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COLORADO SCHOOL OF MINES MAGAZINE

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MANGANESE
Its Ores, Metallurgy, Uses and Production Statistics
By C. Erb Wuensch, '14.

Status of Manganese Mining in United States.

Previous to the war, manganese mining never was a very important industry in the United States. Because of the small size of our high-grade deposits and their remoteness from markets, and because of the difficulty in concentrating our large deposits of low-grade ores, there was no incentive to attempt to compete with the high-grade ores from foreign countries, which occur in large deposits and can be imported cheaply. However, during the war, because of the cessation of imports to the United States from India and Russia, the inadequate shipping facilities to supply us with sufficient Brazilian and Cuban ores and the increased demand for these ores for making ferro-manganese, great impetus was given to the development of our own resources. The higher grade ores brought three to five times their pre-war price, and low-grade ores, which previously could not have been marketed at any price, were accepted. The result was that the mining of manganese became one of the first importance.

From a production of only 2,635 tons of high-grade ore, and 198,463 tons of low-grade ore, in 1914, we increased our production in leaps and bounds until in 1918 we produced 364,366 tons of the former, and 1,665,552 tons of the latter; the amount sufficient to have satisfied all our war demands, even had importation of foreign ores ceased.

With the cessation of hostilities in Europe, the abnormal demand for manganese ores ceased. Almost instantly there was no more market for domestic ores. Many contracts were broken and the industry became demoralized. There were about 250,600 tons of high-grade ores in the stock piles at the various furnaces. This was more than ten months’ supply. Although several companies are still operating on long-time contracts, it is interesting to note how, with the expiration of the contracts, their number is gradually decreasing.

The outlook is that before long the industry will return to about its pre-war status.

Most Important Manganese Ore-Minerals.
Pyrolusite (MnO₂) containing 63.2% Mn and P wollomelane (Mn₃O₅, H₂O + K₂O and BaO in varying amounts) containing from 45 to 60% Mn are the two principal manganese ore-minerals found in the United States. Other oxides are mined, but in insignificant quantities.

Rhodocrosite (MnCO₃) 47.5% Mn is also occasionally used, but it is seldom found in large quantities, except in Butte and Philipsburg, Montana, where, as a result of war-time demands, large supplies have been developed.

Franklinite (Fe₃MnZn)O (Fe₂Mn)O₂ containing from 10 to 20% Mn. This is mined only at Franklin Furnace, New Jersey. It is used as a residue from the zinc oxide plants to make spiegelösen.

Manganese Wad, an impure mixture of manganese oxides in porous earthy material, and containing from 15% to 40% Mn, is occasionally used for making paints.

Classification of Manganese Ores.
The ores are classified as follows:
Class I — Manganese Ores.
Class II — Manganiferous-Iron Ores.
Class III — Manganiferous-Silver Ores.
Class IV — Manganiferous-Zinc Residues.

Class I — To this class belong the high-grade manganese and manganese dioxide ores. Those containing considerable quantities of iron are used for making Ferro-Manganese alloys. Those free from iron and containing from 80 to 90% MnO₂ are in great demand for Lecianche Storage Battery Cells and Dry Cells. If this class of ore should contain an excess of silica (more than 20%) so as to make it undesirable for the above purposes, it can be used for decolorizing glass.

The very pure dioxide ores, free from carbonates, sulphides, iron oxides and silicates are also in demand for the manufacture of Chlorine, Bleaching Lime and Bronzine.

This class of ore is also used for manufacturing oxygen, disinfectants, potassium permanganate, coloring for glass, pottery and bricks, paints, as a dryer in plants, calico-printing, dyes and explosives. The lower oxides of manganese cannot be used for any of these purposes,

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— you would know the secret of its efficiency. Hardinge success is due to the principle on which it is built. The crushing of coarse ore by large balls with the segregation of smaller balls towards the discharge end for work on the finer particles. Note in the picture above how all the large material is at the point of greatest diameter and the finer grade out to the end of the cone. Therein lies the secret of Hardinge Success! A recent booklet which we have just published tells more. It is yours for the asking.

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the “available oxygen” of the dioxide minerals is the valuable constituent.

Pillow-limestone containing large amounts of barite is very desirable for making “Manganese” and “Iron” pigments.

Class II.—To this class belong the manganese ores consisting of iron and manganese oxides in various proportions. Ferro-Manganese and Spiegeleisen are made from those ores which contain high and medium (more than 40% and preferably 50% Mn) amounts of manganese, respectively. Those containing 5 to 15% manganese are not used for either purpose, but just as low grade ore. The manganese in this case is considered an impurity. This ore is slightly more refractory than iron free from manganese.

Class III.—This class which is known as the manganeseiferous-silver ore, is found abundantly in the oxidized portions of many silver deposits in the Western United States. In these ores the iron and lead are usually predominating over the manganese. The manganese content varies from 10 to 40%.

In the unoxidized portions (in the sulphides) containing large amounts of iron and manganese sulphides are found in large quantities of quartz or calcite, or occasionally rhodochrosite and rhodonite. Gold is frequently found but usually in subordinate amounts compared to silver.

This class of ore is again sub-classified as follows:

First Sub-Class.
Ores with a high percentage of silver and lead are used for these metals only. They draw a higher price (average probably $3.00 per ton), if the manganese and iron oxides are present in such small quantities as to make the ore desirable for fluxing purposes.

Second Sub-Class.
Ores low in silver and lead, but containing large amounts of iron and manganese are used for manufacturing spiegeleisen and ferro-manganese. In this class the manganese content is so low that the ore is used only for its iron content.

Third Sub-Class.
Ores too low in silver and lead to be used directly as a source of these metals, and too low in iron and manganese to be used directly as a source of these metals, are sent to the smelters to be used on account of the fluxing qualities of iron and manganese oxides. The silver and lead will be recovered during the smelting conjunction with the other lead-ores of higher grade; the iron and manganese passing off into the slag.

Cubic manganese and iron sulphides result from the distillation of zinc oxide in treating the frankulite of Franklin Furnace, N. J. in the zinc oxidizing the manganese in the manufacture of spiegeleisen. This reduces its iron content to an average amount of $2.50 in 50% Mn.

Notes on the Metallurgical Uses of Manganese Alloys.

Every process of steel metallurgy, the common practice of the present day uses some form of ferro-alloy to produce the properties peculiar to the steel manufactured by that process. But by reason of a comparison of the manganese producing by the use of the various ferro-alloys ferro-manganese is by far the most important.

S piegeleisen is an alloy of iron and manganese containing between 10 to 20% manganese, less than 5% carbon, less than 1% silicon, and the remainder iron. Occasionally in commerce ferro-manganese alloys containing up to 35% Mn are called spiegeleisen, but texturally they are of a different character. These contain more than 20% manganese.

Ferro-manganese includes alloys containing from 20 to 90% or sometimes 90% manganese, all containing more than 90% Mn is unstable unless weathering conditions. Ferro-manganese should contain less than 7% carbon and less than 1% silicon. The commercial standards of ferro-manganese in the 80% manganese alloy, in both of the following conditions, is to have a composition of carbon and silicon of less than 7% and less than 1%, respectively.

In commercial ferro-alloys, the manganese also neutralizes the deleterious effects of sulphur and phosphorus, by forming a manganese sulphide (MnS) and a manganese phosphide (MnP), most of which go into the slag. All good steels, however, do contain some sulphur and phosphorus in these forms. The manganese also prevents the carbon in the steel from graphiting and tends to increase the power of carbon to combine with the iron.

Fourth—Ferro-manganese is used in large amounts in manganese steels. The nature and uses of these will be described in the following sections.

Properties of Manganese Steels.

Manganese steel, in its most serviceable form, contains about 13 or 14% manganese. This alloy possesses a combination of properties that make it extremely valuable for many purposes. Its use is somewhat limited, however, because of its extreme hardness. There is no method of working it with machine tools and necessitates its being cast into forms, as near to the shape in which it is to be used, as is possible.

Manganese steel is not so liable to "honeycomb" as ordinary steel. It is very fluid and can be cast into thin sections, but cools more rapidly than ordinary steels and has a greater coefficient of contraction.

Steel containing from 2.5 to 6% Mn is very brittle; above 7% Mn and up to 15% Mn is very hard and strong alloy is produced. Steel containing 10% Mn forms the softest manganese-steel. At 22% another hard stage is reached, but it is inferior to the 20% stage.

Manganese steel, although it has a large iron content, is practically non-magnetic. It retains no residual magnetism after being subjected to strong magnetic fields.

Uses.

Manganese steel is used for dredger pipes, bucket lip-plates, teeth for steam shovels and other parts of excavating machinery; for ore-crushing machinery, such as roll-shells, stamp-shoes and crusher plates; for ore-chutes and screens; for elevator links; for agricultural implements, as plow-points, cultivator points, shovels, rakes, etc.; for wheels, tires and axles on railroad cars and mining cars; for railroad and street car rails on curvatures of curves and for making muni­
tions and armaments.

One of its most important uses, because of its hardness and non-magnetic properties, is for cover plates and shield in large electric generators.

Miscellaneous Alloys in Which Manganese Is Used.

Manganese is used in the manufacture of many quaternary steel alloys, such as manganese-nickel steel; manganese-chrome steel; manganese-aluminum steel, etc. A quaternary steel contains two elements besides carbon and iron; those containing only one element besides carbon are termed ternary steel. Manganese-chromium, and manganese-nickel steel possess great hardness and withstand severe shocks. Manganese-aluminum steels, containing less than 1% of these elements, is used for high-class springs.

Manganese is used in the manufacture of steel by amalgamation, alloy of manganese and copper. This is used in the manufacture of manganese bronzes, manganese brass, and manganese German silver.

It is also used in the manufacture of manganese-aluminum alloys, which are very hard and non-magnetic, and also for Housner alloys containing iron, copper, manganese and aluminum which possess very unusual magnetic properties.

Notes on the Metallurgy of Manganese.

The reason why a high silica content is objectionable in manganese ores is that the manganese unites with the silica in an acidic slag and is lost. A very basic slag is hence necessary to reduce this slag loss. This means that some barren basic
flux must be added, which reduces the capacity of the furnace.

Manganese increases the fuel consumption at moderate iron ores. It requires 4,500 to 5,000 pounds of coke for each ton of 40 to 50% ferro-manganese. A blast temperature of 1,300°C is required. A higher blast of 1,400°C reduces the silica content of the ferro-manganese, but it corrodes the furnace lining.

In general, in manganese smelting a 40% ferro-manganese produces an 8% manganese slag, and an 80% ferro-manganese results in a 10% manganese slag loss.

Rhodochrosite, manganese carbonate, mixed with manganese and iron oxides, carbon and limestone produces the best grade of ferro-manganese alloys, but the manganese slag loss is much higher (10%).

Ferro-manganese or spiegeleisen is usually added in the form of pellets at the end of the converting period in the Bessemer converters. Experiments have shown that this practice 20 to 30% manganese is lost by volatilization. The practice is tending toward the use of ferro-manganese in liquid form. The ferro-manganese is added in specially designed electric furnaces. The practice is also toward the use of the higher ferro-manganese alloys rather than spiegeleisen since the chemical reactions are much more rapid, and better heat is conserved and volatilization losses are also minimized by their use. During the war, however, the ferro-manganese became very scarce, and numerous experiments were made and plant practice accordingly modified in order to use the lower-grade alloy, whenever possible.

The ferro-manganese alloys, as well as the other ferro-alloys with molibdenum, vanadium, tungsten, chrome, silicon, etc., are manufactured either in the electric furnace or by the aluminum reduction process. The electric furnace practice is to mix the carbon fluxes and mineral oxides, and to smelt by starting with arc heating and completing the smelting by resistance heating. In the aluminum reduction process powdered aluminum and manganese oxide mixed in equal parts (called manganosite) is reduced by a carburant of barium peroxide. This is mixed with the proper fluxes, iron and the mixture of the metal whose alloy is to be formed. The ferro-manganese is formed in the lower part of the crucible, and the slag above it.

Roasting Manganese Carbonates (Rhodochrosite)

Attempts have been made to convert the high-grade, carbonate ores, by calcination, into high-grade manganese dioxide ores of chemical grade. These high-grade ores are considered important because of their availability.

If the ore is powdered (crushed) to 250 mesh in the presence of air manganese dioxide (MnO₂), the brownish-red color and most stable manganese oxide is formed, according to the following reaction:

$$3\text{MnCO}_3 + O + \text{heat} \rightarrow \text{MnO}_2 + 2\text{CO}_2$$

If this oxide (MnO₂) is treated with hydrochloric acid (HCl) the manganese oxide is oxidized to manganese dioxide, thus:

$$\text{MnO}_2 + 2\text{HCl} + O + \text{heat} \rightarrow \text{MnO}_3 + \text{Cl}_2 + \text{H}_2\text{O} + 3\text{MnO}_2 + 2\text{HCl}$$

The objective to all methods of concentration is that it is difficult to subsequently smelt the finely crushed concentrates. The only way in which they can be made marketable is to mix them with coarse "run of mine" ore.

The reason for this is that manganese ores are smelted in blast or electric furnaces. The presence of an excessive amount of fines would obstruct the blast and cause a serious dust loss in either blast or electric furnaces. However, technically, there is no reason why reverberatory smelting could not be practiced just as has been done in the smelting of other metals, when it became necessary to substitute this type of furnace for the blast furnace.

The hydrometallurgical processes work beautifully in theory; these ores can be satisfactorily leached, but the electrolysis is difficult. Invariably the deposit contained the more pulvulent manganese dioxide than compact metallic manganese.

Drying, calcining, or agglomerating fine concentrates is warranted under certain circumstances. Volatilization processes effect a concentration, but the concentrates are in a finely divided state, and in such a concentration as to be impossible of commercial utilization.

The Jones’ Step-Process and other processes of differential reduction by proper control of temperature offer considerable promise. In these processes the iron oxide is reduced to metallic form at a low temperature. It may be expected that this is a very wasteful and inefficient method, but in view of the fact that they are the only practical means of producing manganese concentrates, no other method can be expected.

The following summary of the methods applicable to the concentration of manganese ores is taken from the Bulletin 5, U.S. Bureau of Mines War Minerals Investigation Series, by Edwin Newton. These are all preliminary to the greater and final concentration of the desirable elements in the blast furnace from which the ferro-alloy is produced.

Simple Methods of Concentration:
(a) Selective mining.
(b) Hand picking.
(c) Jiggling.
(d) Screening.

Flotation has not, to my knowledge, given good results. Even though it has, it would be open to the same objection as other methods of mechanical concentration; the finely divided concentrate would be difficult of subsequent utilization.

The use of heavy solutions is impractical because of the tendency of manganese minerals to dissolve. Therefore, it was the practice to use colloids in the heavy solutions and remain in suspension.

Production Statistics.

The following statistics are given in percentages of the ore and its principal products, ferro-manganese and spiegeleisen may be of interest:

<table>
<thead>
<tr>
<th>Product</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ferro-manganese</td>
<td>50%</td>
</tr>
<tr>
<td>Spiegeleisen</td>
<td>30%</td>
</tr>
<tr>
<td>Manganese</td>
<td>20%</td>
</tr>
</tbody>
</table>
Recent Articles on Petroleum and Allied Substances

Compiled by E. H. Burroughs

**HISTORY AND GEOGRAPHIC OCCURRENCE**


**Manganes.** Le monde de l'acier, 10, 1st. 6, Aug. 23, 1920, pp. 37-65. Gives the past two or three years in iron, the location of the deposits and the need of mode of occurrence, production methods, and the most efficient and economical treatment, and concludes with economic considera- tions.

**BIOLOGY AND ORIGIN.**


**Hoyt, W.** Geologist ranks Homer in his list. Oil and Gas Jour., vol. 38, pp. 36-37. Presents the findings of the survey of Homer and states that the oil quality is high and that there are large reserves of oil produced from comparatively shallow wells.


**Recent Articles on Petroleum and Allied Substances.**


**Recent Articles on Petroleum and Allied Substances.**

3. DEVELOPMENT AND PRODUCTION.

California State Mining Bureau. Summary of the California oil field advance chapter, Fifth Annual Report of the California State Bureau of Mines, Sacramento, 1919, pp. 66-67. Contains, in addition to the summary of reports by the State Oil Engineer, a report on the conditions existing during the summer, a report on cause of damage by water, and a report of the Kern River oil field, Kern County, California. See under Ferguson, R. N. Ferguson, R. N.

4. FUZZ MILLING AND DRY MILLING.

Report on cause of damage by water. California State Mining Bureau, Sacramento, 1919, pp. 66-67. Contains a report on the conditions existing during the summer, a report on cause of damage by water, and a report of the Kern River oil field, Kern County, California. See under Ferguson, R. N.

5. PETROLEUM.


6. PHILIP, ARNOLD.


7. SMITH, A. D.


8. STANFIELD, EDGAR AND GILMORE, B. E.


9. APPARATUS FOR TREATING PETROLEUM.


THE GERICAN SCHOOL OF MINES MAGAZINE.

10

THE COLORADO SCHOOL OF MINES MAGAZINE.

11

10.

The present status and prospects of the mining industry in Canada. Discusses the present status and prospects of the mining industry in Canada.

11.

The implications of the Apex law. By John H. Manning. (Mining & Scientific Press, December 6, 1919.)

"This article is an address delivered by the Director of the U.S. Bureau of Mines before the American Mining Congress at St. Louis on November 7. The general problem facing the mining industry is discussed. In each case the author indicates that while more and more the mineral resources of the world are being utilized, fuel of oil, and lastly the training of competent engineers and technologists to solve these problems.

For example, the author believes in the policy of encouraging foreign companies to acquire holdings in the United States. The public interest is better served by acquisitions that make available the maximum profit. He formulates the idea of "spying on one's enemy" as bad for all concerned. The following points should be covered in every contract: date of contract and time element, source of ore; character and classification of ore; tonnage involved, place of delivery, shipping expenses and responsibilities.

W. S. L.


In these two articles the author completely analyzes ore contracts. Contracts are desirable and essential from both the viewpoint of the buyer and seller. Both must get together in a friendly spirit and realize that the best contract is one that enables both parties to realize the maximum profit. He formulates the idea of "spying on one's enemy" as bad for all concerned. The following points should be covered in every contract: date of contract and time element, source of ore; character and classification of ore; tonnage involved, place of delivery, shipping expenses and responsibilities, weights, sampling, moisture, assay, comparison of assays and split sample, leading to representation of fuel and coal. The author analyzes each of these points and shows their bearing on the contract. Part II deals especially with ore schedules. It shows upon what data they are based. This article should be studied carefully.

New angles to the Apex law. By John A. Shelton. (E. & M. J., November 1, 1919.)

A discussion of the question of property rights in regard to existing mineral claims subject to the Apex law, which still continues to be a source of much litigation and dissatisfaction. Some of the fundamental principles underlying the application of the Apex law and its effect on the mining industry of the United States are discussed.
by every engineer, whether he is experienced in buying or selling ores or not. C. ERB WUENSCH.


This is an editorial reviewing the conditions of the present and the outlook for the future. The article also includes the views of several noted men active in mining and metallurgy.

P. A. LICHTENHELD.

Activities of Provincial Sanitary Engineers. By Fred A. Dallyn. (The Canadian Engineer, January 1, 1920.)

The supervision of municipal sanitation is a matter well worth while. It paves the way for the mining engineer to assist in sanitation in and about mining camps.

The article deals with municipal sanitation and its improvements. There are several tables showing that this problem has a future and the results obtained are a reward for their work. P. A. L.


This article is a historical retrospect on the early exploration and settlement of the Oregon territory. Some of the topics discussed are the following: The Louisiana Purchase; Louis and Clarke's Overland Expedition; Founding of Astoria in 1811.

W. S. L.


In this article it is shown that mineral occurrences along the government railroad in the Broad Pass district give indications of great potential wealth, but that there is a need for prospecting and development. Gold, silver, copper, lead and zinc have been found. W. S. L.

Potash Deposits in Spain. By Hoyt S. Gale. (E. & M. J., November 8 and 15, 1919.)

The prospective developments of potash deposits in the province of Barcelona in Catalonia, Spain, is of marked commercial interest. The article discusses and illustrates the geological features, the origin and its possibilities as a source of the mineral.

The Spanish government, as stated by Mr. Gale, has provided that the mines shall be grouped into a syndicate in which the government shall have a share as a voice.

Potash lands may be held for operating by the government and all mining concessions are under the supervisory control of the government.

The article enumerates the principal owners of concessions. They include a Franco-Belgian syndicate, a Spanish chemical company with German affiliations, a Spanish-French chemical company, a German company and an American company.

W. S. L.

MINING.


The Hermi gold mine in Placer County, California, presents unusual features and in the mining of the vein offers difficult conditions. This article describes the veins and the manner in which an unprofitable method of stopping was changed a few years ago into a profitable one by changing from overhead stope with square sets to the panel system. The values of gold bearing quartz veins occurring in the timbering are necessary and a cost less than that required by shrinkage methods was obtained.

W. S. L.

Rand Ore Reserves. By A. Cooper Ker. (E. & M. J., November 1, 1919.)

This article is a historical review of the present status of the gold producing mines of the Rand.

W. S. L.

Technical Operations on the Suan Concession, Korea—IV. By A. R. Weigall and T. F. Mitchell-Roberts. (Mining & Scientific Press, December 27, 1919.)

The subject of flotation on the concession articles of this series, its history, the types of apparatus and reagents used are discussed in detail. Detail drawings of a Suan froth trap and flotation machine are given. This article deals with the mechanical details and necessary provisions that must be made for the successful operation of various types.

W. S. L.

A Calculator for Mine Valuation. By Ross E. Copeland. (Scientific Press, December 27, 1919.)

This article is the last of the series in the subject of flotation on the Suan Concession, Korea—IV. It deals with the equipment and flow sheet of the mill. The treatment includes amalgamation, table concentration and flotation. The products are gold-silver bullion and two concentrates one of which contains approximately 3% by weight of bismuth. An interesting general description of location, living conditions, climate, etc., concludes the article.

W. S. L.

Technical Operations on the Suan Concession, Korea—V. By A. R. Weigall and T. F. Mitchell-Roberts. (Mining & Scientific Press, December 27, 1919.)

This article is the last of the series and deals with the equipment and flow sheet of the Suan Concession, Korea. It includes amalgamation, table concentration and flotation. The products are gold-silver bullion and two concentrates one of which contains approximately 3% bismuth. An interesting general description of location, living conditions, climate, etc., concludes the article.

W. S. L.

C. E. W.

The Use of Naphthalene and Xylidin in Flotation. By Edward H. Robie. (E. & M. J., November 1, 1919.)

This paper deals with the manufacture and use of these reagents in place of cacao in several western mills. The metalurgi-

A paper from the Institute of Mining and Metallurgy on the physics of flotation. Float concentration processes are classified. The results of agitation are discussed at length. A review of the principles and processes involved are also given. Mr. Sulman, who is one of the patentees identified with the Minerals Separation Company, has become the object of much editorial criticism due to his failure to make the details of the method available. The results of agitation are noted. The most promising of the flotation oils as determined by laboratory experimentation is known technically as Alpha-Naphthylamine and commercially as "X-cake." This reagent apparently functions as both collector and frother, but the problem of solution requires the addition of crude Xylidin to the X-cake in the proportion of 40 to 60. In general X-cake froths are much more easily broken down than oil froths and the thickened concentrate is more easily filtered. Improved recovery is obtained on many ores particularly those containing colloidal matter. The cost of X-cake and Xylidin mixture per ton of ore treated is in general greater than that for oil mixtures commonly employed.

W. S. L.

Precipitate Smelting at Tonopah. By George J. Young. (E. & M. J., December 13 and 20, 1919.)

The authors describe the precipitate smelting plant in the various cement plants of Japan. The equipment was purchased in America and installed by the supervision of the Metallurgical Research Institute. C. E. W.

ONE-MAN SURVEYS.

The Junior class will publish a Prospectors this year. It has been two years since a "Prospector" has been published, but the Juniors are vying to do this work in the "h. c. of printing and engraving" in order to issue a book that will be a credit to the school and the class of 1921.

We all realize the necessity of getting out such a book in order to promote good fellowship and under­

W. S. L.

The Annual Freshman Ball was held at Guggenheim Hall on December 12th. The Latin-American students have got­

Editor, Bilisoly: Business Manager, I. M.

W. S. E. MARRS.

Denver, Colo., Jan 10, 1926.

LATIN-AMERICAN CLUB.

The Latin-American students have gotten together and formed an organization to promote good will and understanding between themselves. They have been granted the use of the Athletic Board's room in the "gym.

The officers elected are Ernest Orinola, President; J. E. Soriano, Vice-President; Santiago Uriegas, Secretary and Treas­

The Annual Freshman Ball was held at Guggenheim Hall on December 12th. The affair was unusually well attended.
PERSONALS

19. Clyde M. Eure, who recently returned from the Philippine Islands, is spending the winter at 3021 Third St., Ocean Park, Calif. Any Mines men in that vicinity might be on the lookout for a visit from him. He is enjoying a well earned vacation and incidentally, a new Buick Six, which the Benguet Consolidated Co., of the Philippine Islands presented him in appreciation of his services.

20. Colonel Louis R. Ball is Professor of Military Science and Tactics, Junior Division, R. O. T. C., Los Angeles High School, Los Angeles, Calif., has resigned from the general engineering department of the Butte & Superior Mining Co., Butte, Mont. He is now general manager of the Davis-Daly Copper Co. in the same city.

21. J. L. Bruce has resigned from the general engineering department of the Magnus Copper Co., Butte, Mont. He is now general manager of the Magnus Copper Co. in the same city.

22. Leo L. Fillius is manager of the Anna Beaver Mine at Tule River, Okla.

23. Hal G. Knight is General Manager of the Rubber City Sand & Gravel Co. at Akron, Ohio. Charles A. Reno left the Magma Copper Co. at Park City, Utah.

24. Miss Dorothy Browne, of Kansas City, Missouri, was married on January 20th. Mr. and Mrs. Field will make their home at 1218 West 51st, Kansas City. Mr. Field is practicing law and has offices in the Keith and Perry Buildings.

25. C. Arthur Swanson is here from New York. He is developing a process at the experimental plant to treat the ores from a property at Cherry Creek, Nevada.

26. Peter A. Young visited Golden December 29th. He is with the Nature Products Co. at Colorado City, Colo.

27. Charles N. Bronstein has left the General Smelting Co. at Garfield, Utah. His present address is Apt. 8, 1564 Downey Street, Denver, Colo.

28. A. R. Brousseau has been discharged from the army and has located at Huntsville, Ariz.

29. E. R. Cutcher has returned from Queenstown, Tasmania, where he is strolling an electrolytic zinc plating plant for the Mt. Reed and Rosemary Mining & Smelting Co.

30. Edward V. Graybeal has moved from Great Falls, Montana, and is located at 35 Richmond Avenue, Arrochar, Staten Island, New York.

31. Charles F. Orman is assistant chemist for the Amalgamated Sugar Company at Smithfield, Utah.

32. Samuel J. Bursa and Miss Hazel Smith, of Salt Lake City, Utah, were married on December 24th.

33. Monroe O. Carlson is General Inspector for the Utah Fuel Co. He makes his headquarters at Somerset, Colo.

34. Breene Rosette's present address is Both A. Park City, Utah.

35. G. H. Van Dorp visited Golden recently.

36. R. H. Miller of Great Falls, Mont., visited in Golden during the holidays.

37. Max T. Hodus has returned from his home in Belize, British Honduras, C. A. He will have charge of an oil exploration party.

38. Mr. and Mrs. D. D. Riddle announce the arrival of their second daughter, Miss Dorothy, on December 14th at Saint Anthony's Hospital in Denver.

39. George B. Roll and Miss Nila Bank are married at the bride's home in Kansas City, Mo. Mr. and Mrs. Roll will reside in Casper, Wyo., where Mr. Roll has a position in the operating department of the Midwest Oil Co.

40. Otto H. Metzger has returned to his home at Meeker, Colo., from El Yunque, Puerto Rico. After a short visit he will leave for Cuba where he accepted a position in the mining engineer with the Minas de Matanzas hambra, at Pinar del Rio.

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ATHLETICS

By F. A. Litchfield, '20.

Thus far basketball has attracted little attention although there has been rivalry among the candidates for the team.

Four practice games have been played with the high school teams of Denver. Mines has shown improvement in each game.

If the season opens they should be in good form to tackle any Varsity team in the conference.

The first game will be on January 6 at Golden, when Mines tackles Boulder. This game should prove a battle from start to finish. Both teams will know after the final whistle has blown that they have been thru a real game.

Captain Dunn will lead the team. He will play forward. Altough small he has enough speed to make up for his size.

He has one great "fault"—he is death on long shots. If he does not get ten or twelve baskets in a game Coach Glaze begins to worry. So far Glaze hasn't a gray hair.

Jorden, another fast man who is trying for forward, will make a good running mate for Dunn. His hair should be hard for any guards to stop.

The guard position is being hotly contested by Galucci, Davia, E. Bunte and Rhodes. E. Bunte and Rhodes are letter men from last year and have shown up well. However, the others will give them a run for their money.

A. Bunte and Bryant are fighting it out for the center position. Bunte is a better man from last year and capable of playing either guard, center or forward. Therefore Glaze will probably use him where he needs him most. Bryant is a new man and it is indefinitely known whether or not he will stay in school.

There are several men besides those out for basketball, ready to battle. Van Gorder, one of these, hails from the last year Teachers' team. He is a forward. Famous for his long shots. If he runs true to form he will be a valuable man on the Mines.

The Freshmen have a strong team. They will be eligible for this year's basketball team when the second semester starts.

MINES BASKET BALL SCHEDULE FOR 1920 SEASON.

Jan. 31—University of Colorado at Golden.
Feb. 7—Colorado College at Golden.
Feb. 21—University of Denver at Denver.
March 6—University of Colorado at Boulder.
March 13 colorado College at Colorado Springs.
March 20—Aoggles at Golden.
March 27—Denver University at Golden.

CONFERENCE ADOPTS BOXING.

Prof. Roger H. Motten, Rocky mountain delegate to the National Collegiate Association convention, made a report on his trip. Professor Motten told the adoption of boxing and wrestling as major intercollegiate sports. He also declared that his plea against taking Western athletes to Eastern schools by offering them with pecuniary rewards had met with favorable endorsement. Immediately after hearing Professor Motten's
SOLICITORS WANTED—If you want a good selling article that should be reported, the conference adopted boxing and wrestling as major sports in our schools.

BOXING.

Roper, who has had considerable experience in the art of boxing has a set of huskies training under him. Among them are Peel, a freshman, who is trying out in the 145-pound class; Cunningham, Beven, Levings and Adamson in the 135-pound class. Both Levings and Adamson are veterans from last year's boxing class. In the 135-pound class we have Harron, a new man at the game but a willing "mixer." Strock has had a year's experience and has given a good account of himself in previous years. He boxes in the 145-pound class. Clothier will handle down the 158-pounders.

WRESTLING.

Great interest is taken in the wrestling game. There are several candidates out personal instruction of Soren and Terry who have had experience and know the game well. Both have started in the D. A. C. tournaments. Among them likely men out for this branch of sports are Thompson, Terrazas, Savage, Parks and the Crawford brothers. Dual meets have been arranged with the University of Colorado and Denver University. Colorado College will probably have a team later to compete with Denver Mines.

CORKY, ARTHUR V.
Member Harper, Macdonald & Co., Mining Engineers, Butte, Mont.

DelSOLLAR, TENNY C.
Mining Engineer.
Hancock, Mich.

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Dr. Paul Meyer
Physician

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Taylor, Frank B.
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Reports and Investigations.
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Waltman, W. D.
1215 First National Bank Bldg., Denver, Colo.
Phone Champa 5336.

Wolf, Harry J.
Mining Engineer.
Rocky Mountain Club.
New York.

A. H. Dyer, Proprietor
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Buyers of
MIXED ZINC-LEAD-IRON SULPHIDES

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