THE BOLIVIAN ANDES

A RECORD OF CLIMBING & EXPLORATION IN THE CORDILLERA REAL IN THE YEARS 1898 AND 1900

BY

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APPENDIX

A DESCRIPTION OF THE MINERAL SPECIMENS BROUGHT FROM BOLIVIA BY SIR W. MARTIN CONWAY

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THE forty-six mineral specimens brought from Bolivia by Sir W. Martin Conway were sent to the British Museum for examination and determination; they are now preserved in the collection of the Mineral Department.

Most of the specimens are from a tin and bismuth mine on the mountain of Huaina Potosi near La Paz, and from the silver and tin mines at Oruro. A few other specimens are from the Pulacayo mine near Huanchaca and from Carangas. In the following description the specimens from each of these localities will be taken in turn.

Of special interest are the complicated twin-crystals of stannite; the occurrence of the rare minerals augelite and wolfsbergite at a new locality; the frequent occurrence of andorite; and the association of fluor-spar with Bolivian tin-stone.

1. SPECIMENS FROM HUAINA POTOSI, NEAR LA PAZ

Native Bismuth and *Bismuthite* (Sulphide of bismuth, Bi_2S_3).

These, showing large, bright cleavage surfaces, occur associated together. On some of the specimens bismuthite is associated with cassiterite and pyrites.

APPENDIX

Fluorite (Calcium fluoride, CaF_2. Cubic).

On the most coarsely crystallized specimen of cassiterite, from Chacaltaya, Huaina Potosi, mentioned above, are fairly large crystals of quartz, with limonite, and a group, about 1 cm. across, of corroded crystals of white fluor-spar. The crystals appear to be octahedra, and they have a perfect octahedral cleavage, the cleavage angle being measured as 71° and 109¼°. The specific gravity and hardness are those of fluorite. The material is optically isotropic, and the index of refraction was determined with a cleavage prism to be approximately 1.44. When the material was heated with sulphuric acid, the sides of a glass tube were etched, and crystals of gypsum were observed under the microscope. These details of the determination are given since fluorite is of very rare occurrence in Bolivia, and its association with the tin-stone of this region has been doubted.

II. Specimens from Oruro

The matrix of one or two specimens is an altered volcanic rock or ash with kaolinite and blebs of quartz. On another specimen the matrix is slate, and on another blue clay. Most of the specimens are from the San José mine; from the Tetilla and Atocha mines there is one specimen each.

Augelite (Basic phosphate of aluminium, $AlPO_4$, $Al(OH)_3$. Monoclinic).

The massive mineral from Westanå, Sweden, described in 1868 under the name augelite, and found on analysis to have the chemical composition $AlPO_4$, $Al(OH)_3$, was not considered to be a well-established mineral species until crystals from Bolivia were discovered in 1895.* These crystals were from Machacamarca, near Potosi. More re-

* G. T. Prior and L. J. Spencer, "Augelite," *Mineralogical Magazine*, 1895, vol. xi., p. 16.

cently* crystals of augelite have been found at a second Bolivian locality, namely, in the mines between Tatasi and Potugalete, Department Potosi. The present description of crystals from Oruro adds another to the three localities at which augelite has hitherto been found.

The single specimen from Oruro on which crystals of augelite have been found has the whole of the free surface, measuring about 28 × 23 cm., covered with crystals of augelite, mispickel, quartz, pyrites, and stannite; there are also some kaolinite and minute yellow globules of cervantite(?) incrusting most of the other minerals. It was not possible to determine with certainty the order of formation of these minerals: the quartz, however, clearly belongs to two generations, there being small crystals on the matrix, and very much smaller crystals incrusting most of the other minerals. The matrix of the specimen consists of massive quartz, pyrites, and tetrahedrite. Cavities at the back of the specimen contain crystals of wolfsbergite, andorite, and stannite.

In themselves the crystals of augelite do not differ from those previously described, but the associated minerals are not the same. The well-developed crystals are 2 to 4 mm. across, and are present in large numbers, so that this is by far the best specimen of augelite that has yet been found. The crystals are colorless and transparent, but usually appear to be yellow and opaque, owing to the surface incrustation of cervantite(?). In habit they are tabular parallel to the basal plane c (001); the forms m (110) and x ($\bar{1}01$) are also largely developed (Fig. 2, p. 351). Five crystals were measured on the goniometer, but the only other forms observed were n (112) and o ($\bar{1}12$), which are rarely present as narrow faces. The cleavages, angular measurements, specific gravity, and optical characters of the crystals are in agreement with previous descriptions, and need not, therefore, be given in detail.

* L. J. Spencer, "Augelite from a New Locality in Bolivia," *Mineralogical Magazine*, 1898, vol. xii., p. 1.

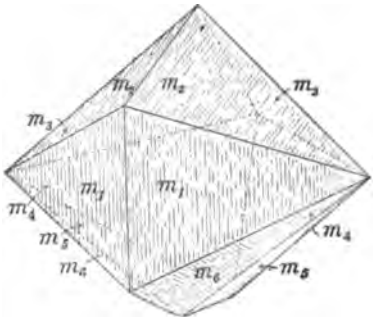

FIG. 1

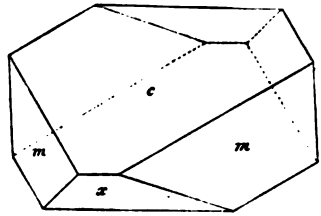

FIG. 2

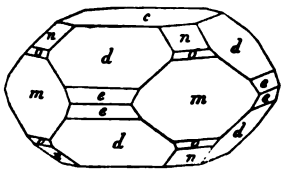

FIG. 3

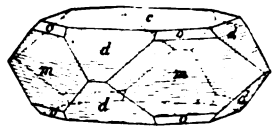

FIG. 4

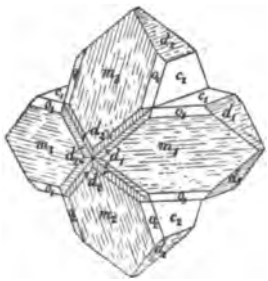

FIG. 5

FIG. 6

L. J. SPENCER *del.*

EXPLANATION OF PLATE

Fig. 1. Cassiterite from Chacaltaya, Huaina Potosi. Six crystals twinned, together producing a pseudo-hexagonal bipyramid. The only form present is *m* (110). (Page 344.)

Fig. 2. Augelite from Oruro. Forms: *c* (001), *m* (110), *x* (101). (Page 346.)

Fig. 3. Stannite from San José Mine, Oruro. Simple tetragonal crystal with the forms *c* (001), *m* (110), *d* (101), *n* (112), *o* (111), *e* (201). (Page 349.)

Fig. 4. Do. Simple tetragonal crystal with the forms *c* (001), *m* (110), *d* (101), *o* (111).

Fig. 5. Do. Two interpenetrating crystals, like Fig. 4, twinned on (011).

Fig. 6. Do. Three interpenetrating crystals, like Fig. 4, twinned on (011) and (101), producing a pseudo-cubic crystal. (Pages 350, 352, 353.)