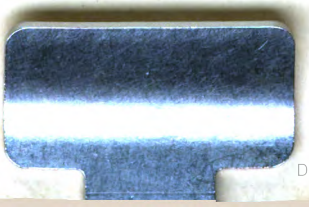
Report of the State Mineralogist of California from ...

California State Mining Bureau



Compliments of

Wm. Irelan Jr.

State Mineralogist

Calif. Dept. of Natural Resources. Div. of Mines

Calif. journal of mines and geology.....

ANNUAL REPORT

OF THE

STATE MINERALOGIST,

FROM

June 1, 1880, to December 1, 1880.

1P

REPORT.

To his Excellency GEORGE C. PERKINS, *Governor of California:*

SIR: I have the honor to submit to you a report of progress made by the California State Mining Bureau since its organization.

The Mining Bureau bill provides for an annual report, showing not only the amount of the disbursements of the Bureau, number of specimens collected, etc., but giving also "such statistical information in reference to mines and mining as shall be deemed important."

There has been some doubt in my mind as to whether this provision referred to the civil year, or to the termination of the official year. Owing to this doubt, I have thought best to present this report of progress, although only six months have passed, and to reserve for future publication, manuscript prepared for a more extended report.

SAN FRANCISCO, CAL., December 1st, 1880.

HENRY G. HANKS,
State Mineralogist.

REPORT OF PROGRESS—HISTORY.

The California State Mining Bureau is the creation of the twenty-third Legislature of the State of California. The bill—which is given in full below—originated in the Assembly. It was introduced by Honorable Joseph Wasson, representing the counties of Mono and Inyo:

AN ACT

TO PROVIDE FOR THE ESTABLISHMENT AND MAINTENANCE OF A MINING BUREAU.

[Approved April 16, 1880.]

The People of the State of California, represented in Senate and Assembly, do enact as follows:

SECTION 1. There shall be and is hereby established in this State, a Mining Bureau, the principal office of which shall be maintained in the City of San Francisco, at which place there shall be collected by the State Mineralogist, and preserved for study and reference, specimens of all the geological and mineralogical substances, including mineral waters, found in this State, especially those possessing economic or commercial value, which specimens shall be marked, arranged, classified, and described, and a record thereof preserved, showing the character thereof, and the place from whence obtained. The State Mineralogist shall also, as he has opportunity and means, collect, and in like manner preserve at said office, minerals, rocks, and fossils of other States, Territories, and countries, and the collections so made shall at all reasonable hours be open to public inspection, examination, and study.

SEC. 2. It shall be the duty of the Governor to appoint a citizen of this State having a practical and scientific knowledge of mining and mineralogy, to the office of State Mineralogist, to hold his said office for the term of four years, or until the appointment and qualification of his successor, who shall take and subscribe the oath of office prescribed by the Constitution, and who shall receive for his services a salary of three thousand dollars per annum, to be paid as other officers of the State are paid, and shall also receive his necessary traveling expenses, when traveling on the business of his office, to be allowed and audited by the State Board of Examiners, the whole to be paid out of the Mining Bureau Fund hereinafter provided for, and not otherwise.

SEC. 3. In addition to the collection, classification, arranging, and preservation of specimens, as provided in the first section of this Act, it shall be the duty of the State Mineralogist to make analytical assays as required; and when the funds in the Mining Bureau Fund are sufficient therefor, to provide and maintain a library of works on mineralogy, geology, and mining; to arrange in cases such specimens as he may collect; to procure and preserve models and drawings of mining machinery, and of milling machinery used in the reduction of ores; to correspond with established schools of mining and metallurgy, and obtain and preserve for public inspection and use, such information respecting improvements in mining and mining machinery as will be of practical value to the people of this State; to visit the several mining districts of each county of the State, from time to time, ascertain and record their history, describe their geological formation and altitudes, the character of the mines and ores, and the general development of the district. At the close of each year he shall make a report in detail to the Governor, showing the amount of disbursements of the Bureau under his charge, the number of specimens collected, and giving such statistical information in reference to mines and mining as shall be deemed important.

SEC. 4. The State Mineralogist may, from time to time, and as the funds in the Mining Bureau Fund will permit, appoint such assistants as he may deem necessary and proper for the carrying out of the objects of this Act, and the efficient provision and maintenance of a Bureau of mining information and statistics, and may procure and maintain the necessary rooms and furniture for the office and uses of the Bureau in San Francisco; but the entire expenses of the Bureau for salaries, assistance, rents, furniture, fuel, and all other things pertaining to the Bureau, must not, in any one year, be greater than can be paid out of the Mining Bureau Fund herein provided for.

SEC. 5. For the purpose of establishing a fund for the maintenance of said Mining Bureau, it shall be the duty of the Tax Collectors in the several counties in this State, and of the License Collector of the City and County of San Francisco, on the second Monday in January, April, July, and October, in each year, to transmit by express to the State Treasurer all moneys collected by them from mining corporations, or from corporations formed for milling ores, or for supplying water for mining purposes, under or by virtue of the Act entitled "An Act imposing a tax on the issue of certificates of stock corporations," approved April first, eighteen hundred and seventy-eight, and to forward to the State Controller by mail a certificate showing the amount of money so forwarded to the State Treasurer, and the date when the same was transmitted, and also showing the names of the several corporations from which the same was received, and the amount received from each. The State Treasurer shall receive the amounts so transmitted, and give duplicate receipts therefor, one of which shall be filed with the State Controller, and the other shall be returned by mail, or return express, to the Collector from whom the money was received; and after paying out of the money so received the charges for the transmission thereof, the amount of which shall be noted on the receipt filed with the State Controller, he shall retain the remainder in his hands as a separate fund, to be known as the Mining Bureau Fund, to be used only in payment of drafts made for the expenses of the Mining Bureau established under this Act, and out of which all the expenses of said Bureau shall be paid.

SEC. 6. Such Tax Collectors and License Collector shall hereafter be required to pay into the county treasuries of their respective counties only that portion of the moneys collected by them under the Act of the Legislature mentioned in the last preceding section, which is collected from corporations other than those mentioned in section five of this Act.

SEC. 7. This Act shall take effect and be in force from and after its passage.

The present State Mineralogist was appointed by the Governor in May following the passage of the bill, his commission bearing the date of May fifteenth, eighteen hundred and eighty. The first step taken toward the establishment of the Bureau was the temporary occupation of a small room, in the building number six hundred and nineteen Montgomery street. It was found difficult to obtain rooms suitable for the use of the Bureau. After examining many, a suite was finally selected which, although falling far below the requirements of a Museum worthy of the great State of California, is perhaps the best available at the present time for the purpose. The rooms at present occupied by the Bureau are on Pine street, number three hundred and thirteen, south side, between Sansome and Montgomery. They consist of a large main hall, lighted from above by a skylight, a spacious office and reception room for the State Mineralogist, an adjoining room, containing the nucleus of the reference library, a large storeroom, and one serving the double purpose of a chemical laboratory and for the preparation of specimens for the Museum. As it is expressly understood that the building is soon to

be torn down and rebuilt, the occupation is considered as temporary, and no cases or other fixtures have been or will be constructed which cannot be readily removed.

Immediately on taking possession of the Pine street rooms, the following circular was prepared and extensively distributed, not only in California but also in the adjoining States and Territories. Another, setting forth briefly the objects and plans of the State Mining Bureau, and containing the full text of the bill, was sent to scientific institutions and individuals, both in the United States and in foreign countries:

CALIFORNIA STATE MINING BUREAU,
OFFICE OF STATE MINERALOGIST, SAN FRANCISCO.

DEAR SIR: By an Act of the Twenty-third Legislature there has been established in the City of San Francisco a State Mining Bureau, and a State Mineralogist appointed by the Governor, authorized to carry out the provisions of the law. As it is an institution new to the people, this circular is prepared to set forth the objects and aims of the Bureau, and at the same time to request the coöperation of all who are interested in the development of the mining interests of the State. The law would on first thought seem exclusive, yet its scope is liberal as to the mining interests of "other States, Territories, and countries," as the tax for the support of the institution comes from the stock of companies operating in the world at large, but who have their transfer and chief offices in the mining metropolis and cosmopolitan city of California. It is proposed to make the State Bureau of Mining a depository of useful and interesting information in every department.

Heretofore, mining in California, and throughout the country generally, has been chiefly confined to the precious metals, while the State and coast at large are rich in many other minerals possessing great economic value in connection with the arts and manufactures. Now that railroads are being built which offer increased facilities for transportation, the utilization of mineral substances hitherto considered worthless, is no longer a problem. Old mines and mining districts that were abandoned because inaccessible, and for want of cheap and rapid transportation, are again attracting attention. As speedily as possible everything bearing on these subjects in the way of practical and reliable information will be gathered into the State Bureau, to which the public will have free access at reasonable hours during every legal day of the year.

The State Mineralogist is empowered to employ scientific and practical assistants, as the funds will permit, to operate in the field, and there will be new and interesting matter constantly added, such as maps, statistics, reports, surveys, etc., besides a collection of all the ores, minerals, fossils, rocks, metallurgical products, building stones, etc., of the Pacific Coast, with models of mining machinery in use and newly invented, and a general collection of ores and minerals of other countries for reference. It is intended to include everything that pertains to practical and legitimate mining.

The Bureau will constitute an historical repository, and all maps, reports, volumes of newspapers, copies of district laws and records, however old and seemingly out of date, will be sought for and preserved; many, if not all such documents, will be found to possess value outside of their rarity, involving as they may, questions of title to valuable property, neglected or idle. The Museum of Practical Geology will be made a special feature of the Bureau, and all contributions will be duly accredited, displayed, and preserved. A feature of leading interest will be the procuring and exhibiting of models of mining machinery; all that is interesting, whether old or new, will be carefully preserved and shown. Inventors are specially requested to exhibit models in the rooms of the Bureau, which will also include a reading-room, where the press will be represented, and a reference library of works on mineralogy, geology, metallurgy, and kindred subjects will be collected. The State Mineralogist has secured for an indefinite period the central, commodious, and well appointed rooms formerly occupied by the San Francisco Art Association, No. 313 Pine street, near Sansome, which he will occupy on the first of June. Satisfactory arrangements with the principal transportation and express companies have been made, whereby persons contributing articles of value and interest can forward such without expense to themselves.

The law requires that all mineral waters or springs throughout the State be examined, their value and characteristics ascertained, and the information duly published. This will materially increase the interest of the world at large in California as a health resort.

It is desired to make the ethnology of the Pacific Coast a feature of the Museum. All Indian relics, recent or prehistoric, will find a place, and their collection will no doubt throw much light on the ancient history of the State. It is the intention of the Bureau to make, sooner or later, a thorough industrial survey of the State. As every county is, to a certain extent, a mining county, all should be represented, and the prominent men of each are requested to see that the State Museum is provided with a full representation of the mineral resources of the county in which they reside. As every article of value sent to the Bureau will become the property of the State for the use and benefit of the public, and will be carefully preserved in the State Museum, and as it is desirable to make it as instructive and attractive as may be, donations of other articles of interest, such as views, pictures, paintings, curiosities, and works of art—in short, anything which would add to the general interest of the Bureau and tend to

make the Museum a popular resort for information and study, are solicited. The Bureau commences with a large and valuable donation of ores, rocks, fossils, reports, books, etc., the entire collection and property of the State Geological Society. Miners and prospectors are requested, when new finds are made, for better determination as to value and character, to always accompany ores with samples of the wall and country rocks, with written descriptions of the same. It is desirable that every mine in the State and adjoining States and Territories, which has a name, should be represented in the Bureau.

When anything occurs in the workings of the Bureau that is of special or immediate interest, it will be given to the public through the medium of the press. Annual reports to the Governor will be printed for general distribution. These reports should be valuable for permanent reference.

The California State Geological Society was organized in January, eighteen hundred and seventy-seven, and incorporated under the laws of the State.

The following is an extract from the By-Laws of the Society:

ARTICLE I—NAME.

The Society shall be known as the "California State Geological Society."

ARTICLE II—OBJECTS.

The objects of the Society are:

1. To make a Pacific Coast geological collection, to be offered to the State of California gratis, upon such terms and conditions as the Society may determine, and as may be agreed upon.
2. To encourage the study of geology in all its branches.

ARTICLE III—CONDITIONS.

Among the conditions which shall be required by the Society before such collection mentioned in the preceding article shall be presented to the State of California, are the following:

The State of California shall provide suitable rooms where the collection may be kept, and shall provide cases to contain the same.

The collection shall remain in the City and County of San Francisco, and shall not be removed therefrom.

It shall always be open to the inspection of the public free of charge, during seasonable hours.

It becoming possible for the State to accept the collection upon these terms by the institution of the State Museum, the whole property, including the collection aforesaid and the valuable library, were turned over to the State by the Society.

The collection embraces one thousand three hundred and twenty-seven specimens from all parts of the Pacific Coast; many of them are of special value. The library numbers seventy-eight volumes and twenty-five pamphlets, including testimony, arguments, and decisions in the case of the Eureka Consolidated Mining Company vs. Richmond Mining Company, of Nevada, a large volume, of which there were but twelve copies published. The identical specimens used in Court in this important suit are included in the mineral collection, and have been placed in a separate case for ready reference.

The collection represents a large amount of labor and money expended in acquisition and preparation of the specimens. The donation is therefore very valuable, and it is to be hoped will be followed by others. The Geological Society retains its organization, but all specimens, publications, and other collections made in the future will revert to the State Museum.

The mineral interests of the State were represented at the Paris Exposition of eighteen hundred and seventy-eight. The collections attracted much attention, and won for the State a gold medal. The greater portion was donated to the French Government, in the name

of the State of California, and is now in the Museum of the Ecole des Mines, in Paris. The specimens returned to the State after the Exposition naturally came into the possession of the Bureau.

Both collections above referred to were delivered to the Mining Bureau packed in boxes. Although partly arranged, it required considerable labor to prepare them for the new Museum. This work was immediately commenced by the State Mineralogist and Lewis G. Larsen, who had been appointed Janitor. The names of the specimens, with localities numbered consecutively, were sent to the printer and returned in printed sheets, to be used as labels and to form a rough catalogue. To facilitate the work, and to make a showing in the Museum, ten glass showcases were hired for temporary use, and a contract was made with William Proll & Co., of San Francisco, to furnish forty plate glass cases and tables of uniform size and finish.

These cases are eight feet long by two feet wide, and ten inches deep; the woodwork is of black walnut. Each table is on castors, which admits of its being moved without disturbing the specimens. The collections already arranged fill all the show-cases in the main hall. This does not include the large number of specimens which have also accumulated, but which cannot be placed on exhibition until more cases are provided.

The following is a showing of the contents of the cases:

Four cases California minerals.
Two cases California gold ores.
One case California silver ores.
One case California lead ores and products of lead manufacture.
One case California quicksilver ores.
One case California chromic iron and products.
One case California fossils.
Five cases California rocks.
One case California copper ores and products.
Two cases Nevada minerals.
One case Nevada rocks.
One case Nevada ores.
One case Nevada ores, Comstock mines.
One case Nevada ores, illustrating suit between Eureka Con. and Richmond.
One case Oregon and Washington Territory ores, minerals, and fossils.
Two cases Arizona ores and minerals.
Two cases ethnological, including Egyptian and other antiquities.
Two cases foreign minerals.
Three cases Eastern States minerals and ores.
One case foreign paleontology.
One case casts of rare fossils.
Two cases corals and shells.
Three cases not classified, owing to lack of case room.

On the tenth of June, Mr. Joseph Perkins was appointed Secretary and Accountant. From the commencement specimens of minerals began to come in, and a general interest on the part of the citizens became manifest. Correspondence has also gradually increased, and questions on matters within the province of the Bureau are asked and answered daily.

On the first of August Mr. Edward Booth wss appointed chemist, and the foundation of a chemical laboratory laid, which should be made in the future the best possible, as this department is of the highest importance.

It has been the policy of the Bureau to collect maps of the counties of the State, and geological and mining maps generally, which has resulted in the acquisition of a large number. Some of them are now placed on the walls of the Museum, Library, and Office, for refer-

ence. While the work of the Bureau has been in progress several scientific gentlemen have been employed to prepare manuscript for publication on various subjects, all within the requirements of the Mining Bureau bill. The science of geology, to which all others are tributary, is so vast in its scope that no one human mind can fully grasp it in detail. It has been found necessary to divide the science into departments, and in many cases to subdivide into specialties. There are in California, gentlemen who have devoted their lives to these departments, and to them the special work of the Bureau should be intrusted. Owing to the great amount of time and labor required to institute the Bureau, and to set the Museum in operation, but little field work has been attempted. The State Mineralogist, has, however, found time to visit the locality of "*roscoelite*," near Coloma, El Dorado County (a new mineral of which but little is known), and to commence the study of the valuable iron deposits near Clipper Gap, in Placer County. He also visited a number of limestone quarries in the same county, the granite quarries at Penryn, and at Rocklin, the Thermal Springs at Calistoga, in Napa County, and a number of mines in the Counties of Placer and El Dorado, reports of which will appear in future publications.

In obtaining information relating to mines and mineral deposits in California, care has been taken to obtain the exact locality—section, township, and range—with a view to place them eventually on a sectional map of the State. When any new discovery is announced in the columns of the press, or any information obtained otherwise by the Bureau, it has been the custom to write for specimens and more accurate information. Experience has shown that while many are willing to send the desired specimens, but few are competent to do so. Many important things are overlooked that would attract the attention of a person of experience. Still the Museum has received many valuable additions by carrying out this plan. When any feature of special interest is thus developed, a memorandum has been made with a view to a thorough personal examination when time and the condition of the funds will permit. There have been many visitors to the Museum, but there is no way of estimating the number. Visitors do not register unless specially requested to do so. When the Museum becomes more important and extensive, there will be an attendant in charge whose duty will be to receive visitors, give information, and to keep a general supervision. When this is the case, no person will enter without registering name and residence. There seems to have been an impression that the Museum is a place suited only for mining men, while it is specially desirable that ladies and children, students of both sexes, strangers in the city, and the public generally, should make free use of it.

MINERALS OF THE PACIFIC COAST.

Many persons have the impression that gold, silver, copper, and quicksilver make up the sum of the mineral products of California. This is a mistake. Many other valuable minerals are abundant. Without regard to scientific classification, the following economic minerals may be mentioned, the localities of which are well known to mineralogists: platinum, iridium, ores of lead, cobalt, tin, tellurium-molybdenum, chromium, antimony, bismuth, nickel, zinc, arsenic, and iron; oxide, silicate, and carbonate of manganese; red and

yellow ocher; umber, carbonate and sulphate of baryta, limestones, marbles in many beautiful varieties, dolomite, hydraulic cement, gypsum, granite, syenite, porphyries, freestone, quartz sand, asbestos, mica, pegmatite, corundum, burh-stone, tripoli, diatomaceous earth, pumice-stone, asphaltum, mineral oils, fluor spar, strontianite, carbonate of magnesia, carbonate of soda, salt, sulphur, tunstate of iron and of manganese, lignite, graphite, fire-clay, borax, boracic acid, besides gems and minerals valuable only for ornamental purposes, and perhaps others; and there are no doubt unknown mineral resources in the State that may develop into sources of wealth. It should be the policy of the Bureau to discover, investigate, and bring them into notice.

DONATIONS TO THE MUSEUM AND LIBRARY.

As this list is intended as a memorandum only, and as some specimens received still remain unpacked, it is more than probable that the names of some donors have been overlooked. Errors and omissions will be rectified, and full details and localities given, in a future carefully prepared annual catalogue.

Donor.	Article.	Where from.
Ambler, S. F.	One specimen sand from copper mine	California.
Ambler, S. F.	Four specimens copper ore	California.
Attosen, Mr.	One specimen selenite	Siberia.
Attwood, Melville	Four specimens minerals	California.
Attwood, Melville	One specimen electrum	California.
Attwood, Melville	One sample mineral water	California.
Attwood, Melville	Three specimens rocks	Nevada.
Britton & Rey	One map of San Francisco	
Bunker, Wm. M.	One specimen rock with dendrites	Nevada.
Bunker, Wm. M.	One specimen silver ore, chloride of silver	Nevada.
Blackburn, D.	One pamphlet, Hot Springs of Paso de Robles	California.
Blair, M. Y.	One specimen asbestos	
Benton, J. E.	One mining report	
Banks, Chas. W.	Fourteen specimens ore	Arizona.
Bacon & Co.	One pamphlet, "Business vs. Speculation"	
Bell, John	One specimen quartz with telluric gold	California.
Blake, Prof. W. P.	One specimen crystalline orpiment, etc.	
Blake, Prof. W. P.	Fifteen Reports of Paris Exposition	
Bixby, John F.	One specimen of chrome iron	California.
Booth, Edward	One pamphlet, Genesis of Cinnabar	
Brown, G. W.	One specimen stibnite	California.
Brumagim, Mrs. J. W.	One volume, Nature Displayed	
Brumagim, Miss Blanche	One sample quartz and chalcedony pebbles	California.
Brumagim, Miss Jennie	One sample sand	California.
Bluxome, Isaac	One pamphlet, Report on M. & Canal Co.	
Bluxome, Isaac	One sample clay	California.
Bluxome, Isaac	One specimen steatite	California.
Bluxome, Isaac	Five samples sand and gravel from hydraulic mines	California.
Barry, John D.	Two reports on mines	
Brastow, S. D.	One specimen gypsum	California.
Brastow, S. D.	One specimen pumice	California.
Brastow, S. D.	One specimen silver sandstone	Utah.
Bost, John W.	One map Merced County	
Baker, J. H.	Four specimens ores and minerals	Nevada.
Baker, J. H.	One specimen, Indian relic	Nevada.
Baker, J. H.	One specimen, Indian bird cage	Nevada.
Behrens, J.	One specimen aragonite	California.
Bateman, A.	One specimen silver ore	Nevada.

DONATIONS—Continued.

Donor.	Article.	Where from.
Burrows, H. L.	One specimen brick from great wall of China	
Bevan, W. J.	One specimen ore	California.
Carpenter, Ezra	Five specimens fossil oysters	California.
Carpenter, Ezra	Five specimens fossil bones	California.
Carpenter, Ezra	Seven specimens ores and minerals	California.
Carpenter, Ezra	Five specimens aragonite	California.
Carpenter, Ezra	Five specimens Indian relics	California.
Carpenter, Ezra	Five specimens tufa	California.
Carpenter, Ezra	Two samples mineral water	California.
Carpenter, Ezra	One map San Luis Obispo County	California.
California Iron Co	One specimen white marble	California.
California Iron Co	Three specimens hematite	California.
California Iron Co	One specimen magnetite	California.
California Iron Co	One sample water from salt spring	California.
Crane, E. M	Seventy-five specimens silver sandstone, etc.	Utah.
Chilaud, E	One specimen gold quartz	California.
Chilaud, E	One specimen wall rock	California.
Cook, Seth	One specimen copper ore	California.
Cook & Spinks	One sample quartz sand from coal mine	California.
Cook & Spinks	One sample clay from coal mine	California.
Collins, S. W	One sample auriferous sand	California.
Collins, S. W	One specimen gold ore	California.
Collins, S. W	One specimen orbicular diorite	California.
Collins, C. J	One specimen thinolite	Nevada.
Collins, C. J	One specimen calcite	Nevada.
Cohen, Richard	Six specimens silver ore	Nevada.
Coffin, Mrs. H. M	One specimen volcanic rock	California.
Church, John A	Six reports on mines and mining, etc.	
Church, A. S	Fourteen specimens from Egypt	
Church, A. S	Five specimens from Italy	
Church, A. S	Three relics from Pompeii	
Church, A. S	Three relics from Holy Land	
Church, A. S	Fourteen mementos of travel	
Church, A. S	Four volumes handbooks of travel	
Cal. Portland Cement Co	One sample cement	California.
Cal. Portland Cement Co	One sample slag from furnace	California.
Cal. Portland Coment Co	Two samples cement test pieces	California.
Davis & Cowell	One specimen marble	California.
Deby, Julien	Two pamphlets, Diatomes	
Durden, H. S.	One specimen scutella interlineata	California.
Dana, Alfred W.	One sample diatomaceous earth	California.
Dietzler, Gen. Geo. W.	One specimen auriferous quartz	Georgia.
Dietzler, Gen. Geo. W.	One stone axe	
Dietzler, Gen. Geo. W.	One pamphlet, Evaporative Coolers	
Daggett, John	One specimen quartz with free gold	California.
DeWoody, J. F.	One specimen hyalite	California.
Dubois, P.	One specimen gold quartz	California.
Davis, J. Z.	Two samples peat	Ireland.
Davis, J. Z.	Two specimens coal	
Davis, J. Z.	Ten specimens minerals	
Davis, J. Z.	Three specimens silicified wood	
Davis, J. Z.	Twenty specimens corals	
Davis, J. Z.	Twenty specimens shells	
Davis, J. Z.	Five specimens fish	
Davis, J. Z.	One specimen bow and arrows, Yuma Indians	
Davis, J. Z.	Six specimens rocks	
Davis, J. Z.	Four specimens pine cones	California.
Davis, J. Z.	Three specimens ivory nut	
Davis, J. Z.	Ten specimens seaweed	
Davis, J. Z.	Five specimens colonial relics	
Davis, J. Z.	Two specimens relics of battle of New Orleans	
Davis, J. Z.	One specimen jaws of orca	
Davis, J. Z.	One specimen pile pierced by teredos	
Davis, J. Z.	Specimen artesian borings	
Davis, J. Z.	Seventy specimens, various	
Davis, N. S.	One specimen aragonite	Arizona.
Dixon, John	One specimen ore	California.

DONATIONS—Continued.

DONOR.	Article.	Where from.
Davis, Wm.	One specimen iron ore	California.
Everett, Jas. W.	One Indian arrow-head	California.
Elmore, R. P.	One specimen sphalerite	Arizona.
Elder & Dobbie	Eight volumes City and Coast Directories	
Fauntleroy, W. H.	One specimen hematite	California.
Fresno Enterprise Co.	One specimen gold quartz	California.
Filcher, J. A.	Two specimens copper ore	California.
Filcher, J. A.	One specimen silicified wood	California.
Filcher, J. A.	One specimen ferruginous clay	California.
Filcher, J. A.	One specimen diorite	California.
Foye Bros.	One specimen graphite	New York.
Flick, Wm. F.	One specimen auriferous quartz	California.
Flick, Wm. F.	One specimen clay	California.
Fulton, R. L.	Two specimens thinolite	Nevada.
Fulton, R. L.	Two specimens silver ore	Nevada.
Fulton, R. L.	One specimen silicified wood	California.
Fernbach, Victor	Six specimens silver ore	Nevada.
Fuller, O.	Two specimens ore	California.
Fowler, Mr.	Twelve specimens coal	
Fox, C. N.	One specimen ore	California.
Fowler, Jas. E.	Two specimens graphite	California.
Gladding, McBean & Co.	Five specimens fire brick	California.
Gladding, McBean & Co.	Two specimens floating brick	California.
Gladding, McBean & Co.	Three specimens crucibles	California.
Gladding, McBean & Co.	Two specimens clay	California.
Gladding, McBean & Co.	Seventeen specimens pottery	California.
Gallagher, Edward A. T.	Two Indian relics	California.
Graves, Hon. W. J.	One specimen diatomaceous earth	California.
Garratt, Hon. W. T.	One sample mineral water	California.
Grayson, Geo. W.	One specimen calcite and barite	Arizona.
George, Dr. S. G.	Five specimens minerals	California.
George, Dr. S. G.	Eight specimens silver ore	California.
George, Dr. S. G.	One specimen rock	California.
George, Dr. S. G.	One specimen fossils	California.
Gibbes, Chas. D.	Two specimens freestone	New South Wales.
Gourguet, D.	One specimen auriferous sulphurets	California.
Gourguet, D.	One specimen rock	California.
Guilbert, E. D.	One specimen silver ore	Utah.
Gibbons, Miss E. P.	Four samples kauri gum	New Zealand.
Hanks, Henry G.	Seventy-five specimens minerals, ores, rocks, etc.	
Hanks, Henry G.	Sixty-six volumes scientific works, reports, etc.	
Hanks, Henry G.	Eighteen maps, geological, etc.	
Heydenfeldt, Judge S.	Twenty-nine volumes reports, etc.	
Harvey, Dr. Philip	One skull flathead Indian	Oregon.
Haft, E. E.	One specimen silver ore	California.
Hale, Wm. E.	One specimen hematite	California.
Hale, Wm. E.	Three specimens magnetite	California.
Heydenfeldt, S., Jr.	Nine volumes publications	
Heydenfeldt, S., Jr.	One specimen stream tin	Mexico.
Heydenfeldt, S., Jr.	Two specimens minerals	California.
Heydenfeldt, S., Jr.	One specimen diatomaceous earth	California.
Heydenfeldt, S., Jr.	One specimen silver ore	Nevada.
Hellings, Wm. B.	One specimen anglesite	Arizona.
Hendy, Joshua	One specimen lignite	Alaska.
Healy, Chas. T.	One specimen coal	California.
Hiscox, H. O.	Three specimens copper ore and copper	California.
Hittell, John S.	One sample Piute sugar	Nevada.
Hume, Geo. W.	One bronze chain cable	Oregon.
Horton, Mr.	One specimen silver gold ore	Idaho.
Holt, John H.	Two specimens paleozoic fossils	California.
Holmes, A. J.	Twelve specimens silver ore	Arizona.
Holmes, A. J.	One specimen wood, from Casa Grande	Arizona.
Holmes, A. J.	One specimen wall-rock	Arizona.
Hughes, D. F.	One specimen platiniridium	California.
Hobart, J. H.	Two specimens, rock and pyrites	California.
Hughes, Mr.	One sample wax, from ancient wreck	Oregon.
Hoagland, Osborn & Co.	One specimen ore	California.

DONATIONS—Continued.

DONOR.	Article.	Where from.
Hurley, Horace	One specimen jefferisite	California.
Idaho Mining Company	One specimen gold quartz	California.
Isham, J. B. G.	One map, Norway and Sweden (geological)	
James, C. A.	One specimen gold quartz	California.
James, David B.	One model of quartz crusher	
James, David B.	One specimen of quartz crushed in same	
Jacques, Mrs. James	One specimen polished carnelian	
Jacobi, M.	One specimen red lava	California.
Jewell, T. E.	One specimen graphite	Mexico.
Jones, Charles C.	One specimen copper ore	California.
Jones, Charles C.	One specimen native copper	California.
Jones, A. S.	Two specimens nickel ore	California.
Joubert, Jules	One volume of Report on Mining	New South Wales.
Kimble, George W.	One specimen magnetite	California.
Kimble, George W.	Four specimens roscoelite	California.
Kimble, George W.	Two boxes roscoelite	California.
Kirkpatrick, J. M.	One specimen silver-lead ore	Arizona.
Kinney, Dr. Aug. C.	Ten specimens fossils	Oregon.
Kinney, Dr. Aug. C.	One specimen jet	Oregon.
Kinney, Dr. Aug. C.	One specimen wax	Oregon.
Knox, Richard F.	One specimen silver ore	Maine.
Kustel, G.	One volume, Roasting Gold and Silver Ores	
Kelly, G. P.	One specimen chalcedony	Mexico.
Lee, Bruce	One specimen auriferous pyrities and hematite	California.
Levy, H. M.	One specimen wulfenite	Nevada.
Levy, H. M.	One specimen aragonite	Nevada.
Lent, William H.	One specimen galena	Colorado.
Lewis, William A.	One specimen gold quartz	California.
Lorquin, E. T.	Two specimens mammalian fossils	Oregon.
Lorquin, E. T.	One Indian relic	Oregon.
Lockington, W. N.	One vol. Report of Commissioner of Fisheries	California.
Larson, A.	Eight specimens gold ores and wall rocks	California.
Mackay, John W.	Two specimens silver ore	Nevada.
Mackay, John W.	One specimen ferruginous limestone concretion	New Mexico.
Maize, H. B.	One specimen galena in quartz	California.
Mackey & Fenton	One specimen magnetite	Oregon.
Merrill, F. H.	Three specimens minerals	California.
McNeir, G. M.	One specimen obsidian	California.
Mitchell, Charles	One stone hammer	California.
Mills, David J.	One specimen sandstone	California.
Moody, W. H.	One Indian arrowhead	California.
Moore, W. H.	One specimen argentiferous copper ore	California.
Moore, L. A.	One specimen silicified wood	Nevada.
Moore, J. P.	One volume Pacific Coast Fungi	
Myers, A.	One specimen auriferous sulphurets	California.
McCormick, Hugh	One specimen azurite	California.
McCormick, Hugh	One specimen ulexite	California.
McCormick, Hugh	One specimen trona	California.
Muir, John A.	One specimen orbicular diorite	California.
McWorthy, T. J.	One specimen auriferous sulphurets	California.
McMillan, Mr.	One map of Yuba County	
McMurtrie, Dr. William	One Report on Culture of Sumac in Sicily	
Murdock, Dr. G. L.	One map of Western Oregon	
Merrill, C. R.	One specimen white marble	California.
Newsome, D. F.	Four samples mineral water	California.
Newton, Henry A.	Two specimens gold quartz	California.
Norris, Richard	Five specimens chromic iron	California.
Norris, Smith	One specimen gold quartz	California.
O'Daly, John Ingham	Two specimens stream tin	New South Wales.
O'Daly, John Ingham	One Report on Tin Mines of California	
O'Daly, John Ingham	One Blue Book of New South Wales	
O'Daly, John Ingham	Six maps of mines in New South Wales	
Oliver, William Letts	One sample borax	Chili.
Oliver, William Letts	One sample borate of lime	Bolivia.
Oliver, William Letts	One sample borax	Peru.
Pailhet, E. W.	Three relics	Egypt.
Pailhet, E. W.	One specimen gold quartz	California.

DONATIONS—Continued.

DONOR.	Article.	Where from.
Pailhet, E. W.	One specimen Brazilian pebbles	Brazil.
Pailhet, E. W.	One specimen silver ore with sphalerite	Arizona.
Parker, Dr. W. C.	Seven specimens silver ore	California.
Paul, Almarin B.	One specimen gold in chalcedony	California.
Pew, J. W.	Two specimens silver ore	Nevada.
Pew, J. W.	One specimen silver sandstone	Utah.
Pew, J. W.	One specimen silver ore	California.
Perrin, R. J.	One specimen asbestos	California.
Porter, David	Two specimens silver ore	California.
Porter, David	Two specimens iron ore and rock	California.
Perkins, Joseph	One volume Memoir on New York Canals	
Peterson, Gus.	Three specimens ore	Nevada.
Pritchard, James A.	One specimen solar salt	California.
Perrier & Galbergue	One specimen ore	California.
Palmer, Joseph C.	One specimen calcite	California.
Palmer, Joseph C.	Two specimens fossils	California.
Randol, J. B.	Eight specimens cinnabar	California.
Randol, J. B.	Seven specimens wall and country rock	California.
Randol, J. B.	Two specimens adobes with cinnabar	California.
Randol, J. B.	One specimen soot from condenser	
Randol, J. B.	One specimen metallic quicksilver	
Raymond, A. S.	One specimen copper ore	British Columbia.
Rodrick, Frank	One specimen orbicular diorite	California.
Rose, Wm.	Two maps Como Lode	
Soper, Wm. H.	Eight specimens ores	
Stambaugh, Dr. S. S.	One phallic emblem	California.
State Geological Society	Thirteen hundred and twenty-seven specimens ores, minerals, etc.	
State Geological Society	Seventy-eight volumes, various	
State Geological Society	Twenty-five pamphlets, various	
San Francisco Glass Co.	One specimen devitrified glass	
Sears, W. H.	One specimen ore	California.
Sherwood, Henry	One specimen chalcedony	California.
Spencer, Geo. W.	One specimen yellow clay	California.
Spencer, Geo. W.	One specimen sulphide of iron	California.
Sheldon, N. P.	One specimen stibnite	Utah.
Stewart, Hon. W. M.	One model Noonday Mine	California.
Selby Smelting and Lead Co.	One specimen sulphate of copper	
Sweet, S. S.	One specimen asbestos	California.
Sleeper, W. O.	One specimen rock	California.
Sleeper, T. P.	One specimen sulphuret ore	California.
Steinhagen, P.	Sixteen samples asbestos manufactures	
Sherburne, J. S.	Two specimens silver ore	New Mexico.
Sherburne, J. S.	One specimen wall rock	New Mexico.
Sherburne, J. S.	One specimen epidote	New Mexico.
Smith, Mrs. Fanny E.	One specimen chalcedonic quartz	Colorado.
Schmidt, W.	One specimen micaceous hematite	Nevada.
Skidmore, W. A.	Six mining reports	
Skidmore, W. A.	One specimen telluric gold	California.
Scupham, J. R.	One specimen obsidian	California.
Sutro Tunnel Co.	Five volumes reports etc. on Tunnel Co.	
Schlagintweit, Robert von	One volume California Lande und Leute	
Taylor, J. M.	One specimen wall rock	Nevada.
Thayer, B. B.	Forty-two specimens cinnabar, etc.	California.
Thibodo, Doctor A. J.	One specimen gypsum	Arizona.
Thibodo, Doctor A. J.	One specimen zinkenite	Idaho.
Thibodo, Doctor A. J.	One specimen limonite	Arizona.
Thibodo, Doctor A. J.	One specimen copper ore	Nevada.
Thornton, H. J.	One specimen dendrites	Nevada.
Thureau, G.	One volume Reports on Mines and Mining in Nevada	
Tubbs, H.	Three specimens fossil shells	California.
Utter, F.	One specimen copper ore	California.
Vosburgh, J. J.	One specimen arrowheads and beads	Arizona.
Wasson, Hon. Joseph	One sample mineral water	California
Wasson, Hon. Joseph	Seven specimens minerals and rocks	California

DONATIONS—Continued.

DONOR.	Article.	Where from.
Wasson, Hon. Joseph	Ten specimens ores	California.
Wasson, Hon. Joseph	Eleven volumes mining reports, etc.	
Wasson, Hon. Joseph	Four maps mining districts	
Walker, Doctor D.	One specimen silver ore	California.
Wier, James C.	One specimen copper ore	Nevada.
Whittier, Fuller & Co.	One specimen pumice stone	California.
Whittier, Fuller & Co.	Ten samples chemical manufactures	California.
Wilson, J. Downer	One specimen calcite	Arizona.
Wilson, J. Downer	Two specimens wulfenite	Arizona.
Wilson, J. Downer	One specimen gypsum	Arizona.
Wilson, J. Downer	Two specimens lead ores	Arizona.
Woodhull, W. S.	One specimen silver ore	California.
Wyman, G. D.	One specimen silver ore	Arizona.
Woodbury, J. G.	One specimen magnetite	California.
Ward & Howell	Four catalogues fossils, etc.	
Whitfield, Professor R. P.	One volume Annual Reports American Museum of Natural History	
Wheeler, Capt. George M.	Ten volumes Reports United States Surveys West of One Hundredth Meridian	
Wheeler, Capt. George M.	Two maps Washoe mining region	
Wilcox, A. O.	Two specimens rock salt	Nevada.
Winder, William A.	One specimen gypsum	California.
Woodhull, S. D.	Twenty-seven specimens ores, rocks, etc.	California.
Young, Joseph W., Jr.	One specimen gold quartz	California.
Exchange and purchase	One hundred and thirty-five specimens rocks, ores, minerals, etc.	Various sources.
Exchange and purchase	Fifty-two volumes reports, etc.	Various sources.
Exchange and purchase	Twenty-eight maps—mining, geological, and county	Various sources.

RECORD OF VISITORS REGISTERED.

June, no record—estimated 150; July, 272; August, 166; September, 287; October, 254; November, 215; total, 1,344.

NOTE.—This does not show the actual number of visitors, as many do not enter their names at all, and a still larger number think, after the first entry, no further entry is desirable, although they may visit the Museum frequently.

CORRESPONDENCE.

Three hundred and ninety-nine letters have been written to three hundred and twenty-one correspondents; one hundred and eighty-nine letters received from one hundred and forty correspondents.

REPORT OF THE CHEMIST.

The Chemical Laboratory connected with the Bureau has been in operation so short a time that the quantity of analytical work performed has not been as great as desirable. A considerable number of mineralogical and mineralogico-chemical investigations have been made in addition to complete analyses. All doubtful minerals that have been presented to the Bureau, have been determined and in many cases analyzed. In addition to the determination of minerals, much of the work has consisted of examination of supposed ores, for gold, silver, copper, nickel, tin, etc.

The principal specimens that have been determined are: Calcite and Quartz; Ferruginous Limestone; Bronze (chain washed ashore in Oregon); Zinkenite; Concretionary Calcite; Kaolinite; Psilomelane, Rhodocrosite, and Quartz; Calcite, Cuprite, Malachite, Melaconite; Native Silver; Galenite and Sphalerite; Clay; Sphalerite; Metallic Gold, Lead, Mercury; Limestone; Galenite, Siderite, Quartz; Obsidian; Pyrite; Magnetite; Chalcopyrite and Erubescite; Nagyagite; Micaceous Hematite; Bindheimite, Anglesite, Azurite; Graphite; Jefferisite; Stibnite; Sphalerite and Calcite; Epidote; Sphalerite and Galenite; Cerargyrite; Pyrophyllite; Jefferisite; Chromite; Argentite; Aragonite; Pyrite; Calistoga water, for gold; Malachite, Cuprite, Native Copper; Ferruginous Limestone; Bindheimite; Aragonite; Magnetite; Wulfenite; Cerussite; Selenite; Calcite, Limonite, Barite; Selenite; Melanterite; Garnet; Galena, Siderite, Quartz; Sphalerite; Chalcopyrite; Native Copper, Cuprite, Malachite, Limonite, and Calcite; Sphalerite; Azurite; Mispickel; Hydraulic Lime; Ulexite; Soda; Coal; Borax; Clay; Selenite; Erythrite; Argentite, Chrysocolla, Malachite; Erubescite; Cuprite and Malachite; Hematite; Chromite and Ripidolite; Hematite; Calcite; Nagyagite; Sphalerite; Calamine; Calcareous Sandstone and Cerargyrite; Manganiferous Clay; Limonite; Limestone; Meteoric Iron; Nickel; Metallic Iron; Limestone; Calcite; Limonite; Graphite; Meteoric Iron; Hornblende; Chalcedony.

Besides these, a large number of negative determinations have been made. That is, an examination for a constituent which was found to be absent, as in many of the supposed gold and silver ores. Complete analyses have been made principally with regard to the iron ores of the State.

MAGNETITE—POTTER'S IRON MINE, SHASTA COUNTY.

Contains 71.16 per cent. of iron.

Silica	.49
Ferrous Oxide	19.59
Ferric Oxide	79.90
	99.98

LIMONITE—CLIPPER GAP, PLACER COUNTY.

Contains 53.88 per cent. of iron.

Silica	9.28
Hygroscopic moisture	2.40
Combined water	11.30
Ferric oxide	76.97
Sulphur	Trace
	99.95

LIMONITE—CLIPPER GAP, PLACER COUNTY.

Contains 56.58 per cent of iron.

Silica	7.16
Hygroscopic moisture	1.90
Combined water	9.90
Ferric oxide	80.83
Sulphur	Trace
Phosphorus	Trace
	99.79

OCHEROUS LIMONITE—CLIPPER GAP, PLACER COUNTY.

Contains 55.93 per cent. of iron.

Silica	5.70
Hygroscopic moisture	3.60
Combined water	11.30
Ferric oxide	79.90
Sulphur	Trace
Phosphorus	Trace
	100.50

RED EARTH—NEAR CLIPPER GAP, PLACER COUNTY.

Contains 38.68 per cent. of iron.

Silica, etc.	34.55
Hygroscopic moisture	2.90
Combined water	6.45
Ferric oxide	55.25
Lime	1.65
Sulphur	Trace
Phosphorus	Trace
	100.60

MAGNETITE—PLACER COUNTY.

Contains 68.28 per cent. of iron.

Silica	3.23
Ferrous oxide	17.06
Ferric oxide	80.05
	100.34

LIMESTONE—PLACER COUNTY.

Silica	.25
Ferric oxide	.25
Magnesia	Trace
Lime	55.72
Carbonic acid	43.78
	100.00

LIMESTONE—NEAR CLIPPER GAP, PLACER COUNTY.

Silica	Trace
Ferric oxide	.05
Magnesia	Trace
Lime	55.97
Carbonic acid	43.98
	100.00

LIMESTONE—NEAR CLIPPER GAP, PLACER COUNTY.

Silica	.15
Ferric oxide	.35
Magnesia	Trace
Lime	55.72
Carbonic acid	43.78
	100.00

ARAGONITE—SUISUN, SOLANO COUNTY.

Silica	.02
Ferric oxide	.07
Magnesia	.50
Lime	55.94
Carbonic acid	43.96
	100.49

COAL—SAN BENITO COUNTY.

Water	18.40
Volatile combustible matter	31.15
Fixed carbon	30.00
Ash	20.45
	100.00

HYDRAULIC LIMESTONE.

Water	.60
Ferrous oxide	11.80
Magnesia	1.95
Lime	38.27
Carbonic acid	32.21
Insoluble residue	15.15
	99.98

INDURATED CLAY—SAN FRANCISCO.

Silica	56.51
Alumina	21.33
Ferric oxide	12.31
Lime	3.53
Magnesia	Trace
Water	6.30
	99.98

LIGNITE—IONE VALLEY, AMADOR COUNTY.

Water	4.00
Volatile combustible matter	36.90
Fixed carbon	13.10
Ash	46.00
	100.00

A large number of partial analyses have also been made where the quantities of one or more of the constituents of a complex mineral have been determined.

The work done in the laboratory has all been of a practical character, and this department promises to become of great importance as the Bureau becomes developed.

EDWARD BOOTH,
Chemist.

STATEMENT

Of Receipts and Expenditures of the California State Mining Bureau, December 1, 1880.

Expenditures.	Amounts.	Receipts.	Amounts.
Postage	$38 20	Warrants received from State Controller	$4,200 00
Museum expense	2,064 76	Advances by bank, Wells, Fargo & Co.	2,118 78
General expense	1,516 51		
Maps purchased	60 00		
Library books purchased	57 50		
Salaries and labor	2,392 50		
Traveling expenses	88 80		
Interest on advances	100 51		
Total	$6,318 78	Total	$6,318 78

STATE OF CALIFORNIA, County of San Francisco. } ss.

I, Henry G. Hanks, State Mineralogist, do swear that the foregoing is a true statement of the receipts and expenditures of the California State Mining Bureau for the six months ending November 30th, 1880, as taken from the books of this office, vouchers for all of which being now on file.

HENRY G. HANKS.

Subscribed and sworn to before me this 6th day of December, 1880.

SAM'L S. MURFEY, Notary Public.

MEMORANDUM

Account of Mining Bureau Fund, San Francisco.

Receipts.	Amounts.	Expenditures.		Amounts.
Collected by R. H. Sinton, License Collector of San Francisco, and paid in to State Treasurer—		Warrant account—		
		Salary of Mineralogist	$250 00	
		Salary of Mineralogist	750 00	
Quarter ending June 30th, 1880	$1,341 60			$1,000 00
Quarter ending Sept. 30th, 1880	3,220 60	General expenses	$1,000 00	
Collected but not paid in, quarter ending December 31st, 1880	3,481 00	General expenses	3,200 00	4,200 00
		Balance to credit of Mining Bureau		3,543 20
Total	$8,743 20	Total		$8,743 20

LOAN COLLECTIONS.

While the institution is young, it would be desirable to encourage those having valuable collections to place them in the Museum as loans. There seems no objection to receiving such loan collections. The plan is quite common in Museums elsewhere. There are many persons who would gladly be relieved of the care of their collections, who are not willing, or who cannot afford to donate them. Such collections often come into the possession of the Museum, either by final donation or by purchase. The slight expense of labels and care is offset by the advantage of temporary possession. The owner should be required to enter into an agreement not to remove them for a specified time, and the Museum should not receive them faster than they can be cared for and placed on exhibition. The uniform Museum cases would be used for their reception, and labels printed, but not entered on the catalogue. They might be designated as Loan Collection No. 1, 2, 3, etc., as the case might be. In the meantime, the work of general collection would be in progress, and when those loaned were removed the cases would be filled with other specimens.

Several valuable and extensive collections can be obtained upon these terms, and others have been promised as donations as soon as a safe and permanent building is secured.

GREAT MUSEUMS OF THE WORLD AND THEIR IMPORTANCE.

The collection of objects of interest for study and reference is not peculiar to any nation or country, but seems to be coeval with civilization. The name Museum denotes "a Temple of the Muses," and is said to have been given to a building in Alexandria, in which the celebrated library was placed. In early times they were few, and were confined to the great centers, but at the present day may be found in almost every country, even in colonies and smaller States. Any country which does not give some attention to the collecting and display of its own resources, becomes a prey to others, in the sense of having its natural and artificial products displayed in Museums of other lands, and must submit to the humiliation of being better represented and known abroad than at home. The first Museum, according to the modern idea, was at Florence, when that city was under the rule of Cosmo the Elder, although no doubt there were similar ones, but of less importance, long before.

The English nation is justly proud of the British Museum, which ranks first as a single national collection. This great institution was, like many others, founded on the purchase of a private collection. Sir Hans Sloane provided in his will that his entire Museum, valued at £50,000, should be offered to the government for £20,000. The offer was accepted by an Act of Parliament, in seventeen hundred and

fifty-three, providing for the purchase of the Sloane Collection, the Harleian Collection of Manuscripts, and for the reception of the Cottonian Library. By the provision of this Act £300,000 were raised by a public lottery, £20,000 paid for the Sloane Collection, £10,000 for the Harleian Collection, and £10,250 for Montague House, Bloomsbury, London, the mansion of the Earl of Halifax, which combined, formed the nucleus of the British Museum. Since that time the nation has subscribed large sums for building and additions. The total expenditure by the Government up to eighteen hundred and fifty-eight, is estimated at £1,500,000 sterling. This is not to be taken as the sum of its value, as it has received many donations which cannot be estimated.

The Museum of Practical Geology of London was established in eighteen hundred and thirty-five. The Director of the Geological Survey of England, Sir Henry de la Bache, became impressed with the importance of making a collection which should present all the geological features of the kingdom, and specially those of economic geology. He called the attention of the Government to the subject, and met with cordial coöperation. The collections were at first placed in a somewhat obscure locality, but they grew in so surprising a manner, principally by donation, that the present elegant building in Jermyn street was built by the Government for their reception, at a cost of thirty thousand pounds. The collections represent the mineral products of Great Britain and her Colonies. The specimens of marble, porphyry, and other ornamental stones are not only shown in mass, but sculptured into vases, columns, monuments, and even into statuary, by distinguished artists. There are on exhibition models of mines and mining machinery, sections and geological studies. While the clays are shown in their natural and crude state, they are also there transformed into wares both useful and ornamental. All the manufactured products of natural material are shown grouped in such a manner as to be instructive as well as interesting. Like most of the other European Museums it is thrown open free to the public.

Other Museums in London of special importance are: The South Kensington, United Service, Missionaries, Asiatic, Soane, East Indian, Surgeons' College, Geological Society, and National Gallery.

Paris might be justly called a City of Museums; besides those of the Louvre, the following may be mentioned: Museum of the Luxembourg, Museum of Natural History, Museum of Natural Science, Museum of Mineralogy and Geology, Museum or Gallery of Botany, Museum of Comparative Anatomy, Museum of Artillery, Colonial Museum, Gallo Romain, School of Medicine, Museum of French Monuments, Museum of Antiquities Hotel de Cluny, Museum of Medals, Municipal Museum, Museum of Mineralogy at the School of Mines, and others.

The last mentioned Museum occupies thirteen large rooms. The French minerals are arranged by departments in alphabetical succession. A side-room is devoted to the collections made by the Prince Napoleon in Iceland, Greenland, Sweden, Sicily, and other countries. In the geological department may be seen the skeleton of an ichthyosaurus, and the entire set of fossil types of the Paris basin, collected and arranged by Cuvier and Brongniart.

The Museums of the Louvre are so vast and magnificent that no description in place here could convey more than a faint idea of

them. It can only be said that they consist of a number of departments filled with the rarest and most interesting collections, made by France during a period when she was mistress of nearly all the world, and that no expense has been spared by the nation.

The commencement seems to have been the donation of nine hundred books by Charles V. In seventeen hundred and ninety-three the pictures, statues, vases, etc., formerly kept in the palaces, were deposited in the old Louvre, and the Museum was opened to the public in August of that year. In eighteen hundred and three, by order of Napoleon, the present Museums were planned, and the great staircases built. All the objects of art and the curiosities taken from conquered nations found a place here. During the years of its existence many collections have been received by donations, the value of which can hardly be expressed. The Louvre and its precious contents have suffered much at the hands of the French people during the numerous revolutions, yet it is now one of the grandest Museums in the world.

The following is a partial list of the departments of the Museum of the Louvre: Museum of Egyptian Antiquities, Museum of Pictures, Museum of Drawing, Museum of Sovereigns, containing a collection of all the precious articles owned by the Sovereigns of France; Museum of Spanish Antiques; Museum of Greece and Egypt, Naval Museum, and the Algerian Museum.

Great attention has been paid to Museums in Rome. In the days of her power, conquered countries were forced to contribute to the Museums of the Eternal City, then in their infancy. In succeeding years they have grown until now they stand unequaled in the world. They are specially rich in works of art, both ancient and modern—in which department those of England and the United States cannot hope to compare.

The following is a partial list of them, the first five having a place in the Vatican: Museo Pio Clementino, which is the nucleus of the great Vatican Museum; Museo Chiarmonti, divided into thirty sections, and containing seven hundred marble sculptures; Museo Gregoriano, mostly Etruscan antiquities, founded by Gregory XVI, in eighteen hundred and thirty-six, contained in twelve rooms; Egyptian Museum; Museum of Christian Antiquities; Museo Gregorianum Lateranense; Museo Italico, newly instituted; Museo Lapidario, devoted to inscriptions only; Museo Kircheriano, founded by Kircher in the last century; Museo Mediœvale, products of Italian handicraft; Captoline, ancient Rome, founded by Innocent X. Many rare things were taken from this Muesum by the French, but were returned to Pius VII; Christian Museum, ancient Rome, founded by Pius IX.

The American Museum of Natural History in Central Park, New York, organized in eighteen hundred and sixty-nine, has, through the munificence of private citizens and liberal acts of the State Legislature, become one of the finest in the world in its special line. The aid received from private citizens is something remarkable. One hundred and seventy-five prominent men of New York, whose names appear in the reports, contributed over two hundred thousand dollars towards the establishment of this institution. An Act of the Legislature provided for the erection of a Museum building, to cost at least five hundred thousand dollars, and donated all the duplicate specimens belonging to the State. There have been

many very valuable private collections donated and others bought, sixty-five thousand dollars being paid for the collection of Professor Hall, for years State Geologist of New York.

It is not the intention to give here a catalogue of all the great collections of the world, but to call attention to their importance, and to the fact that the institution of Museums is universal in foreign countries, and that one of the principal reasons why our young people are sent abroad for higher education is because of the facilities offered by the Museums of the great cities of Europe. This subject is attracting the attention of Americans, and nearly all our larger cities have made a commencement, while the taste for private collections is becoming widespread. In this we are simply repeating what has been done elsewhere, history showing that nearly all the great collections in the world had their origin in a nucleus, the life work of some individual.

The Pacific Coast cannot expect for many years to vie with the great Museums of the old world, nor would it be wise to attempt it, but we can at least lay the foundation for future superstructure. Our Museum should in time become a depository for everything historical and statistical in the State. Duplicates that accumulate should be used for exchanges, and for the public schools of the State for educational purposes.

Where it is not possible to obtain original specimens, it would be well to represent them by casts, which now may be purchased cheaply. At the end of each year a complete catalogue of the specimens acquired should be published, to be supplemented by others annually. To make this plan effective the number once given to a specimen or volume should never be changed.

PROSPECTING,

As understood in California, is simply searching for deposits of the precious metals. It dates back to the earliest history, hammers of stone, and gads, and wedges of copper being found in ancient mines in Siberia, and in mines probably still more ancient at Lake Superior.

From the first discovery of gold in California to the present time, the spirit of adventure which brought the early gold hunters to the Pacific Coast has led them to explore unknown portions of the country in search of more extensive and valuable deposits of the precious metals. Successive years of wild life, and the mountain freedom of California, has had the effect on some natures to cause a thirst for adventure to the extent that nothing but death can hold them in check. To this class of men the world is mainly indebted for the wonderful development of our State. To them belongs the credit of discovering the Comstock lode in Nevada, and many other mines of silver and gold in California and neighboring States and Territories. No danger appals them; no hardship or privation is ever too great for them to brave. At the time of the discovery of the Comstock the excitement extended to all classes, and the wildest speculation was regarded as a legitimate business operation. While the excitement led to the most astonishing development of the country at large, it proved ruinous to individuals, except in a few cases, not from any fault of the mines, but from ignorance and inexperience of those engaged in working them; still through the agency

of the prospectors it has been proved that the whole country abounds in mineral wealth beyond the power of the present generation to realize. From the Mexican boundary to the most northern point possessed by the United States, the most remarkable discoveries have been made.

There are two ways of prospecting, which differ as to the modes or methods practiced. One is the examination of alluvial deposits to ascertain if they contain gold, and if so, whether the metal is in sufficiently large quantities to pay for working; the other is the search for mineral veins, and when found, making such tests as will determine their value.

The usual mode of prospecting for placer gold is to dig a hole like a shallow well in a gulch, or bed of a stream. If the "bed-rock" is reached the chances of finding gold are considered much better than when sinking in the alluvial deposits which overlie the rock formations. At intervals, as the work progresses, a sheet-iron pan, much like an ordinary milk pan in shape, is filled with the earth and taken to the nearest stream. The prospector sits at the edge of the water, and taking the pan in both hands sinks it slowly beneath the surface of the water; lifting it, now full to the brim, he carefully breaks the lumps with his fingers and stirs the muddy mass until the water has sufficiently softened it, then sinks the pan again beneath the water, giving to it an oscillating motion, with care lest any of the heavier matters escape. A large portion of the muddy impurity flows over the edge of the pan. What remains can be examined more carefully. It generally occurs that a quantity of pebbles and fragments of rocks are found in the pan. These are carefully washed and as carefully examined. It is at this stage that lumps of gold called "*nuggets*" are occasionally found, a much more frequent accident in the palmy days of placer mining in California than at present. If an examination of the pebbles shows them to be worthless they are raked out with the fingers and thrown aside. This operation is continued until but a small residue remains in the pan, consisting mainly of magnetic sand from disintegrated volcanic rocks of former ages. This is sometimes removed with a magnet while still under water, but usually the washing is very carefully continued until the gold begins to appear, when it is dried in the pan, the black sand removed with the magnet, and the gold examined. In ordinary prospecting the skillful miner so agitates the contents of the pan in the last stage of the operation as to cause the sand slowly to recede over the bottom, and the precious metal to appear as a golden fringe, rendered more distinctly visible by the dark contrast of the magnetic residue. If a single particle of gold remains in the pan the prospector says that he has found "the color;" if more, the value is expressed in cents to the pan. Five cents to the pan is considered a good prospect in placer mining, while some hydraulic mines are profitable at four cents to the ton.

It is the delight of the prospector to roam over the mountains and hills in search of new mines, guided either by reports of rich discoveries or by surface indications which would escape the notice of the casual observer. He is ready to brave any danger, and actually enjoys the narrowest possible escapes from death from the excitement they afford. In skirting the hills, he looks for "*float*," by which may be understood fragments of the rocky formations lying on the hillsides above, or along the watercourses, and which have

been brought down by various causes to the lower levels. He examines the croppings, ascending by degrees, until the vein or ledge is reached. If the examination is satisfactory, he builds a rough monument of stones upon the discovery and places his notice of location, which will hold the claim as long as he complies with the mining laws. It is remarkable how all classes respect these monuments, and how seldom they are disturbed. A man who would steal a horse without hesitation will turn sorrowfully from a rich mine protected only by a pile of stones and a dirty piece of paper.

Quartz veins generally "*crop out*" in well marked ledges, usually presenting a wall of barren white quartz. It is quite an unusual thing to find rich rock at the surface. A prospect hole is usually sunk on the foot-wall, if the vein is inclined. If there is a clay seam or "*gouge*" near the wall, the chances are better for a good mine. All indications of copper, iron stain, sulphurets, gossan, pyrites, galena, or other minerals, are closely examined. When the sinking has been extended to a few feet, samples of the rock are broken from the ledge and prospected for gold, which is generally done in a horn spoon, sometimes in a miner's pan, less frequently on the blade of a common shovel, and still less frequently in a "*batea*," although the latter is by far the most effective, but is not so generally understood by miners. The horn spoon is a long shallow trough cut in a peculiar manner from a large ox horn.

The rock is crushed by pounding in an iron mortar or grinding on a flat stone with a muller of granite or other hard rock; when fine enough, it is placed in the horn spoon and taken to a convenient pool or stream of water, and carefully washed down in such a manner that the lighter particles flow over the edges of the spoon with the water. This operation is continued until but a small residue remains, consisting generally of pyrites, galena, and other sulphurets, iron from the mortar, and gold, if there is any in the rock. The quantity of gold is usually small, even if the quartz is rich.

Prospectors become extremely skillful in this operation, and can judge by the result what the rock may be expected to pay in a quartz mill. Some quartz is rich, in which no gold can be seen by the eye, but the use of the horn spoon reveals it with rapidity and certainty if the gold is free. Here the ability of the prospectors to judge of the nature and value of the ores they discover generally ceases, and they are compelled to call in the assistance of the assayer, if the ores contain other minerals than gold.

Prospectors of the second class seldom work the mines they discover. When prospected to a certain extent they generally seek a purchaser for their claims, which are sometimes bonded to allow the purchaser time to examine and prove them. The bond gives the control of the mine to the intended buyer for a certain time, with the privilege of purchase at a price agreed upon. In case he declines, the work done reverts to the owner. Some bonds require the payment of a forfeit in advance, while others do not. The bond amounts to a written agreement between the parties, the conditions of which vary according to circumstances.

When gold was discovered in California it was assumed that being a gold country nothing else was worth seeking. It soon began to be observed that coarse gold was found high in the foothills, while that in lower levels was in finer dust; this led to the belief in some great natural storehouse high in the snowy mountains from which the

scattered particles had strayed. It was this idea that led to the swarming of prospectors over the mountains, and the discovery of the noted gold and silver mines in this and neighboring States and Territories. It is well known that the croppings of the Comstock were first worked for gold, and that the rich black sulphurets of silver were considered an annoyance in the rockers and sluices, and for a time were thrown out as useless. It has long been known that the fineness of gold in California varies in different localities, but no special significance was attached to this circumstance until lately, when it has been noticed that gold is more alloyed with silver where mines of that metal exist, and that the discovery of silver mines may reasonably be expected where this pale gold or electrum is found on the surface. The following paper, by Henry G. Hanks and Melville Attwood, bearing on this subject, was read before the Microscopical Society of San Francisco:

PAPER ON THE OCCURRENCE OF ELECTRUM IN CALIFORNIA.

It is a well known fact that the gold in California is argentiferous. Formerly the average fineness was 885, but it is not now so high. The record of the assay of several millions of dollars worth of California gold at the Philadelphia Mint showed an average of 880, the sample lots having a range between 870 and 890.

There is a region of country, lying partly in California and partly in Nevada, in which the gold contains an unusually large quantity of silver. At Aurora, in Esmeralda County, Nevada, the gold is of this nature. During several years' mining in that locality, no true silver minerals, that could be distinguished as such, have been noticed. A blue stain in the rock has, we think, never been examined microscopically or chemically. Most of the rich rock was "peppered" with pale gold, and most of the bullion came from this source.

Many years ago a specimen of white quartz from the Jeff. Davis mine, situated near Millerton, in Fresno County, was exhibited, in which a quantity of very pale native gold was imbedded. One of the writers was so impressed with this discovery that he predicted the finding of silver mines in the vicinity, and has never seen any reason to change his opinion. This occurred before the Comstock was known.

A number of specimens of the veinstones from the Bodie mines having been presented to us, and as the argentiferous gold in them appeared to be crystalline and filiform, differing in so many respects from the native alloy of the Comstock lode, although apparently of the same geological age, we were induced jointly to make a thorough examination of the interesting mineral.

We first selected, as nearly as possible, an average sample of vein-stone from each of the leading mines, and after carefully pounding them in an agate mortar, the resulting coarse powder was panned in a batea, and the gold freed from the lighter portions of the gangue; the residue was then dried and placed on a clean piece of paper, and with a needle—using at the same time a bull's-eye condenser as a magnifier—all the grains of gold, without any foreign substance adhering to them, were picked out and melted together.

We present the Society with four slides, on each of which is mounted a few grains of the argentiferous alloy. On examining slide No. 1 with a two-inch objective, it will be seen that some of the grains are white enough to be taken for native silver. But a chemical examination proves the argentiferous appearance to be superficial, for if a fragment is heated strongly, or acted on by nitric acid, or cut with a knife, it will assume the pale yellow color peculiar to the alloy.

The Bodie electrum is of a pale yellow color, resembling German silver; has a metallic luster; takes a high polish; is malleable and ductile; its hardness equals 3; it is softer than either a gold or silver American coin, being scratched by both.

Specific gravity, 15.15. Contains gold, 633.4; silver, 364.1; total, 997.5.

Electrum is well known to mineralogists, although it is rather rare—the largest mass of which we can find any record was taken from the mines of Vöröspatak, in Transylvania. It weighed twenty-five pounds, and contained twenty-five per cent. of silver.

Electrum was also well known to the ancients. Pliny, in his great work on Natural History (book 33, chapter 23), describes it as containing silver in varying proportions. "When the silver is one fifth of the ore, it is known as electrum." He also mentions an artificial electrum made by melting together gold and silver. In writing of the properties of electrum, this ancient writer states "that one peculiar advantage of electrum is its superior brilliancy to silver by lamplight." The reader, however, begins to lose confidence in his judgment when he states seriously that native electrum has the property of detecting poisons; "for, in such a case, semicircles will form on the surface of the goblet, and emit a crackling noise like that of a flame, thus giving a two-fold indication of the presence of poison."

Electrum is known from California to Cape Horn, among miners of Spanish descent, as "*oroche*," which fact would indicate that this mineral is not uncommon on the American Continent. The gold of Chili ranges in fineness from 840 to 960.

The following analyses of electrum are from Dana's Mineralogy:

	Gold.	Silver.
Barbara Transylvania	645.2	354.8
Vöröspatak Transylvania	604.9	387.4
Siranovski Altai	609.8	383.8
Schlangenberg Altai	640.0	360.0
Santa Rosa, New Granada	649.3	350.7

The gold of Australia is finer than that of California, the average being 925 and the range from 900 to 960.

Nova Scotia gold is nearly pure.

There seems to be a law governing the fineness of native gold in countries where mines of silver exist, and it may be reasonably expected that in localities where the gold is found to be argentiferous, silver mines may be discovered, if not already known.

The discovery of electrum in Fresno County, already mentioned, would seem to indicate that there is a silver region in California not yet discovered.

SAN FRANCISCO, January 20th, 1879.

QUICKSILVER.

It would be almost impossible to work ores of gold and silver without quicksilver. By a wise provision of nature, that metal is found in the State in the greatest abundance. In fact, by the restless energy of the people of California, it has been over-produced and wasted.

Some effort should be made to produce mercurial preparations for export and home consumption. No serious obstacle that now appears, except perhaps high wages, would prevent the manufacture of vermilion, calomel, corrosive sublimate, and mercurial ointment, for exportation, on a large scale, with profit. Such a result will no doubt follow as the country becomes older and more settled.

The principal mines of quicksilver are enumerated in the following table, compiled from the best authority obtainable, which also shows the production of each for the year 1877, in flasks:

New Almaden	24,079
Redington	9,400
Sulphur Banks	11,303
Guadalupe	6,241
New Idria	6,560
Great Western	5,875
Altoona	1,417
St. Johns	2,000
Oceanic	2,628
California	1,490
Oakland	1,395
Cloverdale	1,300
Sunderland	1,200
Abbott	836
Manhattan	457
Napa Consolidated	2,366
Buckeye	466
Phœnix	250
Great Eastern and Jackson	505
Wall Street	100
Other sources	500
Total	80,368

OFFICIAL REPORT

Of the production of Quicksilver at New Almaden for twenty-seven years and three months.

Dates.	Tons of Ore.		Flasks of Quicksilver	Percentage, Yield	No. of Months.
	Tons.	Pounds.			
July 1, 1850, to June 30, 1851	2,485	717	23,875	36.74	12
July 1, 1851, to June 30, 1852	2,321	1,290	19,921	32.82	12
July 1, 1852, to June 30, 1853	2,419	1,520	18,035	28.50	12
July 1, 1853, to June 30, 1854	3,724		26,325	27.03	12
July 1, 1854, to June 30, 1855	4,554	1,300	31,860	26.75	12
July 1, 1855, to June 30, 1856	5,177	1,200	28,083	20.74	12
July 1, 1856, to June 30, 1857	5,149	1,900	26,002	19.31	12
July 1, 1857, to June 30, 1858	5,498	1,170	29,347	20.41	12
July 1, 1858, to October 31, 1858	1,936	1,085	10,588	20.91	4
November 1, 1858, to January 31, 1861	Closed by injunction.				
February 1, 1861, to January 31, 1862	6,661	1,200	34,765	19.96	12
February 1, 1862, to January 31, 1863	7,640	1,400	40,391	20.22	12
February 1, 1863, to August 31, 1863	3,586	660	19,564	20.86	7
September 1, 1863, to October 31, 1863	1,173		5,520	18.00	2
November 1, 1863, to December 31, 1863	1,179	1,300	4,447	18.65	2
January 1, 1864, to December 31, 1864	11,638	1,600	43,489	13.96	12
January 1, 1865, to December 31, 1865	15,974	400	47,194	11.30	12
January 1, 1866, to December 31, 1866	13,442	1,300	35,150	10.00	12
January 1, 1867, to December 31, 1867	13,011	1,933	24,461	7.19	12
January 1, 1868, to December 31, 1868	14,702	1,530	25,628	6.66	12
January 1, 1869, to December 31, 1869	12,729	175	16,898	5.07	12
January 1, 1870, to December 31, 1870	10,548	1,700	14,423	5.23	12
January 1, 1871, to December 31, 1871	11,017	700	18,568	6.44	12
January 1, 1872, to December 31, 1872	10,708	600	18,574	6.63	12
January 1, 1873, to December 31, 1873	8,665	375	11,042	4.87	12
January 1, 1874, to December 31, 1874	11,727		9,084	2.96	12
January 1, 1875, to December 31, 1875	15,553	200	13,648	3.35	12
January 1, 1876, to December 31, 1876	16,658	950	20,549	4.72	12
January 1, 1877, to December 31, 1877	18,615	1,600	23,996	4.93	12
January 1, 1878, to December 31, 1878	18,472	1,808	15,852	3.28	12
January 1, 1879, to December 31, 1879	27,532	1,135	20,514	2.85	12
January 1, 1880, to November 30, 1880	28,500	450	21,403		11
December, about	2,500		1,600		1
Totals and average	315,508	1,198	699,796	9.09	339

Product of Enriqueta from 1860 to 1863, 10,571 flasks.

Total product of all the mines on the company's property, to 1880, say, 710,368 flasks of 76½ pounds each, or 54,343,152 pounds.

IRON.

Of all the metals known to man, iron is the most generally useful. It has been said that the civilization of a country may be measured by the quantity of iron produced and consumed. While iron is the most useful of metals, it is at the same time the most widely distributed. Although seldom found in a metallic state in nature, it seems to permeate the earth's crust, and appears in many forms. It is one of the constituents of the granites which are considered to be almost the foundation of the earth. It is more abundant as an ingredient in the volcanic rocks, and still more so in mountain masses, beds, stratified deposits, eruptive masses, etc., at many localities on the surface of the earth. It is found in mineral waters, and it circulates in solution in the veins and tissues of plants and animals.

Native iron being extremely rare, being almost wholly, as far as

known, of meteoric origin, we must look to the ores of that metal for our material. These ores occur in rocks of all ages, and are abundant in California at a number of known localities. There are two distinct classes of iron ores that are sought by the smelter: those known as *spathic*, the most important of which is *siderite or carbonate of iron*, and the oxidized ores known as *magnetite, hematite, and limonite.* The latter are the most common in the State. Iron occurs in other forms, combined to a greater or less extent with other substances and metals, as *franklinite, pyrites, titaniferous iron, chrome-iron, magnetic sands*, etc., which have their uses in the arts, but which are not suitable for the production of the metal.

Long ages passed after man appeared on the earth before the use of iron was discovered. That metal has so strong an affinity for oxygen that it does not long remain in a metallic state, and there is nothing in the appearance of the rusty looking oxides that would indicate to the uneducated mind that a valuable metal could be extracted from them. The progress was gradual, as shown by the study of primitive man—from the use of rude stone implements to those of polished stone, then to the era of bronze and copper, followed in comparatively modern times by the use of iron. There can be no doubt that gold and copper were in common use long before iron was known. When that metal was first introduced it was no doubt far more precious than gold. It represented excessive labor, while gold and copper were found in a metallic state, and were easily wrought. The relative value of these metals in early times is illustrated by swords and knives of gold, the edges only being of iron, found in ancient mounds in Denmark, with older implements of the stone age, now preserved in the Museum of Copenhagen.

Manifold are the uses to which iron may be put, from the construction of the hull of a war ship to the tiniest screw in a lady's watch. It can be rolled into sheets as thin as paper, drawn into the finest wire, twisted and woven, rolled into bars that can be tied into knots without breaking. It can be forged and welded, turned into desired shapes in lathes. It takes the polish of a mirror, and it can be melted like water, and cast in quantities weighing many tons. Its salts, and compounds with other substances, have many uses in the arts; that of war is almost dependent upon iron, which has led to the naming many of its salts after Mars, the war god of the ancients. In short, this metal has become almost indispensable to mankind.

There are three kinds of iron in common use: crude cast or pig iron, malleable or bar iron, and steel. The different states of the iron depend principally on the quantity of carbon they contain. Cast iron has the most, and bar iron the least. All iron was formerly smelted by the heat generated by the combustion of wood charcoal. In sixteen hundred and eleven it was discovered that mineral or pit coal could be substituted for charcoal, which revolutionized the iron manufacture. It was not, however, successfully used until one hundred and twenty-four years later. In fifteen hundred and eighty-four the attention of the British Government was called to the threatened destruction of the forests by the use of the wood for making charcoal for iron furnaces. An Act of Parliament was passed, restricting the use of wood for that purpose.

In countries where forest trees are abundant, charcoal is still extensively used for the production of crude iron. In California, for

the time being, this fuel must be used, unless our extensive deposits of petroleum can be utilized for that purpose. In early times, rude and temporary furnaces were used for smelting, but in modern days they have been improved until they have become models of human ingenuity and skill. They now represent large capital. They are costly and complex, and, at the same time, nearly perfect in all their parts, the result of consecutive years of experience and study.

As molten iron comes from the blast furnace, it is formed into rude ingots known as "*pigs*" or "*pig iron.*" In this state it is very hard and impure, and can be put only to limited use. To render it malleable is to purify it of certain objectionable substances, such as sulphur, phosphorus, and, more specially, carbon. This is effected by a process called "puddling," by which nearly all the carbon is oxidized. For this purpose a peculiar furnace is used, called, from the operation, a "puddling furnace," in which the crude iron is subjected to the action of heat, and a blast of atmospheric air so managed that the impurities are eliminated, and by a system of stirring, which is very laborious, the soft iron is aggregated into "puddle balls," which are, while in a semi-molten state, hammered, squeezed, or rolled by heavy machinery until the purified metal becomes homogeneous, and is ready to be drawn into bars or rolled into sheets, as may be required.

In view of the importance to California of a supply of cheap iron of home production, as it is desirable that many idle hands should be employed, and that money sent abroad for what could well be produced in the State, should be retained in the land to circulate among our citizens and impart new life to our waning prosperity, it is interesting to know that at least one of the iron deposits of the State is to be developed, and the question solved as to whether labor and capital in California can and will coöperate to their mutual advantage, and thus institute important iron interests leading to other industries and manufactures, without which the State must recede rather than advance in prosperity and importance.

The deposit alluded to is in Placer County, near Clipper Gap. The property is in the hands of some of California's most enterprising citizens, and what is very important in a work of such magnitude, is backed by ample capital. The furnace and charcoal ovens were nearly complete when visited by the State Mineralogist in October. The furnace is constructed on the most modern and approved plans. No expense has been spared to make it as complete and perfect as possible. It is due to the State Geological Survey, conducted by Professor Whitney, to state here that the information which led to this important result is given in the volume on Geology, folio 284, in the following words:

> The ore crops out on a hillside and forms a mass more than thirty feet thick, of which the longitudinal extent is not known, although it is evidently considerable. It is hematite, perhaps mixed with some limonite, and has not yet been analyzed. It appears, however, to be of excellent quality, and is remarkably pure and free from intermixture with rock. With the present prices of fuel and labor, it is not easy to say how soon California will be able to manufacture her own iron; but this locality is perhaps more favorably situated than any yet discovered in the State for trying the experiment.

This statement, published fifteen years ago, attracted the attention of a gentleman identified with the iron interests, and led to the enterprise above mentioned.

Samples of ores, limestones, fire clays, and other products have been

sent to the State Museum. Analyses of some of the iron ores and limestones will be found in the report of the Chemist.

SALT.

The discovery of salt springs in California may lead to important industries connected with the production and consumption of that very useful mineral. While the State Mineralogist was examining the limestone and marble deposits in Placer County, he was informed of two springs, the waters of which were salt, and although they had been known for many years, no special importance had been attached to them. The information was given too late to admit of one being examined, situated on section thirty, township thirteen north, and range nine east, but a sample was obtained from the other—northwest quarter of section fifteen, township thirteen north, and range eight east, Mount Diablo meridian, an analysis of which, made in the laboratory of the Mining Bureau, has proved to be very interesting.

The water is strongly calcareous. It is filled with mechanical impurity, and has a distinct saline taste. A drop evaporated on a glass slide, under the microscope shows an abundance of characteristic hopper-shaped crystals of salt. An analysis was made from the filtered water, and the amount of salt contained was found to be 1143.6 parts in 100,000. The full analysis is not given here, for the reason that the water was taken from the spring without special care, and can hardly be supposed to be a fair sample. The localities mentioned will be carefully studied, and the results published in full.

It is highly probable that a well sunk at this locality would develop a valuable supply of brine—at all events it is worthy of the experiment. The strength of the water, as shown by analysis, falls far short of that of deep salt wells sunk artificially. But this might be expected, as in its passage upward from an unknown depth, it would be likely to become diluted with fresh surface water. The profitable production of salt from this source is a question of labor, fuel, and transportation. If a brine can be found, by sinking, that may be crystallized and delivered at a market with profit, the work will be continued, otherwise one of two things will follow: either greater economy will be studied and practiced, both in fuel and labor, or the work will be abandoned, to be resumed when conditions are more favorable. Salt is already manufactured in the State, generally from sea water, and it may be that at the present time this new source cannot compete with the old; yet in New York, which also has a seacoast, the salt wells of the interior counties have been worked with profit for many years, and will, no doubt, continue to be for many to come.

The following figures, from the geological surveys of that State, will show the importance of this industry: At the Onondaga Salt Works alone, the quantity of salt inspected in sixteen years, from eighteen hundred and twenty-six to eighteen hundred and forty-one, inclusive, was 30,127,837 bushels. In eighteen hundred and sixty-two the salt production of the State was 9,053,847 bushels, and the annual average since that date is estimated at 8,000,000 bushels. The State claims all the salines and leases them, collecting a royalty of one cent on each bushel of salt produced. A State Inspector is appointed, whose duty it is to report the product and to stamp on the packages the quality.

Extensive salt works are in operation in West Virginia, Kentucky, Michigan, Indiana, Missouri, Pennsylvania, and other States. In Michigan, attempts made to utilize the salt springs were at first unsuccessful; so important, however, was the matter considered, that the Legislature offered a premium of ten cents per bushel on all salt produced in the State. Michigan is now second only to New York in the production of salt.

There are three different methods of manufacture, as practiced in New York and other salt-producing States: First, boiling in kettles; second, solar evaporation; and third, evaporation in shallow pans by artificial heat. In the first method the kettles are of iron of a capacity of one hundred gallons, set in brickwork in such a manner that one furnace supplies heat to a number. The kettles are filled with brine, which is kept in a state of violent ebullition. Lime salts first form, which are removed from time to time with suitable ladles, and the operation continued until the resulting salt is nearly dry, when it is removed, drained from the mother liquor, and fully dried. Solar evaporation is effected in shallow wooden vats, built in pairs, one on a higher level than the other. The brine is conducted from the wells to the upper set through wooden pipes, where it remains exposed to the heat of the sun until some of the foreign matters fall, when it is drawn off into the lower set in which the salt, now comparatively pure, crystallizes out. By the third method the brines are evaporated in shallow iron pans, heated either by an open fire or by steam coils.

There are many ways of economizing in the manufacture of salt, the result of the experience of those engaged in its manufacture, in our own country and elsewhere, which would not immediately occur to those new in the business, such as pumping brines by windmills, and partly condensing by the action of a current of air, by which method the brines are pumped to a certain level and caused to fall in showers on faggots of small branches, by which the liquid is broken and divided in contact with the air, becoming rapidly and economically concentrated.

Salt wells are very stable in their nature. One in New York has been pumped for more than forty years without the strength of the brines decreasing.

TIN

Is comparatively a rare metal—it was used in prehistoric ages. It is supposed the ancient people obtained their supply from the Cornish mines. In later times the same mines were worked by Augustus, the Roman Emperor, and they are not yet exhausted. The island of Banca also produces tin in very large quantities, and it is well known that Mexico has deposits likely to be opened to the world at any time. The mines of Banca were discovered in the year seventeen hundred and ninety-nine. This metal was found in Victoria, Australia, in eighteen hundred and fifty-three, by the Rev. W. B. Clarke, a celebrated Australian geologist. It was afterwards discovered in New South Wales, in the New England Pastoral District, and still later in Queensland. Mr. J. Gregory reported to the Queensland Government that having measured one hundred and seventy miles of creeks and river beds, he found, on calculating the value as carefully as possible, of the stream tin alone, without estimating the veins known to exist, that it amounted to the large sum of 13,000,000

pounds sterling. At the Paris Exposition of eighteen hundred and seventy-eight the colonies of New South Wales and Queensland had on exhibition piles of tin bars laid up like cordwood.

The following table of tin ore and metallic tin exported from Victoria during five years, will show the magnitude of this interest:

1870	237,294
1871	255,891
1872	282,105
1873	305,886
1874	325,847
Total, pounds sterling	1,407,023

It is well known that veins of rich tin ore exist in San Bernardino County, in this State. Although tin may have been over produced in Australia, it does not follow that the valuable deposits in our own State should not be turned to account.

CHROMIC IRON

Abounds in California. It has been exported in the crude state in large quantities for consumption abroad. It is purchased by those whose interest it is to obtain it at the lowest possible price. This mineral is becoming scarce at other localities, and the world must look to a great extent to our State for its supply. While we gain some revenue from the shipment of the crude mineral, the State would be still more benefited if some of our idle men were employed in its manufacture. It will not of course pay to import potash salts at the present time to combine with it, and again pay freight to a market, but there seems to be no reason why the chromates of lime, and lead, and the sesquioxide of chromium, may not be produced to advantage in California.

BUILDING MATERIALS.

It has been wisely said that " time seldom spares what it does not take time to create." While the necessity of improvising a new city from the materials at hand, in certain cases, is admitted, it is equally true that such a policy long continued would be unwise in the extreme.

When an intelligent person walks through the streets of our principal city and sees the wretched condition of the sidewalks and the makeshift houses rapidly falling into decay, he must be impressed with the thought that the time has come for a radical change in the manner of building, in the materials used, and in the care and management of the streets themselves. There are encouraging indications of the dawn of a new era, the flimsily built short lived wooden shells, although elegant and even architectural and grand in appearance both inwardly and outwardly, rendered so by a profusion of redwood carving and paint, will not much longer satisfy the people of California. Did not the good sense of our citizens cause them to realize the costly mistakes made in building, the change referred to must still come sooner or later, as the forests of California are being destroyed in the most extravagant and wasteful manner. Those causing this wholesale destruction seem to have wholly lost sight of the fact that while it takes but a few hours at

most to fell the largest tree, nature expended many years in producing it, and the same time must elapse, all conditions being equal, before it can be replaced. It has been said, in illustration of the extravagant ways of our people, that a Californian in want of a pick handle will cut down a noble tree that would furnish many cords of wood or yield sufficient lumber to build a large house, and having satisfied the demand for the pick handle, will leave the fallen tree to decay without a regret.

In most countries special officers or commissioners are appointed, whose duty it is to collect statistics of the forest lands, and to give information as to the best plan to utilize the timber without waste, and to encourage the planting of trees. The United States has not been backward in this duty. The Agricultural Department has given much attention to the very important subject, and has warned the people of the different States of the evil of thus thoughtlessly destroying the forest trees. The State Legislature of California has enacted laws aiming to abate this abuse, but has not, perhaps, attached sufficient importance to the subject. R. W. Raymond, in his report on mines and mining for eighteen hundred and seventy, calls special attention to the waste of timber on the Pacific Coast. There really seems to be danger of a wood famine within a few years, unless other building materials are substituted for lumber, and a larger supply of coal is discovered.

In view of the danger of fire that menaces our wooden cities, it is worth while to turn our attention to fireproof materials with which to rebuild the cheap and ephemeral structures, or to replace those which will certainly be swept away like tinder when circumstances combine to kindle an unusual conflagration. It is not only possible but easy to construct absolutely fireproof buildings, and the materials are plentiful in the State.

The natural building stones of the State may be classified as granites, syenites, diorites, porphyries, sandstones, limestones, marbles, serpentines, alabaster, etc., in many varieties of color, texture, strength, and durability. It will be the duty of the Bureau to collect these from all parts of the State, and to make such physical and chemical examinations as will prove their usefulness for building purposes.

Artificial stones have been manufactured to some extent in California, several of our finest buildings having been built wholly, or in part, of them. In our peculiar mild climate they will, in all probability, prove a durable and convenient building material. The mineral substances of which they are constructed may, in most cases, be found in the State.

Concrete is a cheap and very convenient material for the construction of a certain class of buildings, and for portions of others. In preparing concrete, natural sandstone is imitated. Like artificial stones, there are a number of formulæ for mixing the composition; but the chief ingredients are sand, gravel, lime, and cement. The celebrated French "*bèton*" is simply lime and sand, in such proportions, and so mixed, that only the interstices between the sand grains are filled with the lime. When carefully and properly prepared it is durable and useful, and should have a more general application in California.

Cement, claimed to be equal to any made elsewhere, is now manu-

factured in California. This material is used in concretes and mortars, in artificial stones, pavements, sewer pipes, tiles, and in other ways. It is almost indispensable in the construction of first class buildings, and the modes of its application are likely to be multiplied.

Plaster of Paris is quite largely manufactured in the State, but as yet from foreign material. The method of preparing plaster of Paris is to pulverize the natural hydrated sulphate of lime (gypsum), and to heat it in iron kettles until the water of composition is driven off, when it acquires the property of reabsorbing water and becoming again hard and solid. When calcined with alum it makes a harder cement, know as "Keene's cement;" when borax is substituted for alum it becomes "Parian," and with pearlash "Martins." Stucco is plaster of Paris mixed with weak glue. It has many useful applications in building. Plaster of Paris variously colored is extensively used for imitations of marbles and other ornamental stones. It is also used for filling in between floors, for finish of interior walls under the name of "hard finish," and has many minor uses. It is also valuable in its natural state as a manure. A number of deposits of this mineral are known in the State, some of which have been recently discovered, and it is to be hoped that our own material will soon replace the foreign.

Floating Bricks. Among the most useful and convenient building materials are well burned bricks. The want of bricks for the construction of light masonry has led to a number of inventions, among the most prominent of which is the "Jules Borie's hollow brick," described in detail in the Mining and Scientific Press of July twenty-second, eighteen hundred and seventy-six. In the Italian department of the Paris Exposition of eighteen hundred and seventy-eight, floating bricks were shown, made of diatomaceous earth mixed with a small quantity of clay. These fulfill all the requirements of common bricks, yet they are so light as to float on the water like cork. They are fireproof, possess great strength, and power to resist crushing force quite sufficient to render them suitable for the construction of walls, filling in floors, for furnaces, and for nearly all purposes for which ordinary bricks are used. The Italian floating bricks have many advantages over the above mentioned inventions. The idea of light bricks is not new. Pliny, in his work on Natural History, Book 35, Chapter 49, writes: "At Pitane, in Asia, and in the cities of Maxilua and Calentum, in farther Spain, there are bricks which float in the water when dry, the materials being a sort of pumice earth, extremely good for the purpose, when it can be made to unite." For some reason the art was lost. According to Ure's Dictionary, M. Fabbroni made a series of experiments to ascertain the nature of the material used by the ancients. He found that a natural substance called "fossil meal," which is another name for diatomaceous earth, would produce bricks similar in every respect to the ancient manufacture. This earth is plentiful in Tuscany. It is also found in the territories of Sienna, and it is abundant in California. Bricks of diatomaceous earth, mixed with one twentieth of clay, resist water, unite perfectly with lime, suffer no alteration from heat or cold, their strength is nearly equal to that of common brick, and is much greater in proportion to their weight. M. Fabbroni found that a floating brick seven inches long, four and one half broad, and one inch and seven lines in thickness, weighed only fourteen and one half ounces, while a common brick weighed

five pounds six and three quarters ounces. The fireproof nature of these bricks may be realized when we find it stated that one end can be held in the hand, without inconvenience, while the other is red hot. To test the quality of California materials, Messrs. Gladding, McBean & Co. have made a specimen brick from Placer County clay and Monterey diatomaceous earth, which has been placed in the State Museum, and which seems to be in every way equal to those shown at the Paris Exposition. Common brick of the best quality, both pressed and otherwise, are made in California, and clay suitable for their manufacture is found at many localities in the State.

Asphaltum as a building material is useful in a number of ways, for floors, roofs, etc., applied hot and in a semi-liquid state; made into tiles and paving blocks, formed into pipe for water and sewage; when dissolved in turpentine as a paint or varnish which is tough and durable, and specially suited for the protection of iron from rust. It occurs in quantity in some of the southern counties, notably, Santa Clara, San Luis Obispo, Santa Barbara, Los Angeles, and San Diego. At the Los Angeles locality the liquid bitumen oozes from the shales and shaly limestones, while at most other known localities the action has either ceased or is hidden beneath the indurated overflow. Asphaltum from California localities is not only used to considerable extent in the larger cities of the State, but inquiries have been made from abroad with a view to its exportation. The following is the result of a mechanical analysis of a sample from Santa Barbara County: Specific gravity, 1.30; bitumen-volatile portion, 35; bitumen fixed portion, 7.2; quartz sand, 57.8—100.

It melts at a low temperature, at a higher heat it burns with a yellow flame and a dense black smoke. All the bituminous matter is soluble in ether and in spirits of turpentine, forming the excellent black varnish before mentioned; under the microscope the insoluble portion or residue is seen to be ordinary sand of the desert, and is no doubt blown over the thickening bitumen that flows from a subterranean source and is absorbed. It is evidently a mechanical mixture formed after the liquid asphalt exudes from the ground. In San Francisco asphaltum is heated in large kettles, gravel or sand added, and generally a certain portion of coal tar. There seems to be no system or rule by which the quantity of foreign substances is added. In France the manipulation is brought to a science. There are two kinds of asphalt used in France, one a natural rock and the other an artificial preparation called "mastic of asphalt," both of which are extensively applied to roads and for building purposes. The natural rock is a limestone which is impregnated with bitumen, the specific gravity of which is 2.23. The composition of this rock is from seven to eight per cent. of bitumen to ninety-two to ninety-three per cent. of limestone. This rock has the property of falling into a powder at a temperature of one hundred and eighty degrees, in which state it is used in construction. It is first laid loosely where required, tamped lightly, and then smoothed with a hot iron. If powdered limestone should be added to our asphaltum until the above proportions were obtained, it might be used in the same manner, which is very convenient. It will be seen by comparing the above figures that California asphaltum is much richer than French. One ton of ours would make more than five of theirs. If experiments were made, some important improvements would follow, and the usefulness of the article greatly increased. In view of the fact that

asphaltum is yearly being more extensively used in building, these deposits promise to be of great value, and will add materially to the resources of the State.

Lime, so generally useful, not only for building, but for many other purposes, is now wholly manufactured in the State. The supply is unlimited. Some of the quarries that furnish the limestone to the kilns, yield also marbles, which, either in the rough, or cut and polished, are well suited for building purposes. At one locality in Placer County is found a beautiful white marble, some of which has been sent to San Francisco to be used for the production of carbonic acid in the manufacture of artificial mineral waters. It is the intention in a future report to give a full description of these deposits, and to publish statistics of the lime interests of the State, with such analysis as may be considered of general interest.

Iron is used in construction, not only as a durable and ornamental exterior, but for girders, posts, store fronts, cornices, caps and sills of doors and windows, and as nails, screws, brads, locks, hinges, etc. It has already been stated that the ores of this metal are abundant in California.

Glass is an artificial silicate of soda or potash, to which other substances are added, all of them mineral, to produce varieties of quality, color, or appearance. The following are the most important: Lead, bismuth, zinc, iron, manganese, copper, uranium, gold, tin, antimony, chromium, alumina, silver, cobalt, borax, strontia, baryta, fluor spar, and cryolite. The foundation of glass is silica, generally supplied in the form of quartz sand, but sometimes quartz rocks, flint, etc., are pulverized for that purpose. The tailings of some of our quartz mills are nearly pure silica; if not wholly free from metallic impurities they could probably be rendered so by careful washing. The more common varieties of glass are already manufactured in California, which will doubtless increase until the home demand is supplied. It has been difficult to obtain sand on the Pacific Coast for the finer manufacture of glass, that is, fully up to the requirements of the glassmaker. This difficulty will probably disappear when more careful trials are made of the beautiful white sands of the State, without the prejudice that seems to warp the judgment of workmen accustomed to the use of material from a particular locality, and who are inclined to attribute any fault in the product to the new.

Tile stones are natural slabs of sandstone or other sedimentary rocks, useful for cellar floors, coping of brick walls, tops of parapets, etc. Some samples may be seen in the State Museum, from Oil Creek, San Luis Obispo County, and others from a locality near Clipper Gap, in Placer County. Other localities will no doubt be found when wanted.

Roofing Slates. When fireproof buildings become the rule in our cities, slates will be required—and it is a satisfaction to know that it will not be necessary to send out of the State for a supply.

CLAY DEPOSITS OF THE STATE.

The matter of the clay deposits of the State is too important to be put off with a general notice. It will be the duty of the State Mineralogist to thoroughly investigate the known deposits, and to publish all information that can be obtained relating to them and to

their manufacture. Samples from various sources may be seen in the State Museum, with some of the wares, useful and ornamental, of California manufacture. It is to be hoped in the future that more numerous samples, both of the crude clays and their products, will be added to the collection. This material is quite extensively used in building in California, as sewer-pipes, tiles, chimney-tops, fire-brick, and also manufactured into many useful forms. A few analyses have been made, which are given below:

Analysis of Clay from a deposit at Lincoln, Placer County.

MECHANICAL ANALYSIS.

Coarse sand	10.36
Fine sand	10.76
Combined water	10.60
Hygroscopic water	1.00
Pure clay	67.28
	100.00

CHEMICAL ANALYSIS.

Silica	41.80
Alumina	38.78
Combined water	6.00
Hygroscopic water	1.62
Carbonate of lime	2.64
Magnesia	1.02
Soda	3.46
Sesquioxide of iron	2.12
Loss	2.56
	100.00

The above sample is known to the potters as "White Non-plastic Clay."

Analysis of a sample of Clay, from the same locality, known as "Blue Plastic Clay."

MECHANICAL ANALYSIS.

Coarse sand	3.30
Fine sand	28.52
Combined water	10.80
Hygroscopic water	.80
Pure clay	56.58
	100.00

CHEMICAL ANALYSIS.

Silica	44.82
Alumina	34.54
Combined water	8.37
Hygroscopic water	1.27
Carbonate of lime	3.00
Magnesia	.96
Soda	4.74
Sesquioxide of iron	1.86
Loss	.44
	100.00

Mechanical Analysis of Clay from Cook's Ranch, near Lincoln, Placer County.

Coarse sand	5.30
Fine sand	3.77
Hygroscopic water	4.70
Pure clay	86.23
	100.00

This clay was almost free from iron, and was very plastic and tenacious; it had a strong argillaceous smell, and when baked was very refractory. The sand washed out was nearly pure silica, which for coarse ware or for fireproof material is not objectionable.

PLATINUM.

The platinum minerals are found in considerable quantity on the Pacific Coast. If the miners could be persuaded to collect them, an industry might be established of considerable importance. There is no reason why platinum should not be manufactured in San Francisco, and the American demand in part or wholly supplied by this State. The process of manufacture is simple, the plant required inexpensive, and there are skillful chemists in the State fully competent to manage it. The control of the platinum trade is in the hands of a single English manufacturing firm, which has been the case for many years.

BUHR MILLSTONE.

This valuable mineral has been found at several localities in the State; one examined by the State Mineralogist a number of years ago is a small outlier in Owen's River Valley, Inyo County, known as "Little Butte," which is a prominent landmark on the line dividing Russ from Inyo mining districts. It lies partly on section thirteen, township thirteen south, and range thirty-five east; and partly on section eighteen, same township, range thirty-six east. The stone is hard and brecciated, somewhat resembling the celebrated French buhr stone. A sample has been placed in the State Museum. Dr. J. B. Trask, first State Geologist of California, says in his first report, that it is found in great abundance on Pit River—now Modoc County—extending to the north of Goose Lake. The following quotation shows what importance he attached to the discovery:

> Its admirable adaptation to milling requires no comment. The value of this rock cannot be too highly esteemed in this State, where the prospective is so flattering of its becoming a grain growing country equaled by few on the Atlantic slope. The heavy expenses that are now incurred, and the future wants of the State in this particular, will be obviated, and our dependent condition on foreign import destroyed. These rocks have as yet attracted little notice, but the rapidly increasing wants of the State will ere long bring them into requisition.

LOW GRADE ORES.

The day for sudden and enormous yield of gold and silver has in a measure passed, and it is reasonable to anticipate a cooling down of the mining excitement caused by the extraordinary development of the great Comstock vein. Our State must fall back on the legitimate business of careful and economical mining. The experience of other countries has been that mines producing large quantities of low grade ores are more reliable than those yielding a small quantity of high grade, the former proving the best investment. We have been accustomed, in our prosperity, to regard low grade ores with disfavor, but the day will surely come when we must look to them for our supplies. This being admitted, it is a satisfaction to know that the supply in the State is practically unlimited. As an example of what may be expected of the mines of the future, the Rio Tinto mine, of Spain, may be cited. Although this celebrated

mine has been worked at intervals for centuries, and large capital is now invested, at last accounts ores were being worked with profit containing only two per cent. of copper, and others yielding but fourteen pennyweights of silver to the ton.

BLACK SANDS FROM HYDRAULIC AND PLACER MINES.

The tailings from hydraulic and placer mines are an interesting study. It has been difficult to separate the gold from them in many cases, and various theories have been advanced as to the cause. The difficulty seems to be mechanical; the magnetic residue is so nearly of the same specific gravity as the gold that the precious metal is lost by the mechanical force of the water used in concentration. Some of the gold is coated with foreign matters which prevent amalgamation. The following paper on this subject was read before the San Francisco Microscopical Society, at a recent meeting:

RUSTY GOLD,

Is a term applied to placer gold which escapes amalgamation in hydraulic and sluice washing. For many years it has been a common belief among miners that a large proportion of gold passes through the sluices, under-currents, grizzlies, tail-races, and other appliances—coming repeatedly in contact with quicksilver without being arrested by it—and finally escapes. By others, this has been held to be a mistake, and what was believed to be gold, covered with rust, was, in reality, something else. I must admit that I never had much faith in the theory of rusty gold, as I have repeatedly examined samples, claimed to be in that state, which failed to show any abnormal condition. Most of the samples sent to me were from quartz; in all of which cases I found the gold to amalgamate without difficulty. Within a few months I have had my attention called to some placer gold, which has made me a convert to the opinion so often expressed by the miners. I have brought samples this evening for your inspection. They were furnished by Mr. Charles W. Banks, Corresponding Secretary of this society. They are from a large deposit of Feather River tailings, at a locality below Oroville, in Butte County. The following is the result of a chemical and mechanical examination of this interesting material: Under the microscope, the particles have a dark brown color, showing, in some cases, nearly white silica, in irregular, imbedded fragments, forming a compound cement; having, when magnified, the appearance of a conglomerate or breccia. Some of the samples were wholly coated, others only partially so. In some cases the coating was perfectly opaque, hiding the gold from sight, while in others it was semi-transparent, through which the gold was plainly discernible. Placed in mercury, those pieces wholly coated were not acted on; those only partially so, became amalgamated to the extent to which the gold was unprotected. The coating was found to be brittle. When the pieces were turned on their edges and struck lightly with a small hammer, the coating scaled off, leaving the gold bright and clean; after which it amalgamated without difficulty. On boiling some of the rusty gold in hydrochloric acid, the coating was decomposed, silica separating, the acid acquiring a golden yellow color, and giving a strong reaction for iron. The gold was left clean and bright. Six of the particles, boiled in hydrochloric acid, and weighed before and after, in milligrammes, gave the following result:

	Before.	After.	Loss.	Per Cent.
No. 1	126.5	15.0	1.5	1.18
No. 2	28.0	26.5	1.5	5.30
No. 3	40.0	35.8	4.2	10.50
No. 4	25.1	22.3	2.8	11.20
No. 5	18.3	16.8	1.5	8.30
No. 6	33.4	32.7	0.7	2.10

Average percentage of the coating by weight, 6.43.

Mr. George Attwood, son of Melville Attwood, of this society, read a very interesting paper on this subject in July of last year, before the Chemical Society of London. The specimen, or nugget, upon which his experiments were made, was much larger than those I have described—so much so, that the microscope was not required to study the ferruginous coating. This coated gold was obtained personally by Mr. Attwood from the State of Guayana, Venezuela, South America. From the fact that Mr. Attwood found finely divided gold disseminated through the

coating, and attached to the surface of the larger nugget, he came to the conclusion that gold nuggets grow larger from external causes. The following are his own words:

"In conclusion, from the above experiments, made and recorded, on a gold nugget, covered with a glazed ferruginous earth, it would appear to me to prove that gold nuggets do gradually increase in size, owing to the accumulation of fresh particles of freshly precipitated gold."

I am not prepared to venture any theories at the present time, but desire to continue my investigations, with the hope that they may throw some light on this very interesting subject; and as the miners of the Pacific Coast are more directly interested than I am, I do not think it too much to ask them to send, to the Corresponding Secretary of the San Francisco Microscopical Society, small samples of gold for examination, with the promise that the results shall be made public, through the publications of the society.

Mechanical Analysis of a typical sample of California Black Sand.

No. 1, gold separated by amalgamation, and weighed; No. 2, magnetic portion separated by the magnet; No. 3, sand separated by Schultz's apparatus. The remaining portion, No. 4, was dried and weighed, and the sand, No. 3, estimated by loss. At a high temperature, a large portion of this residue became magnetic, and was found to have gained 0.42 per cent. in weight. In heating it decrepitated and became somewhat darker in color. The magnetic portion was removed by the magnet, and the remainder, No. 5, consisting of microscopic crystals and metallic grains was weighed. The percentage of constituents with specific gravity was found to be as follows:

	Percentage.	Specific Gravity.
No. 1, gold	.0003	
No. 2, magnetic portion	16.8125	4.841
No. 3, sand	40.7872	3.185
No. 4, magnetic by heating	23.1504	4.694
No. 5, residue	19.2496	4.557
	100.0000	

The gold, No. 1, was of good color; it amalgamated readily, but the amount was too small to examine critically. No. 2 was a homogeneous black powder, highly magnetic; under the microscope it was found to be rounded masses of a black color, and semi-metallic luster. Some of the particles showed signs of crystallization, but the angles were too much worn to identify. Some well marked octahedrons were observed. Some of the particles had a cellular appearance, in which the cavities were well marked. When ground in an agate mortar, the powder was black; it was infusible alone, gave a greenish glass with borax, was partly soluble in nitro-hydrochloric acid, and was decomposed by fusion with alkaline carbonates, the residue being wholly soluble in hydrochloric acid. No. 3 was the ordinary ocean beach sand, consisting mostly of white and yellowish quartz, with some dark colored particles. No. 4 resembled No. 2 physically, in nearly every particular. No. 5 was by far the most interesting, consisting, for the most part, of microscopic crystals of great beauty, and partly of metallic particles, non-magnetic. Some of the crystals were of a pale yellow color, others were white and red. The red ones were rounded and worn so as to render their crystalline form doubtful. The white and straw colored crystals were perfect on the edges—as well defined as if freshly crystallized from solution. Their hardness may be inferred when it is remembered that all the other particles were rounded; and their specific gravity,

from the fact that they could not be removed by the water in Schultz's apparatus without taking over metallic particles; although they had been subjected to a high temperature, the luster of the crystals had not been impaired.

Examination of Sand from Capella, Mendocino County.

Coarse portion (A) which remained on 60-mesh sieve, black, shining, homogeneous rounded globular masses, with a few pieces of quartz, and some octahedrons, a few red dodecahedral crystals; the largest piece resembled obsidian	22.255	per cent.
Magnetic portion (B) generally dull, some splendid crystals, like the Elba magnetic; a few quartz particles lifted mechanically	5.600	per cent.
Water (C)	0.800	per cent.
Fine sand (D), from which water, coarse portion, and magnetic were removed	71.345	per cent.
	100.000	

The portion (D), consisting, as it does, of zircons, white and yellow quartz, black, non-magnetic particles, and splendent red crystals, the nature of which is doubtful, is an interesting study under the microscope. After removing the magnetic portion (B), the residue was heated to strong redness and again tested with the magnet, but none of the constituents of the sand had become magnetic; when examined again under the microscope it was seen to have remained unchanged, the zircons and red crystals retaining their remarkable brilliancy.

The percentage of constituents was obtained by counting under the microscope, and the mean of several readings taken. The result was as follows:

Zircons	26
Black sand	52
Quartz	20
Red crystals	2
	100

ALKALINE LAKES.

Attention should be given to the alkaline lakes of the State, which contain great stores of chemical salts in solution, which in all probability can be made to furnish large quantities of useful products by simple pumping and evaporation by solar heat. The most important are of Mono and Owen's. Careful examinations of these in particular are planned for the succeeding year. Full analysis will be made of the waters for publication.

EXTENSIVE METALLURGICAL WORKS REQUIRED.

Now that reasoning men begin to regard mining as a legitimate field for the investment of capital, it is well to consider the past, and to utilize experience so dearly bought. If we do so we shall find that we have made many costly mistakes; perhaps the most disastrous has been the premature erection of mills. It is deplorable to see the expensive and finely finished machinery lying useless in many parts of the State. There are but few mines that can be expected to pay on the surface. All should be proved by deep prospecting, and much cool judgment exercised before a mill is built. This mistake is too

often made in the haste to satisfy stockholders who demand immediate returns for the money invested, or to inflate stocks and give to them a fictitious value. Experience has shown that few mines will warrant the erection of extensive metallurgical works of any kind. It is well known that mineral veins change their character frequently, as depth is attained upon them. For these and other important reasons ores of a complex character should be bought and sold like wheat or other produce, after dressing and concentration—the value to be determined by assay and the price left to competition.

If there could be more large metallurgical works near San Francisco, Sacramento, Los Angeles, and other central points, to which transportation is cheap, a demand for such ores would grow up which would be of great importance to the State. At these works all the various substances in the ores would be utilized, the sulphur saved as such, or made directly into sulphuric acid, to be employed at the same works in various metallurgical operations. The arsenic, copper, lead, bismuth, antimony, zinc, etc., could be extracted, even though present in small quantities. After the pyrites, which is the *bete noir* of the quartz miners, had been treated with chlorine, after utilizing the sulphur; the oxide of iron now generally wasted, could be treated with the surplus acid and made into sulphate of iron, which has many uses, or manufactured by a cheap and simple process into an excellent pigment; the copper present could be recovered as metal or changed into blue-stone. There is no more reason why every mine owner should work his own ores, except in case of free gold, than that the farmer should turn his wheat into flour and bake it all into bread.

There are mines which, under this system, would pay for years to small operators who, selling their ores, would have capital to work their mines on a larger scale, while mines more doubtful might by this plan be so developed as to become worthy of the investment of capital.

One of the first things that attracts the attention of visitors to the great metallurgical works of Swansea, is the cheap and unpretentious buildings which cover the works, and the economy with which the old material, as fire-bricks, flues, grate-bars, etc., are used over and over again, as long as any wear can be obtained from them. Everything is utilized, and the most painstaking economy observed. All the by-products that can by any possibility be used are turned to account. The experience of such an establishment is worthy of attention.

SUPPLY OF COAL.

The supply of coal in the State is a subject of the greatest importance, and one to which particular attention should be given. The extension of the known area of the carboniferous formation in the State by recent discoveries is an encouraging fact, which may result in important developments.

LITHOLOGY.

There is no branch of geology of which the masses are so generally ignorant as the science of lithology. Mining men, who visit the Museum, more frequently inquire for typical specimens of the rocks, than for any others. As soon as possible a collection of the foreign rocks should be purchased to supply this want. In the meantime a

collection of California rocks has been commenced, and sections will be cut for microscopical study and reference.

ETHNOLOGY.

Every object and all publications bearing on the ethnology of the State should be collected and carefully preserved. Considerable progress has been made in this direction. The Bureau has information of certain caves in the State which may be expected to yield interesting relics.

STATE MANUFACTURES.

Every encouragement should be offered to State manufactures, by giving information to those interested, as to the localities of natural products, and by placing on exhibition samples of manufactured goods of every description produced in the State. This policy has already been commenced, as an inspection of the cases in the Museum will show.