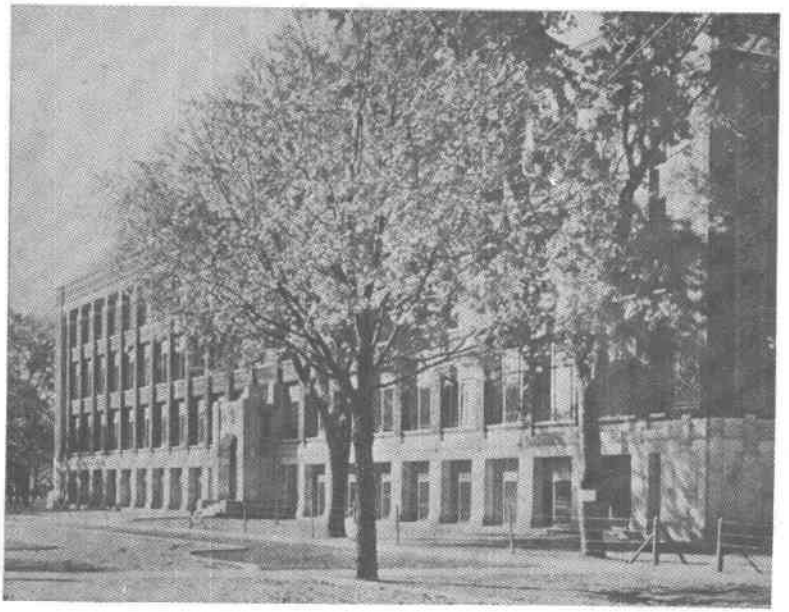

FIG. 1. The Natural Science Building.

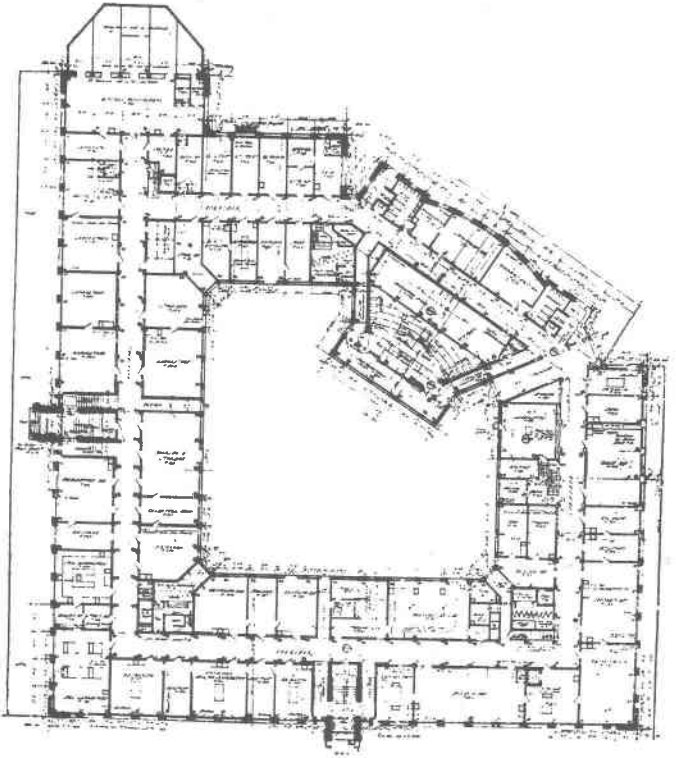

FIG. 2. Plan of ground floor of Natural Science Building.

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THE NEW MINERALOGICAL LABORATORY AT THE UNIVERSITY OF MICHIGAN

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The preëminent position of the United States in the production of minerals and mineral products, and the vastness of our mineral resources, have been brought forcibly to the attention of the general public by the war. Further, the application of petrographic-optical methods to the solving of special problems imposed by the war, for example in the production of optical glass and the developing of spark plugs to meet the exacting requirements of airplane service, to mention only two cases, has also served to stimulate interest in the study of minerals and the methods devised by mineralogists and petrographers. Chemists, physicists, ceramists, and engineers have come to realize that in many fields of human endeavor a knowledge of mineralogy is absolutely indispensable. Hence, it is reasonable to assume that mineralogy and allied subjects will gain in favor with college students as fields offering unexcelled opportunities for men of scholarly instincts both on account of the many purely scientific problems to be solved, and because of the diversified applications of mineralogical methods to be made in commerce and industry. It therefore appears that a series of articles describing the facilities for instruction in mineralogy and cognate subjects at the various institutions of higher education in America is fully justified, for the time is at hand when we must make every effort to assume leadership in this important field. The present article describes the Mineralogical Laboratory recently completed at the University of Michigan, and the development of the subject at that institution. It is hoped that similar articles descriptive of the facilities for the teaching of mineralogy at other institutions may be published in due time.

One of the first purchases authorized by the board of regents of the University of Michigan, founded March 18, 1837, was that of the well-selected collection of minerals then owned by

Baron L. Lederer of New York City. This collection contained twenty-six hundred specimens, mostly from foreign localities. It became the property of the University early in 1838, and later Baron Lederer augmented it by a gift of many exceedingly desirable specimens. Thus, when the institution was formally opened for instruction in 1841, a mineral collection of approximately five thousand entries was available. From that time on, the acquisition of minerals and rocks has been constant, thru purchase and gift, so that the various collections now aggregate approximately forty thousand specimens.

From the beginning of the University, the teaching staff has always included someone competent to offer courses in mineralogy, altho for many years mineralogy was not an independent department, but was affiliated with chemistry. In 1838 the distinguished scientist, Douglass Houghton, was appointed professor of chemistry and mineralogy, which position he held until 1845, altho he never gave instruction in either subject. The first actual work in mineralogy was given by Dr. Silas H. Douglas, who was professor of chemistry, mineralogy and geology, from 1846 until the early seventies. During this period the importance of the subject had grown to such proportions that late in the seventies a separate department was created with Professor W. H. Pettee in charge, and he continued to give all the instruction in mineralogy until the time of his death in 1904.

In the early days of the University, the collections were housed at various times in different buildings, until the completion of the museum building in 1881, when approximately one half of the main floor was devoted to the mineralogical collections. With the rapid growth of the university during the nineties it became necessary to use the museum for general instructional purposes and consequently the mineral collections were removed to Tappan Hall, where they remained, for the most part inaccessible to the public or the student body in general, until the completion of the Natural Science Building in 1915.

Over twenty-five years ago it became apparent that the natural sciences were rapidly outgrowing their quarters, and repeated efforts were made to obtain more suitable laboratory facilities. These were all unsuccessful. In the spring of 1913, however, the state legislature appropriated $375,000 for a building to house the following departments: botany, forestry, geology, mineralogy, psychology, and zoölogy. Various committees

were authorized to visit important institutions east and west, and to make an exhaustive study of the best available methods and facilities for instruction in the several subjects concerned. These committees were always accompanied by the architect, Mr. Albert Kahn of Detroit, who was thus enabled to secure first-hand information concerning the needs of the building. Each department was requested to submit to Mr. Kahn an outline of its needs and to indicate what its staff considered an ideal arrangement of the floor space to be allotted to it. Mr. Kahn and his associates succeeded to a remarkable extent in incorporating in the final plans most of the suggestions thus made.

The construction of the building was begun in the spring of 1914, and it was ready for occupancy in the fall of the following year. Reinforced concrete construction, similar to that employed in modern factories, forms the basis of the building. Dark red tapestry brick, simple patterns in terra cotta, Berea sandstone, and Bedford limestone, have all been used to good effect in producing a simple but rather pleasing exterior. (See Frontispiece, Fig. 1.) One of the chief aims in mind in designing the building was to secure a maximum amount of floor space and light, even tho exterior appearance might have to be sacrificed. Utility was placed above architectural beauty.

The building is absolutely fireproof. Every office or laboratory is exactly the width of the space between the piers, or multiples of that space. The entire space between piers is glass, thus affording a flood of light at one end of each room. This is a departure from ordinary laboratory design, but it meets the requirements of laboratory instruction so admirably that it undoubtedly will influence the design of many laboratory buildings in the future. This building is the largest on the university campus, its extreme dimensions being 74.06 m. (243 ft.) by 79.86 m. (262 ft.). It contains about 14,400 sq. meters (155,000 sq. ft.) of floor space, distributed among 270 rooms. The plan of the first or ground floor is shown in Fig. 2. Each of the six departments in the building has been assigned a section from the ground floor to the roof rather than each taking a separate floor. This gives each department the advantages of the basement for laboratory facilities involving heavy machinery or apparatus; convenient offices, lecture rooms, laboratories, and collection rooms on the second and third floors; and airy rooms unobstructed by trees on the fourth floor.

The Mineralogical laboratory is admirably located, occupying the northeast portion of the building. The exposure to the north is most desirable and on the second and fourth floors is about 36.57 m. (120 ft.) in length, and 28.95 m. (95 ft.) on the first and third floors. In all there are thirty-six rooms. On the first or ground floor, Fig. 3, there is a suite of five rooms designed for research purposes. Three of these rooms have light-tight shutters and are provided with non-vibration piers equipped with water, gas, compressed air, and alternating and direct cur-

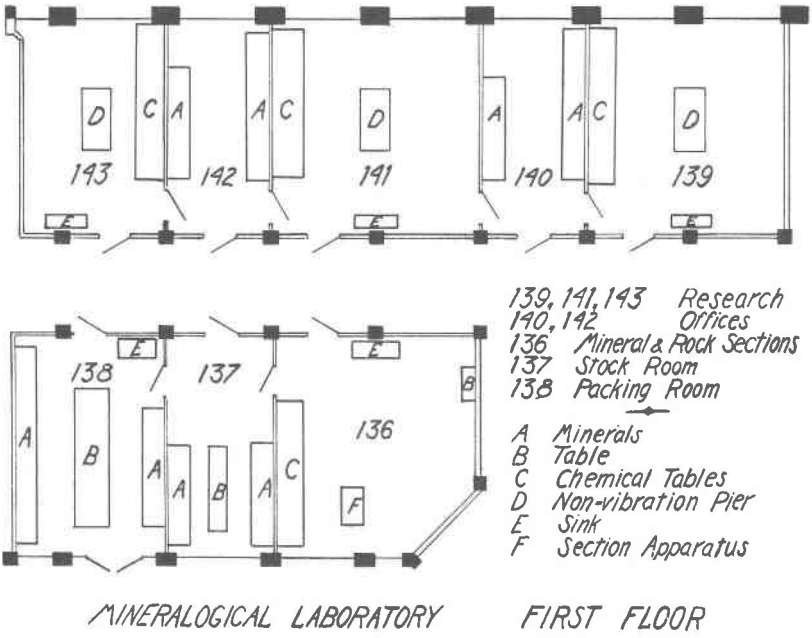

FIG. 3.

rents. Between these three rooms are two smaller ones which serve as offices for those engaged in research on this floor. Across the hall are the packing, store, and grinding rooms. In the latter, a simple but very efficient cutting, grinding and polishing machine, for the making of thin sections, is installed. This apparatus was made in the instrument shops of the University.

On the second or main floor, Fig. 4, are the large room devoted to the exhibition collections, the general lecture room of the department, an office, and two model rooms. The general lec-

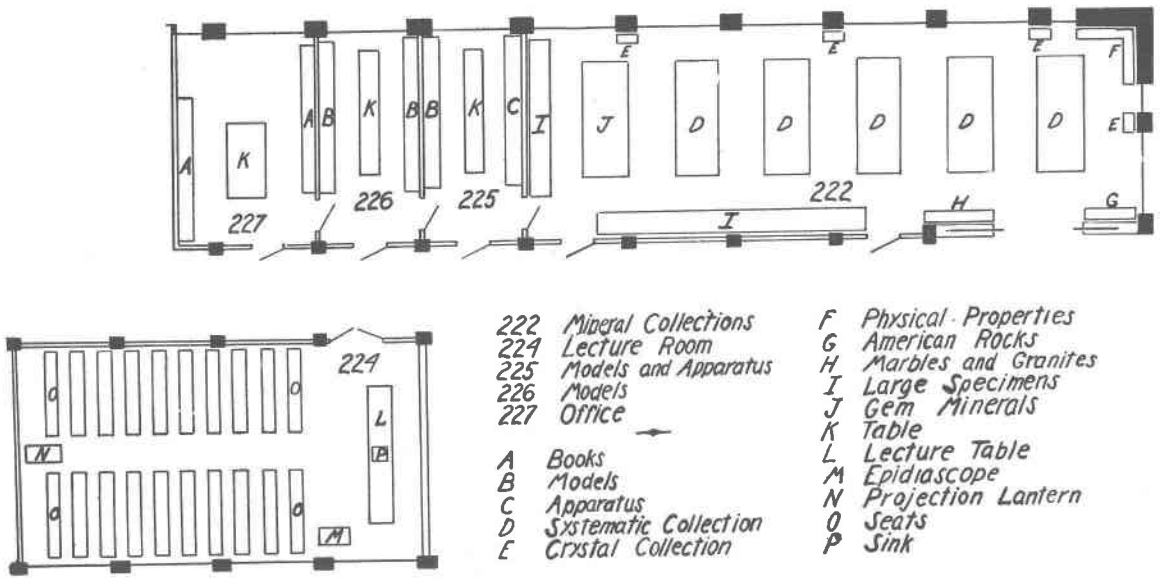
222 Mineral Collections
224 Lecture Room
225 Models and Apparatus
226 Models
227 Office
A Books
B Models
C Apparatus
D Systematic Collection
E Crystal Collection
F Physical Properties
G American Rocks
H Marbles and Granites
I Large Specimens
J Gem Minerals
K Table
L Lecture Table
M Epidiascope
N Projection Lantern
O Seats
P Sink
MINERALOGICAL LABORATORY
SECOND FLOOR

FIG. 4.

ture room is 7.3 × 14.6 m. (24 × 48 ft.) in size, and has a seating capacity of one hundred and ten. A portion of its floor is raised so as to insure an unobstructed view to every student. The lecture table is unusually large and contains 35 drawers in which the lecture collections of crystals and minerals are kept. The table is also equipped with water, sink, gas, compressed air, and outlets for both direct and alternating currents. Back of the table the blackboard extends across the entire end of the room, and above are mounted maps, charts, and two screens for projection purposes, one of which is placed in the center, the other to one side. The central screen is for use with an ordinary projection lantern mounted in the rear end of the room. The other screen is used in connection with a Leitz epidiascope, by means of which opaque objects, lantern slides, containers with liquids, and microscopic objects, such as thin sections, fragments, and so forth, may be projected in either ordinary or polarized light. While the use of this instrument is absolutely indispensable in the instruction in physical crystallography, it is also frequently employed in several of the more elementary courses.

Accessory apparatus, perfected in the laboratory, makes it also possible to use the epidiascope to project the double refraction of light by calcite rhombs upon the screen, and to determine the vibration directions of the emergent rays when the rhombs are in different positions. In order that students may follow this instructive experiment easily, the ordinary projection lantern is also used to throw upon the central screen a slide showing what is to be expected when the rhombs are rotated thru various angles. The well-known Mitscherlich experiment, involving the variation of the optic angle of gypsum with the temperature, is also easily demonstrated.

Immediately across the corridor are the model rooms containing extensive collections of large glass, wooden, and paper crystal models for lecture demonstrations, and abundant apparatus to illustrate the various physical and optical properties of crystals, including a Fuess monochromator, Abbe refractometer, and numerous microscopes of representative makes. The exhibition collections are immediately adjacent to these rooms, as is also the office of the head of the department.

The room containing the mineral collections is 7.3 × 21.9 m. (24 × 72 ft.) in size. It is exceptionally well lighted, for the

north and east exposures are practically all glass. The exhibition collections may be grouped as follows: (*A*) *Mineral collections*, (*B*) *Gem collections*, (*C*) *Rock collections*.

(*A*) *Mineral Collections*.—The systematic collection is exhibited in five double cases in the center of the room. Here may be found many of the minerals of the original Lederer collection referred to earlier. Important additions have been made recently by Dr. L. L. Hubbard, of Houghton, Michigan, formerly state geologist of Michigan, and at present one of the regents of the University. This systematic collection contains approximately 3,000 specimens, and includes many of the rarer species.

Collections of natural crystals and of glass crystal models are arranged in small wall cases between the windows on the north and east sides of the room. The various physical properties of minerals are illustrated by well-selected groups aggregating 250 specimens, displayed in the northeast corner. Large and unusual specimens are exhibited in the deeper wall cases on the south and west side.

(*B*) *Gem Collections*.—Representatives of the important natural, synthetic, and imitation gems, together with uncut material, occupy one double case in the center of the room. The various steps in the cutting and polishing of gems, as well as the various types of cutting, are illustrated by well-selected suites.

(*C*) *Rock Collections*.—These occupy wall cases on the south side of the room near the east end. One group consists of 125 specimens of important American rocks. A second group contains 190 slabs of polished marbles and granites, representative of the principal foreign and domestic building and decorative stones. Adjacent to these is a collection of 105 specimens illustrating the important rocks and minerals occurring within the state of Michigan.

All cases in this room are provided with ample drawer and shelf space for duplicate specimens. Special mention should also be made of a series of twenty large photographs illlustrating the development of diamond mining in South Africa, which are mounted on the walls over the side cases. Fig. 5 gives a partial view of this room.

On the north side of the third floor (Fig. 6) are located the laboratories for general mineralogy and for advanced rock and mineral analysis, with a professor's office and a balance room be-

tween them. These laboratories and rooms are all intercommunicating. Across the corridor are the laboratory for blowpipe methods, with a stock room adjoining, and two rooms suitable for assistants or advanced students.

The laboratory for general mineralogy (Room 333) has been made especially attractive and is conveniently arranged. The various collections of crystal models, natural crystals, and minerals for determination at sight, by means of physical properties, are placed in cases on three sides of the room. The drawers are of such size that they can be easily handled by students. Four double tables, accommodating 48 students, are placed immedi-

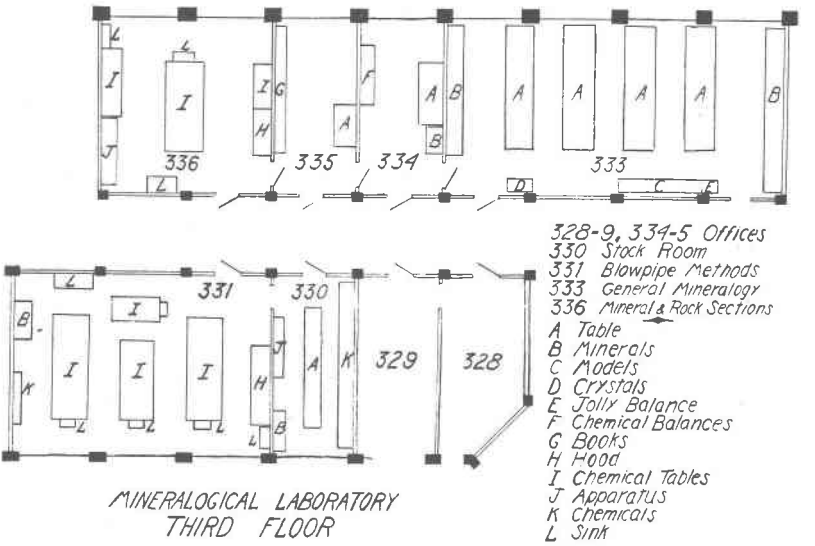

FIG. 6.

ately next to the windows, thus insuring abundant daylight, so necessary for the accurate recognition of the various physical properties. Fig. 7 shows the arrangement of this room (No. 333), which is 7.3 × 14.6 m. (24 × 48 ft.) in size. On the walls are many photographs illustrative of well-known mining localities and methods. There are also photographs of distinguished mineralogists. A large portrait of the late Professor W. H. Pettee, for many years in charge of the department, hangs in a prominent place on the east wall. These photographs prove very instructive to students, especially those from foreign countries.

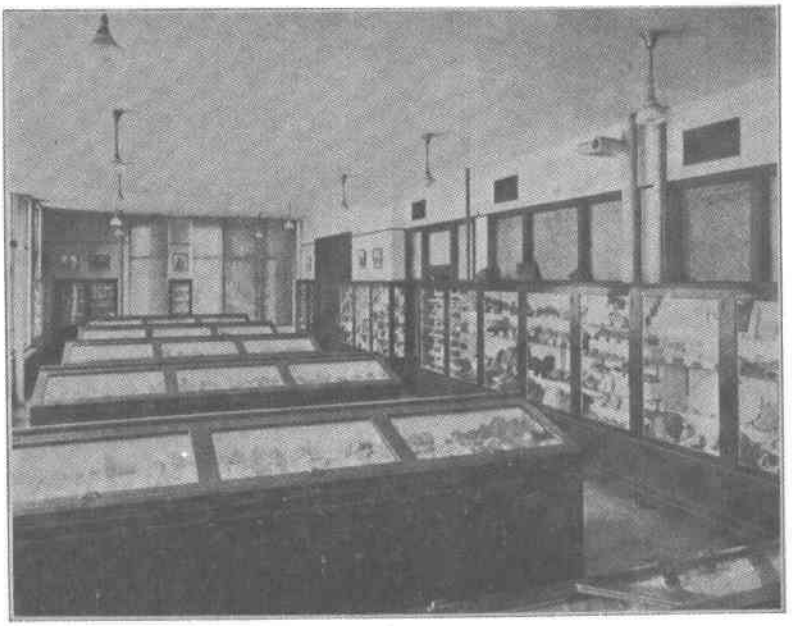

FIG. 5. Partial view of room containing the collections.

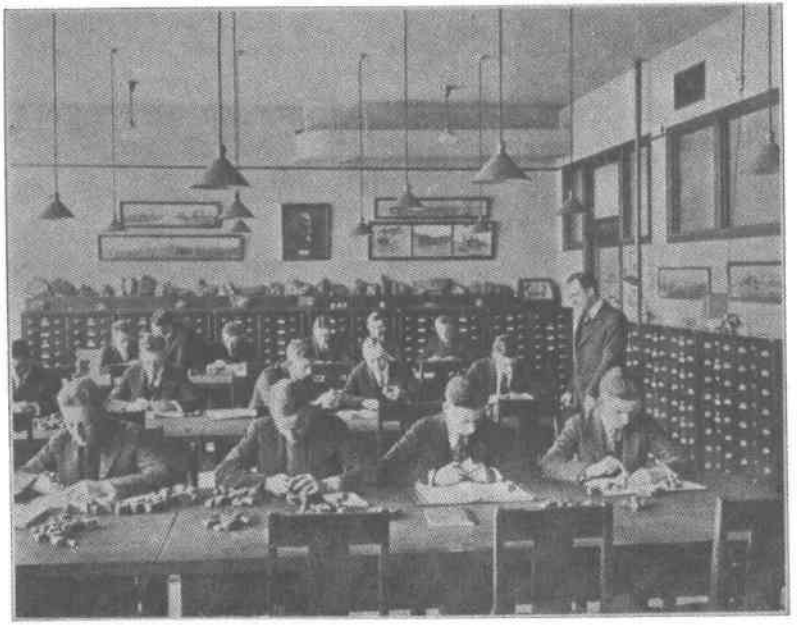

FIG. 7. The laboratory for General Mineralogy, Room 333.

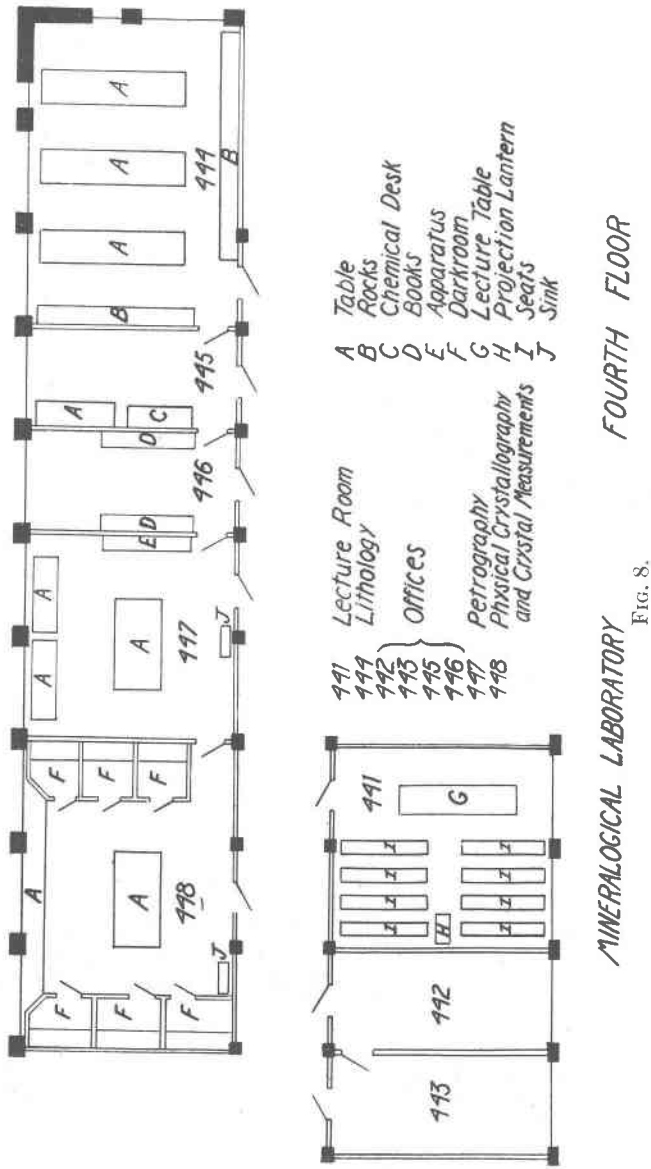
MINERALOGICAL LABORATORY
FOURTH FLOOR
A Table
B Rocks
C Chemical Desk
D Books
E Apparatus
F Darkroom
G Lecture Table
H Projection Lantern
I Seats
J Sink
111 Lecture Room
114 Lithology
112 Offices
113
115
116
117 Petrography
118 Physical Crystallography and Crystal Measurements

FIG. 8.

The laboratory for rock and mineral analysis is a two-unit room, namely 7.3 × 7.3 m. (24 × 24 ft.). It is a fully equipped modern laboratory for quantitative analysis. The room for blowpipe methods is 7.3 × 10.95 m. (24 × 36 ft.) in size. It contains three large desks with individual drawers for fifty-six students. Each student is supplied with gas and compressed air, so that the ordinary mouth blowpipe may be easily replaced by the blast torch. There is also an excellent demonstration desk. Altho most of the work done in this laboratory is of a qualitative character, instruction is also given in quantitative blowpipe methods.

On the fourth floor, Fig. 8, with exposures to the north, are the lithological, petrographical, and crystallographical laboratories, and two offices. There are also two offices for assistants and a small lecture room with southern exposure. The lecture room is used principally for classes in lithology.

In general arrangement, the lithological laboratory is similar to that of the general laboratory on the third floor, already described. Double tables are placed in the center of the room, the cases for the study and determinative collections of rocks being arranged on two sides of the room, which has exposures to the north and east. The room is 7.3 × 10.95 m. (24 × 36 ft.) in size.

In the petrographical laboratory, 7.3 × 7.3 m. (24 × 24 ft.) in size, the working table extends across the north end of the room, and is placed immediately next to the windows. Being above the trees, there is an unobstructed view for microscopic work at all times during the day. This table is equipped with electric light, gas, and compressed air. A large case contains much of the smaller accessory apparatus used in petrographical optical methods. A table of large size in the center of the room provides ample space for reference books and other material.

The laboratory for physical crystallography and crystal measurements, 7.3 × 10.95 m. (24 × 36 ft.) in size, is unique in design. On the east and west sides are six small dark rooms, 1.8 × 2.4 m. (6 × 8 ft.), for goniometric and refractometric work. The general arrangement is shown in Fig. 8 (Room 448). Each of these small rooms is equipped with ample outlets for electric lights and current. Gas and compressed air are also available. With a suite of six such rooms it is possible to always keep goniometers, refractometers, and other optical apparatus fully ad-

justed and available for immediate use. In this laboratory, also, the working table extends across the north end of the room, and thus has the advantage of 10.95 m. (36 ft.) of window space. In the center of the room a very large table is available for reference works and sundry apparatus. It may also be used for drawing purposes.

CRYSTALLOGRAPHY OF SOME CANADIAN MINERALS: 9. CERUSSITE[1]

EUGENE POITEVIN

Geological Survey of Canada

The cerussite crystals here described were collected by Mr. S. J. Schofield of the Geological Survey in 1911[2] at the Society Girl mine, two miles east of Moyie, Fort Steele Mining Division, British Columbia. Here the mineral occurs associated with pyromorphite and limonite in an oxidized zone of the ore body. The principal metalliferous components of the unoxidized ore are argentiferous galena and zinc blende.

Cerussite crystals from this locality were described and figured by Thomson[3] but the present ones show so many new features that this further account has been prepared. It may be noted that the pyromorphite of this locality has also been described crystallographically and chemically by Bowles.[4]

The cerussite crystals generally vary in color from white to reddish brown; more rarely they are colorless and in some instances malachite-green individuals have been observed. Not infrequently they are found imbedded in dense masses of limonite. The luster of the crystals varies from vitreous to resinous. Crystals vary in size from those of microscopic dimensions to those having a length of 1 cm. The prism *r* (130) exhibits vertical striations. The dome *k* (011) and the brachy-pinacoid also show striations.

The crystals show three habits, which in their order of frequency are as follows:

[1] Published by permission of the Director of the Geological Survey of Canada. Continued from page 36. This paper concludes the series.

[2] *Summary Rept. Geol. Survey*, **1911**, 162.

[3] *Am. Min.*, **3**, (5), 42–43, 1918.

[4] *Am. J. Sci.*, [4], **28**, 40.