RECENT ACCESSIONS IN THE DIVISION OF APPLIED GEOLOGY.

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Owing to curtailment of imports and the urgent demand for certain unusual mineral products for use in war industries, the recent World War acted as a great stimulant to the mining industry, particularly in connection with what are popularly known as the minor minerals and rare earths. In endeavoring to do its part in the work of aiding production of these highly necessary raw materials, especial effort was made by this department to build up its series, both exhibition and study, of these ores and minerals with which the public was naturally little acquainted. That this effort was successful is shown by the large number of mining men who have visited the museum, both during and since the war, to acquaint themselves with the physical characteristics and associations of many of these uncommon ores. Some of the more important and striking of the materials acquired in this work are described in the following brief summary of the recent growth of the collections of applied geology.

The most notable recent accessions and those of greatest general interest are the ores of the rarer metals, most particularly the so-called minor metals used in steel manufacturing, which include tungsten, molybdenum, vanadium, and, to a less extent, chromium and titanium. These are of the utmost importance in the manufacture of alloy and tool steels which are used in the metal-working industries and are essential in the manufacture of munitions. The growth of the exhibition series of ores of these metals is in large measure due to the personal efforts of Mr. Frank L. Hess, honorary custodian of the collection of rare earths and rare metals. Through his extensive acquaintance with producers both in this country and abroad, Mr. Hess has been able to secure large numbers of exceptionally fine examples, especially of tungsten and molybdenum ores. These are too numerous to be described individually, and only a few of the larger and more striking will be mentioned.

Scheelite, or calcium tungstate, is one of the more important ores of tungsten, and contains, when pure, 80.6 per cent of tungsten trioxide. A specimen recently placed upon exhibition is presumably the largest single mass of this mineral ever mined. This specimen, which is 4 feet 8 inches in length and weighs in excess of 2,600 pounds,

is estimated to contain 30 per cent of tungsten trioxide and had a market value, when mined, of more than $1,650. The specimen which shows the full width of the vein, is from the Union Mine, Atolia, California, and is a gift from the Atolia Mining Co. This district is the largest producer of scheelite ore in the world. When tungsten ore was in greatest demand during the war, operating companies sustained considerable losses through miners stealing small pieces of ore which they sold to illegitimate buyers, it being possible to carry several dollars worth of the high grade ore from the mine in an ordinary dinner pail. A number of excellent smaller specimens of scheelite have also been received from various western mines, especially from various localities in Nevada.

Wolframite, the most important of the ores of tungsten, is a double tungstate of iron and manganese intermediate between ferberite and hubnerite. Many fine specimens of wolframite have recently been received, many being from little known foreign mines. A specimen showing bladed and columnar black wolframite in quartz (Cat. 90, 564) from Eastern Kwangtung Province, China, is a gift from Sir Paul Chater, of Hongkong. A large specimen from Bukuka, 100 versts north of Borza station on the trans-Baikalian Railway, Siberia (Cat. 90657), was received from Mr. C. W. Purington. A large speci men showing wolframite in quartz (Cat. 88989) is from the Kam-Mine, Cochabamba, Bolivia; and Mr. B. Bryan has donated an exceptionally good specimen of wolframite (Cat. 90521) from Easley and Inslee's mine, east of La Paz, Bolivia. Mr. Rafael Taborga, of New York City, has donated a series of 30 specimens (Cat. 90435) from the San Antonio mine, Ponga, Oruro, Bolivia, showing black wolframite in quartz largely altered to beautiful canary yellow tungstite, the native trioxide of tungsten. Another very fine large specimen of wolframite (Cat. 90575) received through Mr. J. Morgan Clements is from the Yamomoto Mine, Ryudo, Chushihoku Province, Korea. Among American wolframites may be mentioned a large exhibition specimen of the pure granular wolframite from near Lead, South Dakota, where this mineral occurs in a unique manner as a bedded replacement of dolomitic limestone. This specimen (Cat. 90586) is from the Hidden Treasure mine and is a gift of the Homestake Mining Co.

The mineral ferberite, the pure iron end member of the wolframite series, is represented in the collection by a complete series of the Boulder County, Colorado, ores, showing all the varieties and associations of both crystallized and massive ferberite ore. One specimen recently received (Cat. 90591) from this district shows ferberite associated with abundant gold tellurides. A specimen of ferberite from near Soldier, Idaho (Cat. 89119), received through Mr. V. C. Heikes, bears a remarkable resemblance to the Colorado ores.

Hubnerite, the manganese end member of the wolframite series, is also well represented by large and fine specimens, especially noteworthy being one from the Tungstonia mine, White Pine County, Nevada (Cat. 90274), and several specimens showing blades up to several inches in length of bronzy hubnerite in white quartz from the Blue Wing District, Lemhi County, Idaho (Cat. 88123). The latter specimens were received from Messrs. C. H. Hussey, M. S. Duffield, and F. L. Woods.

A rare and unique tungsten ore is a large specimen of the newly discovered mineral tungstenite, a tungsten sulphide recently described from the Emma Consolidated mine, at Alta, in Little Cottonwood Canyon, Utah.[1] This specimen (Cat. 90402) is the gift of Mr. William Garrett Ridgley, of New York City. It shows a large mass of the soft gray tungstenite, which resembles fine-grained molybdenite, intimately mixed with pyrite, galena, and tetrahedrite.

The series of tungsten ores exhibited is in all probability the finest and most complete of its kind in the world, and is especially valuable, since it contains all of the types which were recently used as the basis of a profusely illustrated treatise on Tungsten Minerals and Deposits by Mr. Hess.[2]

Molybdenum is a metal which is similar to tungsten in its properties and also in the effect which it has upon the physical properties of steels, with which it is alloyed. Indeed, molybdenum is said to be more efficient than is tungsten for many of the same purposes, but owing to its greater rarity and consequent higher price it is much less generally used. The ores of molybdenum are less numerous than are those of tungsten, the most important being the sulphide, molybdenite, which is a soft scaly gray mineral resembling graphite. Less important ores are molybdite, a hydrous ferric molybdate which occurs as a yellow powder resembling tungstite, and wulfenite, lead molybdate, which forms tabular yellow to orange crystals. The series of molybdenum ores now exhibited is very complete; all varieties of the ores and all important localities are abundantly represented. Among important recent accessions may be mentioned a large specimen of molybdenite from the Climax Molybdenum Co.'s mine, Climax, Colorado (Cat. 90562), and a large amount of unusually pure molybdite (Cat. 90761) from the same locality. Several very large masses of molybdenite were recently received from the R. and S. Molybdenum Co.'s mine in Taos County, New Mexico (Cat. 90738).

Vanadium is another of the metals important in alloy steel manufacture. Perhaps one of the most valuable and unique sets of ores in the exhibition series is the collection of vanadium ores from Minasragra, Peru (Cat. 89897–89905), collected for the museum by Mr.

[1] R. C. Wells and B. S. Butler, Journ. Washington Academy Sci., vol. 7, pp. 596–599, 1917.

[2] Frank L. Hess, U. S. Geological Survey, Bulletin 652, 1917.

D. Foster Hewett. These deposits, as described by Mr. Hewett,[1] consist of veins filled with the hitherto unknown minerals quisqueite, a lustrous black sulphur-bearing hydrocarbon, a natural coke, patronite, a black vanadium sulphide, and bravoite, a nickeliferous variety of pyrite. Near the surface these ores have largely oxidized, yielding secondary vanadium compounds, chief among which are hewettite and pascoite, hydrous calcium vanadates. Fine large specimens of all of the minerals of the ore are included in the exhibition series. Since being preserved in the collections many of the specimens of patronite have become coated with the green sulphate of vanadium minasragite.

A series of vanadium ores (Cat. 90431–90434) from the United States Vanadium Development Co.'s mines near Kelvin, Arizona, donated by Maj. H. S. Bryan, shows crusts of fine red vanadinite and brown to black descloizite coating limestone. Several very large and fine specimens of the vanadiferous sandstone from Colorado have recently been received.

Aside from the steel-making metals, some fine specimens of antimony, bismuth, and rare earth metal ores have been received. Messrs. Root and Simpson, assayers of Denver, Colorado, recently sent to the museum an unusually large and fine specimen of the rare lead sulphostannate cylindrite from Bolivia.

Among recently acquired additions to the saline collections is a series of large specimens of sodium salts from the Pintados Salar, Tarapaca, Chile, collected by Mr. Hoyt S. Gale. This large salt deposit in the Chilean desert consists of an upper hummocky layer of irregular blocks of sodium chloride, the crust having been broken and heaved upward by the crystallizing force of the underlying bed, which consists of thenardite or anhydrous sodium sulphate. Mr. Gale has also contributed some beautifully banded specimens of red and white potassium and sodium chlorides from the Amelie Mine, Alsace. These specimens are very showy and illustrate the seasonal variations in the deposition of the salts.

Among other materials recently received are large numbers of sets of rocks and ores of various American mining districts transferred by the United States Geological Survey. Much material from the Panama-Pacific Exposition has recently been unpacked and found to contain extensive series of Australian, Bolivian, Brazilian, and Japanese ores. A series of Japanese ores and rocks is being prepared for exhibition as a unit. Other series from this material to be placed on exhibition include a set of uranium-vanadium ores from Utah, showing the minerals carnotite, volborthite, and calciovolborthite in sandstone, and a suite of ores from Huitzuco, Mexico, showing the association of stibnite, gypsum, and native sulphur, with the rare mercury ores, livingstonite, barcenite, and ammiolite.

[1] Hewett, D. F., Trans. Amer. Inst. Min. Eng., 1909, p. 291.