

THE PENNSYLVANIA STATE COLLEGE

Mineral Industries Experiment Station Circular 27

Frederick Augustus Genth
1820 - 1893

Chemist - Mineralogist - Collector

by

W. M. MYERS and S. ZERFOSS



The Pennsylvania State College
SCHOOL OF MINERAL INDUSTRIES
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The findings described in this bulletin comprise a part of a large program of research carried on in many fields as one of the primary functions of The Pennsylvania State College.

The foundations of The Pennsylvania State College are the Morrill Land-Grant Act of Congress signed by Lincoln in 1862 and the 1863 act of the Pennsylvania Legislature implementing the federal legislation and designating this institution as the instrument of the Commonwealth in carrying out the terms of the federal act.

The spirit of research which permeates the College is in keeping with the purposes of the Land-Grant Act in bringing the methods and procedures of modern science into relation with the agricultural and industrial pursuits of the nation.

At the present time more than 600 active projects are being carried on, representing work being done in all the Schools and nearly all the departments of the institution.

The results of research are reported in bulletins (many of which are obtainable free on request) published by the agricultural, engineering, and mineral industries experiment stations, and in numerous contributions to scientific and professional journals.

FREDERICK AUGUSTUS GENTH
1820-1893
CHEMIST—MINERALOGIST—COLLECTOR.

BY

W. M. MYERS* AND S. ZERFOSS.†

A complete history of the development of the science of mineralogy in America is yet to be written. We are partially aware of the debt we owe to the early workers in the science but the contributions of a number of them have become obscured by the passage of years. Frederick Augustus Genth stands in the foremost rank of the pioneer mineralogists of America. His contributions in the field of chemical mineralogy are outstanding. The passage of time and the review of his work which has accompanied it have demonstrated repeatedly the extraordinary accuracy of his results and the unrelenting diligence with which he pursued every activity which would advance the knowledge of the minerals of America. His researches served to expand the basic principles of mineralogy and his European background and education supplied him with technical tools possessed by few in the United States in his time. Indeed, Dr. Genth was one of those intellectual bridges that served to introduce to America the accumulated scientific knowledge which was developed by the early workers in chemistry and mineralogy in Germany.

The Genth collections of minerals, books, photographs, notebooks, medals, letters, reprints and scientific apparatus have been established as a memorial to him in the School of Mineral Industries of The Pennsylvania State College through the generosity of the daughters of Dr. Genth. These collections are being preserved as a unit and now form the most prized item in the extensive mineral collections of the School of Mineral Industries. The documents supply a record of accomplishments and personalities active in the science of mineralogy without known equal in the country. The mineral collection was complete for the time during which it was assembled. Its scientific value today is greatly enhanced by the presence of type specimens from original localities.

The significance of this collection and the character and the accomplishments of the man who assembled it are such that it seems desirable to make a permanent record of this unusual contribution to mineralogy.

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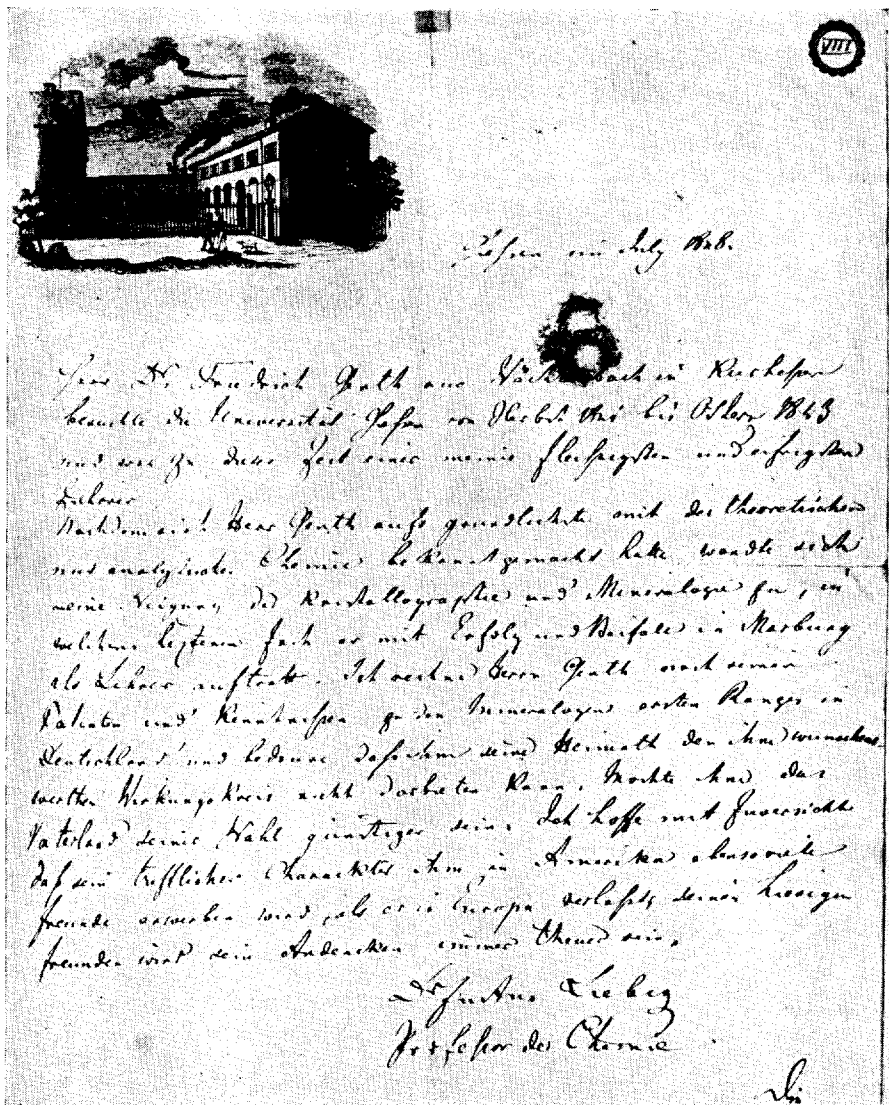
BIOGRAPHY OF FREDERICK AUGUSTUS GENTH.

Friedrich August Ludwig Karl Wilhelm Genth was born in the village of Waechtersbach, Hesse, on May 17, 1820. This is only three years after the death of Werner. He displayed an acute interest in natural history at a very early age. After spending three years in the Hanau Gymnasium he matriculated in the University of Heidelberg in 1839. He there began the systematic study of chemistry, geology, and mineralogy under Gmelin, Blum, and Leonhard. He left Heidelberg in 1841 and became a student in the University of Giessen, concentrating



in chemistry under Fresenius, Kopp, and Liebig. He left Giessen in 1843 due to ill health and then entered the University of Marburg in 1844, studying under Bunsen and Gerling. He thus had the advantage of contact with an eminent group of professors. After obtaining his doctor's degree at Marburg he became Chemical Assistant to Professor Bunsen and later was appointed Privat-Dozent in the University. He held this position for three years and in the summer of 1848 sailed for Baltimore. This was a year of unrest in Germany and of migration of many Germans to the United States, who subsequently founded many outstanding American families.

The following letter preserved in the Genth Collection was written for him by his old Professor Justus Liebig. The original is reproduced in the accompanying illustration.



Giessen, July 1848

"Dr. Frederick Genth from Waechtersbach in Hesse-Cassel was a student of the University at Giessen from the autumn of 1841 until the spring of 1843, and was during that time one of my most diligent and industrious pupils.

"After Mr. Genth had made himself most thoroughly acquainted with theoretical and analytical chemistry, he became interested in Crystallography and Mineralogy, in which latter

science he delivered successful lectures at Marburg, which added to his reputation. With reference to talents and knowledge I consider Mr. Genth to be one of the best Mineralogists in Germany and I am sorry that his native country cannot afford him a desirable position. It is to be hoped that he will receive more favor in his adopted country. With confidence I anticipate that his excellent character will make him as many friends in America as he leaves in Europe. His friends here will always entertain a kind remembrance of him."

(signed) Dr. Justus Liebig,
Professor of Chemistry

Translation—Liberata Emmerich.

Soon after his arrival in America he went to Philadelphia and established one of the first analytical laboratories in America. He then spent a short time as Superintendent of Mining operations in North Carolina but returned to Philadelphia in 1850. He reopened his laboratory and devoted his energies to commercial chemistry, research, and the instruction of a few pupils. He soon established correspondence with the leading scientists of America which was continued throughout his life. In 1872 he was offered the Professorship of Chemistry in the University of Pennsylvania. He finally accepted this offer with the understanding that his private practice could be carried on. He continued his connection with the University until the fall of 1888, when he left and returned to consulting work and research.

The amazing part of the career of Dr. Genth is that while engaged in consulting work with the commercial applications of chemistry he found time to make substantial contributions to fundamental science. Among the outstanding researches he carried out were those on the complex cobalt-amine compounds, in collaboration with Dr. Wolcott Gibbs, corundum and its alteration products, meteorites, telluride compounds, phosphates and fertilizers, and rare minerals.

Edgar F. Smith in his book, "Chemistry in America," presents the following entertaining account of Genth at work.

"The writer met J. Lawrence Smith in the laboratory of Genth (1879). It was his privilege to observe these two eminent and brilliant chemists at work. They had differed on a point in the analysis of a complex silicate and, rather than cover valuable pages of some journal with their differences, occupying space that could be better used, they determined to settle the point at issue by experimental demonstrations made in each other's company. In this particular case Genth was in the right.

"It was a further privilege of the writer to see Gibbs, Genth, and Smith working amicably and cheerfully in the same room over problems which greatly interested them. Some of the difficult points in the analytical study of the cobaltamines were settled by Gibbs and Genth with the writer a very silent but much interested observer and auditor of the work and remarks of these pioneers.

"Smith appeared in the laboratory of the University where the writer was an assistant. He was then short and stout of figure. His hair was heavy, thick, quite gray, parted on one side, rather long and brushed back. He wore spectacles which rested on the end of his nose. On learning that the writer was endeavoring to procure a compound ether by heating the silver salt of an organic acid with ethyl iodide, Smith, having seated himself on a high stool, remarked "that is a new method to me." On several occasions the writer enjoyed hearing from Smith the story of his study of the rare earths and, in particular, his experiences in unravelling the composition of samarskite, in which he was especially interested.

"The reader will pardon this personal digression on the part of the writer, but to him it has always seemed as if there could not be too much credit given Genth, Gibbs, and J. Lawrence Smith for the admirable contributions they made to the development of chemical science in the United States."

Chemistry in America. By Edgar F. Smith. D. Appleton and Co., New York. 1914. pp. 259-261.

The period in which Dr. Genth lived was one characterized by an intense interest in pure discovery, the discovery of new lands, new rocks, new minerals, and new processes. The interest in taxonomy in the

TABLE I
List of New Minerals Reported by Genth

Mineral Name	Composition*	Year Reported
Barnhardtite	Cu, Fe, sulfide	1855
Whitneyite	Arsenical Copper	1859
† Melonite	NiTe ₂	1868
† Calaverite	AuTe ₂	1868
† Cosalite	Pb ₂ Bi ₂ S ₅	1868
† Schirmerite	PbAg ₄ Bi ₄ S ₉	1874
† Coloradoite	HgTe	1873
Nickel Gymnite (Genthite)	Hydrated Mg-silicates with Ni	1851
† Montanite	Bi ₂ O ₃ TeO ₃ ·2H ₂ O	1868
† Kerrite	Vermiculites	187
† Maconite		
† Willcoxite		
† Dudleyite (after Margarite)		
† Psittacinite	Var. Descloizite	1876
Magnolite } Ferrotellurite }	Te minerals	1877
† Endlichite	Var. Vanadinite	1885
† Lansfordite	MgCO ₃ ·5H ₂ O	1888
† Nesquehonite	MgCO ₃ ·3H ₂ O	1890
† Phosphuranylite	a Uranyl-phosphate	1879
† Penfieldite	Pb(OH) ₂ ·3PbCl ₂	1892

† Mineral species or varieties recognized at present.

* Formulas taken from Dana's System, Vol. I, 7th Edition, 1944, or from Dana's textbook of Mineralogy, 4th Edition, 1926.

natural sciences was still acute and chemists were constantly on the search of a new mineral species or trying to certify a new meteorite. Dr. Genth was particularly happy when engaged in the identification of a new mineral species. The list of new minerals (23) reported in his memoir in the National Academy of Sciences is given in the accompanying table. Subsequent investigations have indicated not all of this list are true species. Those marked with † can be found in our present mineralogy. If we consider that his only tool of identification was chemical analysis the fact that some of the minerals were not true

species is not remarkable. The total of accepted species is a very substantial contribution to be made by one investigator.

Dr. Genth served the Commonwealth of Pennsylvania, being Chief Chemist and Mineralogist to the Second Geological Survey. He also was appointed Chemist to the Board of Agriculture where his knowledge of analytical chemistry was of great value in solving agricultural problems, particularly those connected with fertilizers.

Dr. Genth died in Philadelphia, February 2, 1893, in his seventy-third year at the end of a lifetime unsparingly devoted to the advancement of science. His contributions to the literature of chemistry and mineralogy total one hundred and two.

THE GENTH CORRESPONDENCE.

The Genth correspondence consists of over eight hundred letters, practically all of which are holographs. The list of correspondents is a "Who's Who" of mineralogy of the world. Over two hundred of the letters are in German, a few in French, and six hundred in English. This material will supply a rich mine of data to the research student. Among the European correspondence, to mention only a few, we find such names as Zirkel, Ahfeld, Bronn, Bertrand, Hausmann, Groth, Weisbach, Kolbe, Breithaupt, Gadolin, and Des Cloizeau.

Among the English letters we find such familiar names as Louis Agassiz, who sometimes wrote in German, Wolcott Gibbs, George L. English, George F. Kunz, William E. Hidden, W. C. Kerr, J. A. Holmes, R. A. F. Penrose, Jr., Charles E. Munroe, Ira Remsen, Edgar F. Smith, F. W. Clarke, J. Lawrence Smith, A. C. Hamlin, Joseph Henry, T. Sterry Hunt, J. P. Lesley, A. W. Winchell, C. F. Chandler, N. S. Shaler, Joseph Leidy, Franklin Bache, and S. P. Langley.

Of special interest to the mineralogist is the correspondence from James D. Dana, consisting of 45 letters, dated from 1853 to 1892; from George J. Brush, 36 letters, dated from 1854 to 1889; from Samuel L. Penfield, 39 letters, dated from 1888 to 1893; and from Benjamin Silliman, Jr., 48 letters, dated from 1853 to 1887.

THE GENTH MINERAL COLLECTION.

Dr. Genth was an enthusiastic and persistent collector of mineral specimens. He acquired material by purchase, exchange, and personal collection for which he had exceptional opportunity due to his extensive professional contacts. For example, an acquaintance in Arizona sent him a number of specimens of the mineral vanadinite. In the course of the correspondence the acquaintance expressed the wish that Genth would name any new mineral found in the material after Endlich. Genth did name an arsenic rich vanadinite—Endlichite, from New Mexico and quite naturally the mineral specimens thus acquired were included in his collection.

His collection of more than 5000 cataloged specimens is typical of the "mineral cabinet" of the nineteenth century. The specimens average about 3 inches in largest dimension and are arranged in separate trays with a carefully hand written numbered label in each tray. Genth placed the whole collection in six specially built mahogany cases.

His collection was practically complete for its time and as a scientific study collection must have had few private rivals for its period. A species is rarely represented by less than two localities and in the case of the American minerals the most important localities are represented. Since the collection is that of a scientist rather than a mere collector and value of the specimens lies in the completeness of labelling and variety of localities rather than in the size or superficial beauty. That is not to suggest that some of the specimens are not beautiful items. There are numerous well formed crystals, crystal groups, or polished slabs in the collection that would attract the artistically interested collector.

Among the outstanding and irreplaceable specimens are seventy meteorites, fifty-eight of which are from finds made in North America and in addition seven specimens of terrestrial iron. Nesquehonite and Lansfordite, two Pennsylvania minerals established by Genth and Penfield, are represented by nineteen specimens. Corundum and its alteration products, material on which Genth was an authority, complete a suite of 265 representative specimens. The garnet family is illustrated with 128 specimens. Pennsylvania minerals are exceptionally well represented with specimens from the Gap nickel locality and many representatives from the pegmatites of the Brandywine district. Very few thin-sections are to be found in the collection but it must be remembered that Genth was a chemist and not a petrographer. The full value of this collection will not be realized fully until more work has been done with it. Its service to science will increase with the years. The most remarkable specimen is the fragment of a well formed crystal of Genthelvite from W. Cheyenne Canyon, El Paso Co., Colorado. As far as known this is unique and no similar material is known to exist.

The example of Dr. Genth in his devotion to science and the presence of his collections continue to serve as an inspiration to students of mineralogy at The Pennsylvania State College.

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Vivianite.
Linnaeite. Wavellite.
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Native bismuth. Pholerite.
Whitneyite. Scheelite.
Bernhardtite. Rhombic tungstate of lime.
Gersdorffite. Wolfram.
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Antimonial Arsenic and Arsenolite. Pyrope.
Arsenides of Copper, Domeykite, Al- Lime-Epidote.
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Petzite and Hessite. Calaverite, a new mineral.
Altaite. Tetradymite.
Native Tellurium. Montanite, a new mineral.
Melonite, a new mineral.
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| Native Tellurium. | Sylvanite. |
| Tetradymite. | Calaverite. |
| Altaite. | Tellurate of Copper and Lead. |
| Hessite. | Bismuthine. |
| Petzite. | Schirmerite, a new mineral. |
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| Native Tellurium. | Ferrotellurite, a new mineral. |
| Hessite. | Roscoelite. |
| Coloradoite, a new mineral. | Green Mineral from Colorado (Aluminous Roscoelite). |
| Calaverite. | Volborthite. |
| Tellurite. | |
| Magnolite, a new mineral. | |
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- I. 1. Corundum altered into Spinel.
 2. Corundum altered into Zoisite.
 3. Corundum altered into Feldspar and Mica.
 4. Corundum altered into Margarite.
 5. Corundum altered into Fibrolite.
 6. Corundum altered into Cyanite.
 7. When were the corundum alterations formed?
 - II. Alteration of Orthoclase into Albite.
 - III. Alteration of Talc into Anthophyllite.
 - IV. Talc, pseudomorph after Magnetite.
 - V. Gahnite from Mitchell county, N. C.; from Cotopaxi, Col.; by H. F. Keller.
 - VI. Rutile and Zircon from the Itacolumite of Edge Hill, Bucks county, Pa.
 - VII. Sphalerite and Prehnite from Cornwall, Lebanon county, Pa.
 - VIII. Pyrophyllite in Anthracite.
 - IX. Beryl from Alexander county, N. C.
 - X. Niccolite from Colorado.
 - XI. Artificial Alisonite.
1883. 79. On Robert Wilhelm Bunsen in *Encyclopaedia Americana*, i, pp. 675-677.
1883. 80. Analyses of Fertilizers in Seventh Annual Report of Pennsylvania Board of Agriculture for 1883, pp. 365-374, Nos. 300-518 and 86-295.
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- Vanadinite. Descloizite.
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1. Tin and associated minerals.
 2. Joseite and Tetradymite.
 3. Seleniferous Galenobismutite.
 4. Argentobismutite.
 5. Cosalite.
 6. Schirmerite and Beegerite.
 7. Tetrahedrite—Sylvanite.
 8. Polybasite.
 9. Arsenopyrite and Scorodite.
 10. Alteration of Magnesian Limestones from Berks County, Pa.
 11. Ilmenite from Carter's Mines, N. C.; Oligoclase.
 12. Topaz from Stoneham, Me.
 13. Orthoclase from French Creek, Chester County, Pa.
 14. Muscovite after Nephelite.
 15. Stülpnomelane pseudomorphs—Ankerite.
 16. Calamine.
 17. Titanite.
 18. Vanadinite.
 19. Annabergite.
 20. Dr. Clemens Winkler and Herderite.
1886. 85. Analysis of pseudomorph from Magnet Cove, Ark., in Geo. F. Kunz *Mineralogical Notes*. *Am. Jour. Sci.* (3), xxxi, p. 74, January, 1886.

1886. 86. On an undescribed meteoric Iron from East Tennessee, with two photographic plates. *Proc. Ac. Nat. Sci.*, December 28, 1886.
1887. 87. Contributions to Mineralogy, No. 24. *Proc. Am. Phil. Soc.*, March 18, 1887, with 1 phototype plate and 3 wood cuts.
- I. Occurrence of Tin ores in Mexico.
 1. On Cassiterite—a, C. red variety; b, C. yellow variety; c, C. pseudomorphs after hematite; d, C. pseudomorphs after magnetite.
 2. Hematite.
 3. Mimetite and M. pseudomorphs after anglesite.
 - II. Vanadinite and Descloizite.
 - III. Pyrite pseudomorphous after pyrrhotite.
 - IV. Hessite.
 - V. Tapalite.
 - VI. Allanite.
 - VII. Willemite.
 - VIII. Hisingerite pseudomorphous after calcite.
1888. 88. On Lansfordite, a new mineral. *Groth's Zeitschrift*. xiv, 255-6.
1889. 89. On Two Minerals from Delaware County, Pa. *Proc. Ac. Nat. Sci.*, 1889, pp. 50-52, with one wood cut.
1. Gahnite.
 2. Columbite.
1889. 90. Contributions to Mineralogy, No. 44. *Am. Jour. Sci.* (3), September, xxxviii, pp 198-203.
1. Gadolinite from Texas.
 2. Cacoclasite.
 3. Monazite from Villeneuve, Canada.
1890. 91. Jarosite from Utah. *Am. Jour. Sci.* (3), xxxix, p. 73, January, 1890.
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- On a new occurrence of corundum in Patrick County, Va.
- | | |
|------------------------------------|--------------------|
| Corundum. | Muscovite. |
| Andalusite. | Margarite in part. |
| Cyanite and Rhaetizite Chloritoid. | |
1890. 93. On Lansfordite, Nesquehonite, and Pseudomorphs of Nesquehonite, after Lansfordite. By F. A. Genth and S. L. Penfield. *Am. Jour. Sci.*, xxxix, pp. 121-137, February, 1890.
1890. 94. Contributions to Mineralogy, No. 48. *Am. Jour. Sci.*, xl, pp. 114-120.
1. Tetradymite.
 2. Pyrite.
 3. Quartz, pseudomorphous after Stibnite.
 4. Gold in Turquoise from Los Cerillos, N. M.
 5. Zircon.
 6. Scapolite.
 7. Garnet.
 8. Titaniferous Garnet.
 9. Allanite.
 10. Lettsomite from Arizona and Utah
1890. 95. Contributions to Mineralogy, No. 49. With crystallographic notes by S. L. Penfield. *Am. Jour. Sci.*, xl, pp. 199-207.
1. Amarantite.
 2. Sideronatrite.
 3. Ferronatrite.
 4. Utahite.
 5. Picropharmacolite from Joplin, Mo.
 6. Pitticite.

7. The so-called Gibbsite from Chester County, Pa., a phosphate.
 8. Atacamite.
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1. Three new varieties of Axinite; a, from Franklin, N. J.; b, Guadalucazar, Mexico; c, McKay's Brook, Northumberland County, N. S.
 2. Eudialyte from Magnet Cove, Ark.
 3. Titanite from Magnet Cove, Ark.
 4. Monticellite from Magnet Cove, Ark.
1891. 97. Contributions to Mineralogy, No. 51. *Am. Jour. Sci.*, May, 1891 (3), xli, pp. 401-403.
1. Aguilarite, a new species.
 2. Seleniferous Bismuthinite and Guanajuatite.
1891. 98. Minerals of North Carolina. Bulletin No. 74, U. S. Geological Survey.
1891. 99. Contributions to Mineralogy, No. 52. By F. A. Genth, with crystallographic notes by S. L. Penfield. *Am. Jour. Sci.*, xliii, pp. 184-189.
1. Hübnerite.
 2. Hessite from Mexico.
 3. Bismutite.
 4. Natrolite.
1891. 100. On Penfieldite, a new mineral, No. 53, September, 1892. *Am. Jour. Sci.*, xliv, p. 260 (No. 53).
1891. 101. Contributions to Mineralogy, No. 54, November, 1892. *Am. Jour. Sci.*, xliv, pp. 381-389. With crystallographic notes by S. L. Penfield.
1. Aguilarite.
 2. Metacinnabarite.
 3. Löllingite.
 4. Rutile.
 5. Quartz resulting from the alteration of Orthoclase, from W. Cheyenne.
 6. Danalite.
 7. Yttrium-Calcium Fluoride.
 8. Altered Zircon or Cyrtolite.
 9. Lepidolite.
 10. Fuchsite.
1891. 102. On Anglesite, associated with Bolëite, No. 55, January, 1893, *Am. Jour. Sci.*, xlv, pp. 32-33.

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Research results of the Experiment Station are disseminated through the following publications: (1) Bulletins which present the proceedings of technical conferences and the detailed results of the experimental studies of a problem which may be more comprehensive than a single project. (2) Information Circulars which present in non-Technical language the results of studies which are given in greater detail in other publications, statistical data or pertinent information gathered from other sources. (3) Technical Papers consisting of bound copies of papers published in scientific journals (reprints), of progress reports, and of results of experimental studies which represent isolated phases of research and which will be summated later in bulletin form.

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