain Linderholm, All-State end in 1917, has returned in good condition and great things are expected from him this fall, as well as from Art Bunte, who played end last year, but will be tried out in the back-field, where he showed to good advantage in the practice games toward the close of last season. Among last year's "letter" men who have returned, are: Bunte, Clark, Clough, Gibbons, Hamilton, Haskins, Hyland, Poulin and J. Robertson. The members of last year's Freshman team, among whom are several old Greeley players, notably Benjamin, McGlone, Severinni and Mitchell, will furnish considerable opposition to last year's 'Varsity men. Sherriger, Yates, Jordan, Parkinson, Davis, R. Crawford and Fahey will also be heard from.

The line will be the heaviest that the Mines has had in some years, five of the candidates weighing close to 200 pounds. McGlone, Crawford, Hyland, Houssels, Sherriger, Clough, Severinni and Gibbons will be among the candidates for line positions.

Glaze will not be hampered by the lack of material as he was last year. Many men who were prevented from coming out for last season's team because of the rigorous Sophomore curriculum will be candidates.

According to all pre-season predictions this year's team of the School of Mines will be at least heard from.

ASSISTANT COACH MURPHY.

Because of the short hour and a half devoted to football practice, Glaze has found it necessary to secure an assistant to coach the line while he devotes his entire attention to the back-field. Cuddy Murphy, formerly of Dartmouth, has taken entire charge of the line and is acting as general assistant to Glaze.

Murphy played tackle for Dartmouth during the seasons of 1917, 1918 and 1919. It was due mainly to his efforts that Dartmouth succeeded in giving Penn State the only drubbing it received during the 1919 gridiron season. In the selection of the All-American football team for 1919 he was mentioned by Walter Camp as one of the two best tackles in the east. After the close of last year's football season he played with Jim Thorpe's professional team in Ohio.

Erle Kistler, athletic-director of the School of Mines from 1912-1914, and Bob Newton, have agreed to aid Glaze in whipping the Mines team into shape for the coming season. Both Kistler and Newton are old Yale stars—Kistler being a back, while Newton played in the line. These men have agreed to come out at least once a week and are paying all expenses out of their own pockets.

FRESHMAN FOOTBALL.

About thirty freshmen have turned out for freshman football practice. More will appear when the necessary equipment has been secured. The freshman team will be strengthened by the addition of men not eligible for the 'varsity.

Billy Williams, former Manual Coach, has been secured to coach the freshmen. It is expected that he will have them in condition to play the 'varsity toward the latter part of the month.

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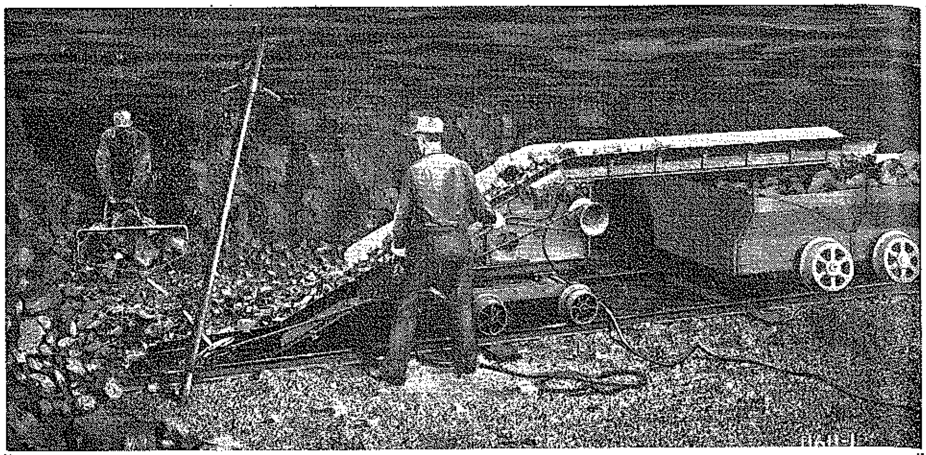

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