

diagonal) in Table 5, in which the positions of the indices correspond roughly to the relative positions of the reflections on the photograph and of the points of the reciprocal lattice projection made from it. The omitted corrections would be very different for reflections of rays having very different path lengths through the crystal, as in the cases of the pairs of reflections mentioned by Helwig.

Helwig's  $F_{\text{obs}}$  values are in good agreement with ours but include more reflections. Calculations of  $F$  values for all of the reflections listed by him (a) as made by him, using atomic  $F$  curves of unknown origin, (b) as made by me, using his parameter values and the atomic  $F$  curves given in Ref. 3, and (c) as made by me, using the Huggins and Frank parameter values, show practically the same measure of agreement with the  $F_{\text{obs}}$  values. The last however seems to be slightly the best.

Although Helwig implies that he used the concept of interatomic distances to deduce his parameter values, the latter lead to improbably small values (2.20 Å for one kind of potassium, 2.31 Å for the other) for the distances between each potassium center and the centers of two of its six oxygen neighbors. K-O distances in other crystals (See Ref. 3, p. 590) are always much larger. For this reason the writer believes that Helwig's values for the parameters cannot be correct.

The results of these structure factor and interatomic distance calculations are given in more detail in a paper being sent to the *Zeitschrift für Kristallographie*.

DIRECTORY OF AMERICAN AND CANADIAN MINERAL  
COLLECTIONS

SAMUEL G. GORDON, *Academy of Natural Sciences  
of Philadelphia.*

(Continued from page 418.)

NORTH CAROLINA

ASHEVILLE            BURNHAM S. COLBURN, Greystone Court,  
Biltmore Forest.

A fine collection of minerals from the Southern Appalachians may be seen on application.

CHAPEL HILL            UNIVERSITY OF NORTH CAROLINA.  
Teaching collections.

CONCORD SCOTIA SEMINARY.

DAVIDSON DAVIDSON COLLEGE.

The Richard T. Brumby collection, acquired in 1870 was destroyed by fire. A new collection of about 2000 specimens may be seen daily except Sunday. W. L. Porter is Custodian.

DURHAM DUKE UNIVERSITY, Museum of Natural History.

GASTONIA FRED M. ALLEN.

JOHN L. BEAL.

RALEIGH NORTH CAROLINA STATE MUSEUM.

The series of about 2000 specimens includes the collection of J. A. D. Stephenson, (North Carolina minerals). Harry T. Davis, Curator. Open 9 A.M. to 5 P.M. daily except Sundays and Christmas.

NORTH CAROLINA STATE COLLEGE.

Dr. J. L. Stuckey in charge.

SPRUCE PINE TENNESSEE MINERAL PRODUCTS CORPORATION.

A local collection.

TRYON GREEN MUSEUM.

POLK COUNTY MUSEUM.

#### NORTH DAKOTA

FARGO NORTH DAKOTA AGRICULTURAL COLLEGE.

UNIVERSITY (GRAND FORKS) UNIVERSITY OF NORTH DAKOTA.

A general collection of 1200 specimens is in custody of the Professor of Geology in the Mineralogical Laboratory in Merrifield Hall, and may be seen on Saturdays. Another collection in the Babcock Building, in custody of the Director of the School of Mines, may be seen daily, except Sundays, from 8:30 A.M. to 12 M.; and from 1 P.M. to 5 P.M.

WAHPETON NORTH DAKOTA STATE SCHOOL OF SCIENCE.

#### OHIO

ALLIANCE MOUNT UNION COLLEGE.

ATHENS OHIO UNIVERSITY AND THE STATE NORMAL COLLEGE.

BEREA BALDWIN-WALLACE COLLEGE, Herman Herzer Museum.

BOWLING GREEN STATE COLLEGE.

A general and local collection of about 4500 minerals and rocks is in the Science Building, and includes most of the private collection of the Curator, Professor Wm. P. Holt of the Department of Geology. Open daily except Sundays.

CINCINNATI CINCINNATI MUSEUM ASSOCIATION.  
CINCINNATI SOCIETY OF NATURAL HISTORY,  
Museum, 312 Broadway.

A general collection of 2500 specimens, including the Allen and Paul Mohr cabinets. Ralph Dury, Curator.

RALPH E. CLARK, JR., Reading Road and  
Linton Street.

A general collection of 740 specimens.

C. B. GARRISON, 4314 Hamilton Avenue.

A general collection of 2000 specimens.

UNIVERSITY OF CINCINNATI.  
HERMAN WUESTNER, 3335 Cavanaugh Ave-  
nue.

A general collection of 4400 specimens, including a complete series of minerals from Kelly, New Mexico.

CLEVELAND ADELBERT COLLEGE OF WESTERN RESERVE  
UNIVERSITY.  
CASE SCHOOL OF APPLIED SCIENCE.

Museum of Mineralogy and Geology, Main Building. A general collection of 5247 specimens.

CLEVELAND MUSEUM OF NATURAL HISTORY,  
2717 Euclid Avenue.

J. E. Hyde, Curator. A general collection of 2900 specimens including the J. H. Wade collection of cut gemstones with some unusually fine opals.

WESTERN RESERVE UNIVERSITY, Geology  
Building.

A general collection of 3000 specimens including 150 meteorites may be seen upon request.

COLUMBUS OHIO STATE MUSEUM,  
(OHIO STATE ARCHAEOLOGICAL AND HIS-  
TORICAL SOCIETY), High Street at Fifteenth  
Avenue.

Howard R. Goodwin, Curator of Mineralogy. A general collection of about 1000 specimens.

OHIO STATE UNIVERSITY, Department of  
Geology, Orton Building.

A general collection of 2500 specimens. Depository of the State Geological Survey. J. Ernest Carman, Custodian. Open weekdays 8 A.M. to 4 P.M.

DAYTON DAYTON PUBLIC LIBRARY, Museum.

A general collection of about 1000 specimens may be seen daily from 9 A.M. to 5 P.M., and on Sundays from 2 P.M. to 5 P.M. Custodian, Sigmund Metzler.

DELAWARE OHIO WESLEYAN UNIVERSITY.

Contains the Merrick-Trimble Collection

FREMONT HAYES MEMORIAL LIBRARY AND MUSEUM.

GREENVILLE CARNEGIE LIBRARY, Museum.

HIRAM HIRAM COLLEGE.

MARIETTA MARIETTA COLLEGE, Museum.

OBERLIN OBERLIN COLLEGE.

Teaching collections number about 7500 specimens. Custodian, Professor George D. Hubbard. May be seen daily, except Sundays, from 8 A.M. to 5 P.M.

SANDUSKY HIGH SCHOOL.

A collection of 1500 specimens, including much celestite. May be seen Sunday afternoons. Professor E. L. Moseley of State College at Bowling Green is Curator.

TIFFIN HEIDELBERG UNIVERSITY.

Contains the Charles H. Jones Collection.

TOLEDO FRED F. BRADLEY, 2466 Broadway.

A general collection of 2000 showy specimens.

WALTER J. PAQUETTE, 417-4th Street.

A collection of 3000 general and local specimens.

TOLEDO INSTITUTE OF NATURAL SCIENCE.

(Toledo Zoological Society), Walbridge Park. Fred F. Bradley, mineralogist. A collection of 500 minerals is exhibited in the Carnivora Building every day of the year.

URBANA URBANA UNIVERSITY.

WAKEMAN ELMSLEY T. THOMAS.

WESTERVILLE OTTERBEIN UNIVERSITY.

WOOSTER COLLEGE OF WOOSTER.

YELLOW SPRINGS ANTIOCH COLLEGE.

A general teaching collection of 2000 specimens. H. C. Swinnerton, Custodian.

## OKLAHOMA

BACONE BACONE COLLEGE.  
 NORMAN UNIVERSITY OF OKLAHOMA.

## OREGON

CORVALLIS OREGON AGRICULTURAL COLLEGE.  
 EUGENE UNIVERSITY OF OREGON, Condon Building.

A general and local collection of 3000 specimens. E. J. Hodge, Custodian.  
 May be seen on weekdays or upon request.

PORTLAND COLLECTION OF THE CITY OF PORTLAND,  
 City Hall.

A general collection of 600 specimens, including many Oregon agates.

H. C. DAKE, 793½ Thurman Street.

A general collection of 1000 specimens, including many Oregon and Idaho minerals.

SALEM J. M. TRACY, 601 Orange Street.  
 WILLAMETTE UNIVERSITY.

## PENNSYLVANIA

ALLENTOWN MUHLENBERG COLLEGE.  
 A small collection.

ANNVILLE LEBANON VALLEY COLLEGE.

ARDMORE HAROLD W. ARNDT, 614 Woodcrest Avenue.  
 A general collection, rich in New England minerals.

BEAVER FALLS GENEVA COLLEGE.

BETHLEHEM LEHIGH UNIVERSITY.

Contains the J. DeB. Keim, and William T. Roepper collections, housed in the Department of Geology.

BROOKLINE J. C. BOYLE, 225 Kenmore Road.  
 A small general collection.

BRYN MAWR BRYN MAWR COLLEGE, Department of Geology.

Contains the Theodore D. Rand Collection, a general collection rich in local minerals.

GEORGE VAUX COLLECTION, Gulph Road.

A general collection, remarkable for the high average quality of the specimens, and which number about 10,000. Included in it are 20 extraordinary specimens from the William S. Vaux Collection.

- CARLISLE                    DICKINSON COLLEGE.  
Collection of 5000 specimens.
- CHESTER                    PENNSYLVANIA MILITARY COLLEGE.
- EASTON                    LAFAYETTE COLLEGE.  
A general collection of several thousand specimens.
- NORTHAMPTON COUNTY HISTORICAL SOCIETY.  
Edward K..Swift Collection.
- ELKINS PARK              MORRELL G. BIERNBAUM, 8108 Cadwalader Road.  
The Hoadley-Biernbaum collection, comprising a general and local series collected by Mr. Biernbaum, and the collection of Charles Hoadley, in part. The Hoadley collection while general, contains many fine specimens from New England and New Jersey, particularly from Franklin and Paterson.
- ERIE                        ERIE PUBLIC MUSEUM.
- GETTYSBURG              GETTYSBURG COLLEGE.  
A collection of 6000 specimens.
- HARRISBURG              STATE MUSEUM, in Capitol group of buildings.  
A small mineral collection.
- HAVERFORD              HAVERFORD COLLEGE.  
A small mineral collection. The collection of Joseph Sansom (1750-1820) presented in 1832 has lost its identity.
- LANCASTER              FRANKLIN AND MARSHALL COLLEGE, Museum.  
Professor H. Justin Roddy, Curator. A general and local collection specializing in minerals from Lancaster County. Open daily, except Sundays, from 8 A.M. to 5 P.M.
- HENRY W. RICKSECKER, 631 W. Chestnut Street.  
A local collection of 1500 specimens.
- LEWISBURG              BUCKNELL UNIVERSITY.
- MEADVILLE              ALLEGHENY COLLEGE, Natural History Museum.  
Said to have the Alger, Prescott, and Haldeman Collections.
- MEDIA                    DELAWARE COUNTY INSTITUTE OF SCIENCE.  
Contains a general collection, including the cabinet of Lewis Palmer, rich in local minerals.

**MERION**                      **FRANK J. KEELEY, Latches Lane.**

The premier collection of box mounts of minerals for the microscope, for in addition to his own choice collection, Mr. Keeley possesses the collection in the original cabinet, of George Fiss, who had had the opportunity of rounding out his collection from the Clarence Bement series of box mounts, before these went to Harvard.

**MIQUON**                      **HAROLD POOLE.**

A general and local collection.

**MYERSTOWN**                **ALBRIGHT COLLEGE.**

A small collection.

**NEW BRIGHTON**        **MERRICK FREE ART GALLERY, Museum and Library**

Contains the Louis A. Glaser Collection.

**NEW WILMINGTON**      **WESTMINSTER COLLEGE.**

**OXFORD**                      **OXFORD HIGH SCHOOL.**

Contains the John F. Rose Collection.

**PHILADELPHIA**            **ACADEMY OF NATURAL SCIENCES OF PHILADELPHIA, Mineral Hall.**

(Frank J. Keeley, Curator of the William S. Vaux Collections; Samuel G. Gordon, Associate Curator, Department of Mineralogy and Geology.) The Natural History Museum is open daily from 9 to 5, and on Sundays and most Holidays from 1 to 5 P.M. The William S. Vaux Collection (numbering 12,000 specimens) is exhibited, in part, in Mineral Hall. This collection, bequeathed to the Academy in 1882, had absorbed previously the collection of Francis Markoe Jr., which at one time was the finest collection in America. (It contained the best specimens from the collection of Henry Stephen Fox, Minister of Great Britain from 1836-1844.) Additional material was also obtained by William S. Vaux in Europe, and he acquired the best specimens from the collection of Joseph Leidy. A small fund aids in maintaining the collection which has been further enriched by expeditions sent to Greenland, the Andes, and Africa. The phenomena of fluorescence is spectacularly shown in a special exhibit in Mineral Hall. A fine collection of cut gems and a small collection of meteorites form other exhibits. Equally large, but not exhibited, is the general mineral collection of the Academy, which dates from the founding of the institution in 1812. Incorporated in it are the collections of S. Godon (1816) an early collector, T. B. Wilson, Thomas M'Euen, Samuel Ashmead, George W. Carpenter, J. M. Hartman, Thomas Harvey, E. D. Drown, and William H. Shaw. Kept intact and arranged according to Cleaveland's Mineralogy, in its original cabinet, is the collection of Adam Seybert (1773-1825), who was the first American mineralogist. The Academy collections are rich in Pennsylvania minerals. The collections of the First and Second Geological Surveys are also deposited in the Academy.

## CENTRAL HIGH SCHOOL.

A small collection.

EDMUND H. CIENKOWSKI, 6803 Bustleton Av.

A general and local collection of several thousand specimens.

COMMERCIAL MUSEUM, 34th and Spruce Streets.

Charles Toothaker, Curator. Collections of economic minerals and products.

ALEXANDER FLEMING, 2904 Diamond Street.

JOHN S. FRANKENFIELD, 236 N. 53rd Street.

A general and local collection of showy specimens: one of the best collections in Philadelphia.

## GIRARD COLLEGE.

HORACE J. HALLOWELL, 4609 Springfield Avenue.

A general collection, and an extensive series from the French Creek mines.

JOSEPH R. HELLMER, JR., 611 E. Phil Ellena Street, Germantown.

A small general collection.

WILLIAM C. KNABE, 3853 N. Gratz Street.

A general and local collection of several thousand specimens.

THOMAS J. LEWIS, 6706 Lansdowne Avenue.

A collection of box mounts of minerals for the microscope.

HENRY E. MILLSON, 8128 N. Hennig Street, Fox Chase.

A small general collection.

DR. WILLIAM S. NEWCOMET, 3501 Baring Street.

A general and local collection, including the cabinet of Stanley Law.

## NORTHEAST HIGH SCHOOL.

A collection donated by the Philadelphia Mineralogical Society.

WILLIAM PARRISH, JR., 2567 Ambler Street.

A general and local collection.

GEORGE PETERSON, 3914 N. Franklin Street.

TEMPLE COLLEGE, Broad Street and Montgomery Avenue.



CHARLES R. TOOTHAKER, 4 Pine Street.

A small general collection.

HARRY W. TRUDELL, 2030 E. Madison Street.

One of the best private collections in Philadelphia. A general collection with many good local specimens.

UNIVERSITY OF PENNSYLVANIA, College Hall:  
Department of Geology.

Contains the collections of Frederick A. Genth, Joseph A. Clay, and John T. M. Cardeza.

UNIVERSITY MUSEUM.

Contains a few carved jades and a large crystal (quartz) ball.

WAGNER FREE INSTITUTE OF SCIENCE.

Contains the collection of the founder, William Wagner, and the Morris collection, in part.

DR. L. C. WILLS, 5733 Chester Avenue.

A large collection of box mounts of minerals for the microscope.

PITTSBURGH      CARNEGIE MUSEUM.

Contains the William W. Jefferis Collection (a general collection, with fine New York and Pennsylvania specimens), and the Gustave Guttenberg collection.

UNIVERSITY OF PITTSBURGH.

READING      READING PUBLIC MUSEUM.

Contains the collections of Levi Mengel, who founded the Reading Museum, and of John Schoenfeld. These are not as yet on exhibition.

SCHWENKSVILLE      FREDERICK HILBIBER.

A small local and general collection.

JOHN TALLIS.

A small local collection.

SCRANTON      EVERHART MUSEUM OF NATURAL HISTORY,  
SCIENCE AND ART.

STATE COLLEGE      STATE COLLEGE.

A large collection of minerals.

SWARTHMORE      WILLIAM T. CLAY, 511 Walnut Lane.

A small general collection.

SWARTHMORE COLLEGE.

Contains the collections of Joel Bailey, and Joseph Leidy (in part), and of Leopold C. Bierwirth.

WARREN                   WARREN ACADEMY OF SCIENCES.  
 WASHINGTON           WASHINGTON AND JEFFERSON COLLEGE.  
 WAYNE                   DR. FLORIAN CAJORI.

A small general collection.

WEST CHESTER       STATE TEACHERS COLLEGE.  
 Library Building. Open weekdays.

WESTTOWN           WESTTOWN FRIENDS SCHOOL.  
 A general collection of 8000 specimens may be seen on application at the office.

WILKES-BARRE       WYOMING HISTORICAL AND GEOLOGICAL SOCIETY.  
 Frances Dorrance, Director. A general collection of several thousand specimens.

WILLOW GROVE       JOHN VANARTSDALEN.  
 A local collection.

#### RHODE ISLAND

KINGSTON           RHODE ISLAND STATE COLLEGE.  
 PROVIDENCE         BROWN UNIVERSITY.  
 PARK MUSEUM (Roger Williams Park).

The H. Anthony Dyer Collection.

WESTERLY           PUBLIC LIBRARY.  
 A general collection, including the cabinet of Charles Hyde Denison. Two-hundred specimens are permanently displayed. Open daily from 9 A.M. to 9 P.M.

#### SOUTH CAROLINA

CHARLESTON         CHARLESTON MUSEUM.  
 Has the Daniel S. Martin Collection (in part), and a collection of phosphates assembled by Charles U. Shepard.

COLLEGE OF CHARLESTON.  
 SOUTH CAROLINA MILITARY ACADEMY.

CLEMSON            CLEMSON COLLEGE.  
 CLINTON            THORNWELL MUSEUM.

COLUMBIA           UNIVERSITY OF SOUTH CAROLINA, LeConte College.

A general collection of 7000 specimens, including that of the State Geological Survey, the Thomas Cooper Collection (which received rough treatment dur-

ing the Civil War), the small Louis R. Gibbs collection (in part), and some of the meteorite material of C. U. Shepard. The collections may be seen daily from 9 A.M. to 5 P.M.

GREENVILLE            FURMAN COLLEGE.

Daniel S. Martin Collection, in part.

NEWBERRY            NEWBERRY COLLEGE.

ORANGEBURG        CLAFIN UNIVERSITY.

ROCK HILL            WINTHROP COLLEGE.

A general collection of 200 specimens. Miss Minnie Parker, Custodian. Open daily 9 to 5; Sundays 2 to 3.

SPARTANBURG        WOFFORD COLLEGE.

A small collection of minerals.

SOUTH DAKOTA

CUSTER              SCOTT ROSE QUARTZ COMPANY.

About 1000 local specimens.

RAPID CITY         SOUTH DAKOTA STATE SCHOOL OF MINES.

VERMILLION        UNIVERSITY OF SOUTH DAKOTA.

A general collection of 2000 specimens. Depository of the State Geological Survey.

YANKTON             YANKTON COLLEGE.

TENNESSEE

CLARKSVILLE        SOUTHWESTERN PRESBYTERIAN UNIVERSITY.

A large collection.

HARRIMAN          PUBLIC MUSEUM.

JACKSON             UNION UNIVERSITY.

KNOXVILLE        UNIVERSITY OF TENNESSEE.

Small teaching collections. Professor George M. Hall, Custodian.

LEBANON            CUMBERLAND UNIVERSITY.

MARYVILLE        MARYVILLE COLLEGE.

MEMPHIS            COSSITT LIBRARY MUSEUM ASSOCIATION.

SOUTHWESTERN COLLEGE.

Has the Lardner Vanuxem collection, purchased by the earlier Masonic College of Clarksville, Tenn.

MILLIGAN            MILLIGAN COLLEGE.

JEFFERSON CITY    CARSON AND NEWMAN COLLEGE.

## NASHVILLE

## TENNESSEE DIVISION OF GEOLOGY.

State Geologist, Custodian. General state collections may be seen by visitors from 8.30 to 4.30 P.M. daily, and on Saturdays until 12 M.

VANDERBILT UNIVERSITY, Garland Hall.

General teaching collections, 12,000 specimens. W. B. Jewell, Custodian.

FISK UNIVERSITY.

WALDEN UNIVERSITY.

## TEXAS

## ALPINE

## WEST TEXAS HISTORICAL AND SCIENTIFIC SOCIETY.

Sul Ross State Teachers College. Main Building. E. E. Townsend, Curator. A general and local collection of 600 specimens. Open Fridays 2 to 5 P.M., or by appointment.

## AUSTIN

## BUREAU OF ECONOMIC GEOLOGY. University of Texas: Museum Building.

A general collection of 4000 minerals and 2 meteorites. Open daily, 8.30 A.M. to 5 P.M.

## BROWNWOOD

## HOWARD PAYNE COLLEGE.

## DALLAS

## TEXAS MUSEUM OF NATURAL HISTORY.

## EL PASO

## EL PASO MUSEUM.

## PUBLIC LIBRARY.

Specimens are in storage for a future museum.

UNIVERSITY OF TEXAS, Museum of the College of Mines and Metallurgy.

## HOUSTON

## HOUSTON MUSEUM OF NATURAL HISTORY.

C. L. Brock, Director. A general collection of 5000 specimens. Open 10 A.M. to 5 P.M. daily.

## SAN ANTONIO

## SCIENTIFIC SOCIETY OF SAN ANTONIO, Stevens Building.

WITTE MUSEUM, Brackenbridge Park.

A general collection of 5000 specimens. Open daily from 9 A.M. to 6 P.M.

## SAN AUGUSTINE

## HORACE E. WOLCOTT

About 4000 minerals and gems, including many local specimens.

## WACO

## BAYLOR UNIVERSITY. Carroll Science Hall.

(To be continued)