

## COMMONWEALTH OF PENNSYLVANIA

---

DEPARTMENT OF INTERNAL AFFAIRS  
James F. Woodward, Secretary

---

BUREAU OF TOPOGRAPHIC AND GEOLOGICAL SURVEY  
George H. Ashley, State Geologist

---

---

## GOLD IN PENNSYLVANIA

By

J. Ross Corbin

---

The discovery of gold in this or that locality in Pennsylvania is announced from time to time in the daily papers. As reported in the newspapers the "finds" have so frequently turned out to be false that a large portion of the public is disinclined to believe that gold has been found in Pennsylvania. However, there are several well-authenticated reports of gold "finds" in the State.

Persons inexperienced in the occurrence of gold are prone to be misled by several minerals which possess certain properties more or less remotely resembling some of the properties of gold. Despite the teaching in the public schools to the contrary, pyrite or "fool's gold" (a sulphide of iron) is still the most frequent cause of undue excitement. Certain micas present a bronzy, flaky appearance, and are sometimes erroneously supposed to be gold flakes. This happens more frequently when the flakes are found in a stream-bed, for when wet the bronze micas sometimes possess a distinct metallic sheen.

Distinguishing characters: For most people experience with gold is limited to jewelry, ornaments, and coins. Almost invariably these are alloys with other metals. Pure gold is so malleable, ductile, and soft that it does not "wear" well; hence other metals are added during the melting processes in order to make a more serviceable product. By adding various proportions of copper and silver, differences in hardness and in color may be obtained.

The color of native gold is so markedly characteristic that the noun itself is used as an adjective for describing a particular yellow. As found in nature, native gold invariably contains a small quantity of silver. The proportion of silver varies with the locality where the gold originated. A variation in the proportion of

silver produces a slight variation of "color" (tint). The gold from each locality ("gold-field") has peculiarities of size, shape, color, etc., which are characteristic. One experienced in these characteristics can identify the locality from which gold nuggets or gold dust originated. So definite are these local characteristics that in several instances attempts to "salt" gold mines have been discovered because the examining engineer was familiar with the appearance of gold from different localities.

Besides being found in the metallic condition, gold occurs also in combination with tellurium, forming the minerals sylvanite, calaverite, krennerite, and petzite. None of these minerals have been authentically reported from Pennsylvania localities.

### Occurrence in Pennsylvania.

Although the reports of finding gold in Pennsylvania are numerous, only a few such reports are of authentic discoveries. Because of the burning of the Capitol Feb. 2, 1897, and also owing to the numerous "reorganizations" which the various Pennsylvania Geological Surveys have had forced upon them, any official samples or original notes by members of the Survey which may have been on file have been destroyed or lost. Also, most of the authentic reports were published many years ago when geological and mineralogical investigations of the State were in early stages. In the following discussion, therefore, the literature on the subject has been drawn upon freely. Many of these reports are out of print and can be consulted only in the larger libraries. They cannot regularly be obtained from second-hand book dealers.

Lancaster County. Genth\* states: "Traces of gold I have found in.....the ores from the Gap mine." The mine here referred to is the Gap nickel mine in Bart township, Lancaster County. The quantity meant by the word "trace" is indefinitely small, but nevertheless recognizable. The Gap mine ceased working a few years after Genth's report was printed. The value of the gold contained in the ore is indefinite and probably no attempt was made to recover it. Under modern metallurgical treatment the gold would be recovered from the "mud" or "slime" in the electrolytic refining tanks or from the furnace residue if the carbonyl method, now in use, were applied to this ore.

The Gap nickel ore occurs at one of the few places in Pennsylvania where the surface exposure shows diabase (a basic igneous rock) cutting a very old rock. The metallic minerals, including the gold, are probably directly connected with the diabase or with the magma from which the diabase originated. This association has been observed in other, somewhat similar, situations.

---

\*Genth, F. A., Second Pennsylvania Geological Survey, Report B, p. 2, Harrisburg, 1875.

Lebanon County. The following quotation from Mineral Resources of the United States\* indicates the position of Lebanon County in gold production in Pennsylvania:

"There has been no production of gold, silver, lead, or zinc ores reported from Pennsylvania for many years, but since 1908 there has been annually a copper production yielding small quantities of precious metals in refining. The greater part of the output has been a by-product separated from magnetic ores of the Cornwall iron mine."

A table following the above statement shows the quantity of ore producing copper, silver, and gold, and the metal output from 1908 to 1910.

Ore treated and mine production of metals in Pennsylvania,  
1908 - 1910.

Ore sold or treated		Gold	Silver	Copper	Total Value
Short tons		Value	Fine Ounces	Pounds	
1908	(a) 157,269	\$ 704	.....	186,869	\$ 25,371
1909	191,198	4,941	43	621,969	85,819
1910	218,183	5,640	50	927,360	123,442

(a) Estimated.

The writer believes that the low recovery in 1908 was because the concentrating plant was not running at full capacity during the entire year; and that after 1910 gold and silver were not reported because the smelter did not account for minute percentages of these metals. The value of the gold recovered was only about  $2\frac{1}{2}$  cents per ton of ore treated.

As noted elsewhere\*\* the Cornwall ore deposit is characterized by the presence of diabase. It is evident that there, as well as at Gap and other localities, the origin of the gold is connected with

\*Mineral Resources of the United States, 1914, Pt. I, p. 156  
Washington, 1916.

\*\*Corbin, J. Ross, "Magnetite in Pennsylvania" Pennsylvania Geol. Survey Bull. 61, page 4. Harrisburg, 1923. For details of this deposit see Spencer, A. C., "Magnetite deposits of the Cornwall Type," United States Geological Survey Bulletin 359; also Second Pennsylvania Geological Survey, Annual Report 1885 (1886), Pages 491-570.

the diabase or with the magma from which the diabase originated.

Berks County. Genth\* states:

"Major Samuel L. Young, of Reading, has a fragment of quartz, containing a small particle of gold about the size of a No. 5 shot, crushed, which is said to have been found in the neighborhood of Reading by the late Jno. P. Miller.

"Dr. W. J. Hoffman, of Reading, who kindly furnished me with this information, states that the matrix appears to correspond with the rocks found northeast of the city, but that he has never felt perfectly satisfied regarding the specimen in question.

"Although somewhat doubtful, I give this additional locality, as it may lead to the discovery of larger and perhaps workable quantities of this metal."

Dr. Charles M. Wetherill investigated the occurrence of gold near Reading. His published results follow:

"During a stay at Reading, in the summer of 1851, I noticed a vein of decayed ferruginous quartz, very much resembling the auriferous quartz of North Carolina. It was uncovered in exploring the deposits of iron ore in Penn's Mount behind the city. I neglected at the time to secure specimens, and upon a second visit to the locality this spring, to obtain a quantity for analysis, I found it covered. I obtained, however, from the vicinity a quartz rock, quartz and feldspar mingled, and sand, which, on analysis, yielded an exceedingly minute quantity of a brownish powder after treating the silver button resulting from cupellation by nitric acid; but which were too minute from which to derive any definite conclusion as to the presence or absence of gold. A former pupil of mine in an examination of the pyrites of the same locality, thought to have detected traces of gold. I have no doubt, that a more careful examination of the rocks in the vicinity would yield affirmative results in an examination for this metal."\*\*

Later, in another publication\*\*\* Dr. Wetherill reports a continuation of his investigations:

"Last summer, (1853 or 1854 ?) Mr. Philipps, a mining geologist, in searching for iron ore on the farm of Mr. Entlich; a few miles eastward from Reading, and of Mr. Jonathan Deininger, about a mile from the same place on the western slope of Penn's Mount, detected gold by washing specimens of the ferruginous quartz. I called upon Mr. Deininger, who showed me the specimens in his possession, and gave me some of the quartz rock from his farm. Mr. Deininger showed me a specimen of gold, in weight I should judge between one and five centigrammes, which was broken by himself out of the rock.

---

\* Genth, op. cit., p. 207

\*\*Wetherill, C. M., "On the Occurrence of Gold in Pennsylvania." Transactions of the American Philosophical Society, Vol. X (New Series) page 350. 1855.

\*\*\* Wetherill, C. M., "On the occurrence of Gold near Reading." Proceedings of the Academy of Natural Sciences, Vol. VII, p. 233, 1856

"I have noticed this quartz scattered over the ground in various parts of Berks County, some specimens bearing very strong gold characteristics; they are partially water worn, but the angles are moderately sharp; on breaking them open the enclosed masses of dark oxide of iron are apparent.

"At the angles formed by the intersection of 8th and 9th streets, Reading, there is a heap of stones gathered from the adjoining fields, containing about two per cent of pieces of this quartz rock; I brought home specimens with me for examination. These specimens, together with those obtained from Mr. Deininger's field by myself, were pulverized and washed, but without, in any instance; detecting gold. They were then smelted with litharge and charcoal, and the button of lead cuppelled. Of course, the litharge was examined for gold. The 30 gramme button of lead from about 100 of litharge gave a silver button of 0.00575 grms., and which contained no gold.

"A. 8th street quartz--65 grammes plus 130 litharge plus 10 black flux gave a lead button of 14 grms., and silver 0.0075, which contained gold beyond a doubt, as judged from its lustre and resistance to nitric acid.

"B. Another portion of quartz from the same locality -- 200 grms. plus 400 litharge plus 0.5 charcoal dust, gave lead 17 grms.,; silver 0.00875 containing gold, though not as distinctly as the last.

"C. Quartz from Mr. Deininger's fields -- 185 grms. plus 370 litharge plus 0.5 charcoal gave 20 grms. of lead containing 0.00825 silver, in which no gold could be detected."

The Second Pennsylvania Geological Survey reports\*:

"One locality is thus far reported in Berks County, where native gold is said to exist, viz: at the western base of Mt. Penn, near the suburb of Hampden. The late John P. Miller found a piece of quartz bearing traces of this metal, with one or two very prominent particles. Dr. Charles M. Wetherill found traces of gold in ferruginous quartz from the same place."

From these descriptions it is difficult, if not impossible, to state the geological relations with any hope of accuracy. The city of Reading (Hampden, also) is located on limestone. Mount Penn is a granitic mass with several dikes appearing at the surface. At the west base of Mt. Penn, between the granite and the limestone, is quartzite. The pieces of quartz which contained the gold may have come from this quartzite, from some portion of the granite, or possibly from some vein or lode with quartz gangue in the limestone at an unknown location. Each of these is a possibility but there is apparently no way of determining which of these (or what other) was the real source.

---

\*D'Inwilliers, E. V., Second Pennsylvania Geological Survey Report DDD, Pt. II, page 397, 1883.

Another locality in Berks County from which gold has been authentically reported is near Rittenhouse Gap, Longswamp township. Messrs. J. L. W. Birkinbine, of Philadelphia, and James R. Evans, of Douglassville, have studied exhaustively the occurrences of iron ores at this locality. As a part of this study micrographic slides were made. Small flakes of gold were observed in several such slides.\*

Granite occurs in many facies at Rittenhouse Gap. Faulting is very frequent. The fault-planes present no evidences of the circulation of mineral-bearing solutions. The gold was one of the original constituents of the fluid magma and is not sufficiently abundant to warrant attention further than a notation of its occurrence as a mineralogical curiosity.

Chester County. Genth\*\* says: "Traces of gold I have found in the chalcopryite or copper pyrites from the Chester County mines, near Phoenixville." Again the word "trace" means an indefinitely small amount. In any future milling operations in the Phoenixville district attempts will probably be made to separate the chalcopryite from the other minerals. Should such operation be successful the gold content of the chalcopryite might or might not be valuable, depending upon the proportion present.

Dr. B. L. Miller, an associate geologist of this Survey, had the opportunity of visiting the Phoenixville district when certain mines were in operation. His information is therefore augmented by underground observations. Concerning the origin of these deposits he says:\*\*\* "The lead, zinc, and copper lodes of Chester and Montgomery counties are of hydrothermal origin. They have been formed by deposition from heated solutions probably given off from some deep-seated igneous masses. They are fissure veins and may follow faults wholly or in part. In the Chester County lode the foot-wall is prominently slickensided and in places the hanging wall also shows slickensides. In the Wheatley mine the vein cuts three trap dikes that have been displaced several feet. On the mine dumps one also finds occasional pieces of slickensided rocks. However, one cannot say whether faulting preceded the deposition of the lodes or not. The shattered character of the gangue and ore minerals and the presence of clay gouge and open quartz-lined fissures indicate that there has been at least some displacement following the formation of the lodes.

"The lodes are of Triassic or post-Triassic age as proved by the fact that they cut the Triassic shales of the Stockton formation and the trap dikes that are so commonly found as intrusives of the Triassic rocks of the State.

---

\*Oral communication, J. L. W. Birkinbine to J. Ross Corbin.

\*\*Genth, F. A., op. cit. p.2.

\*\*\*Miller, B. L. Penn. Geol. Survey Bull. 67, pages 6 and 7, Harrisburg, 1923.

"In every case the lodes have undergone secondary changes through the agency of downward percolating waters. The gossan and cavernous quartz of the outcrops, the secondary minerals such as pyromorphite, cerussite, anglesite, calamine, etc., some of which are found at considerable depths, furnish evidence of the extensive alteration which the lodes have undergone.

"The abundance of pyromorphite is difficult to explain as there is now no evidence of the source of the phosphoric acid. It is possible that there were some phosphatic beds in the overlying Triassic strata now removed by erosion, but this is only a conjecture.

"It seems that Rogers probably over-emphasized the distinctions between the lodes lying within the gneisses and those found in the shale areas although he was correct in pointing out general differences. Undoubtedly the shales tended to cause the deposition of the primary chalcopryite to a greater degree than did the gneisses and vice versa the gneisses had a selective reaction on the solutions causing greater deposition of the galena than is found in the veins enclosed by the Triassic shales."

Montgomery County. The old Perkiomen and Ecton mines are located near Audubon. These are not specifically mentioned as carrying gold, but inasmuch as their origin is similar to that of the Phoenixville deposits of Chester County it is probable that this mineral exists along with others, although it may not yet have been recognized.

In an article on copper deposits in southeastern Pennsylvania Wherry\* says: "In a trap sheet near Congo, Montgomery County, chalcopryite appears in large irregular grains embedded in seams of fibrous hornblende. Some years ago this material was announced as gold-bearing, and the writer made an assay of it, finding .3 ounce of that metal and 1.7 ounces of silver. As these values are probably confined to the chalcopryite, which constitutes less than 10 per cent of the rock, this mineral would appear to be extremely rich. But the amount of the "ore" is limited, and profitable working seems out of the question."

Here again the gold is associated with diabase, and originated either in the diabase or in the fluid magma from which the diabase came.

Another occurrence of gold in Montgomery County is described in the following quotation\*\*

"On the Occurrence of Gold in Pennsylvania. In the spring of 1851, an earth was given to me for examination, of which the locality was not exactly stated, but which was said to have been taken not far

---

\*Wherry, Edgar T., "The Newark Copper Deposits of Southeastern Pennsylvania." Econ. Geol. Vol. III, No. 8, p. 732, December, 1908.

\*\*Wetherill, Charles M., Trans. Am. Phil. Soc. Vol. X (N.S.) p. 350, 1853.

from the city, in which gold was detected. The earth was said to have been obtained in digging a well. Several months later, while in Reading, I met with a notice in a German newspaper of that place, which stated that some time previously an earth had been found in digging a well, upon the land of Mr. Yoder, Franconia township, Montgomery County, which proved, upon examination, to contain gold. I have no doubt but that this is the locality of the earth which I examined. Several rocks from the neighbourhood were submitted, consisting of clay slate rock, ferruginous quartz, decayed in places, containing pyrites and magnetic oxide of iron sand. In most of these gold was detected in traces. Some specimens contained no gold whatever. The earth from the well, which was more particularly examined, consisted of sand and gravel, coating in some places fragments of shale or other rock. A careful examination of these with the lens, detected a rather thick spangle of gold adhering to the gravel. \*\*\*\* Separating the rock and washing, gave a further quantity of gold spangles. \*\*\*\*\* One and a half pounds of the original substance, from which these spangles were removed, after separation of the rocks and concentration by washing, were melted with twice their weight of litharge, (previously tested for gold,) and a small quantity of charcoal powder. The resulting button of lead was cupelled (adding to the lead the gold already found) and the silver treated with nitric acid which left a coherent mass of gold weighing 0.006 grammes. One hundred pounds of the earth would, therefore, contain 0.4 grammes of gold, worth about twenty-six and a half cents."

Philadelphia County. Concerning this county Genth\* notes that, "One of the workmen in Mr. Charles Lennig's Chemical Works, by the name of Kuhbach (Keller-Tiedemann's Nordamerikanischer Monatsbericht I, 231; also, F. Fraley, in Proc. Am. Phil. Soc., V, 313); who was familiar with the operations of washing gold on the Rhine, found in the gravel of the Delaware River, at Bridesburg, native gold in scales, accompanied by menaccanite, magnetite, etc. This discovery was verified by Mr. Wm. Schrader, then chemist at the works, who extracted the gold from the sands by mercury, and reduced it to a pure state. The quantity of gold which a hand could wash from the Delaware River sands, was variously estimated at from 25 to 60 cents per day."

This same discovery was discussed at a meeting of the American Philosophical Society.\*\* "Mr. Fraley mentioned, in connection with this subject; that a workman in the chemical laboratory of Mr. Lennig, in this city, had obtained gold by washing from the sand on the bank of the Delaware River, near Bridesburg, about five miles above Philadelphia. The gold thus obtained, by a day's labour, was worth about twenty-five cents."

---

\*Genth, F. A., op. cit. p. 2.

\*\*Proceedings of the American Philosophical Society, Vol. V, page 313, 1854.



At another meeting of the same society Messrs. Dubois and Eckfeldt presented some results of investigations:\* "Underneath the paved city of Philadelphia there lies a deposit of clay, whose area, by a probable estimate, would measure over three miles square, enabling us to figure out the convenient sum of ten square miles. The average depth is believed to be not less than fifteen feet. The inquiry was started whether gold was diffused in this earthy bed. From a central locality, which might afford a fair assay for the whole, the cellar of the new market-house in Market Street near Eleventh Street, we dug out some of the clay at a depth of fourteen feet, where it could not have been an artificial deposit. The weight of 130 grammes was dried and duly treated, and yielded one-eighth of a milligramme of gold; a very decided quantity on a fine assay balance.

"It was afterwards ascertained that the clay in its natural moisture loses about fifteen per cent. by drying. So that, as it lies in the ground, the clay contains one part gold in 1,224,000.

"This experiment was repeated upon clay taken from a brick-yard in the suburbs of the city, with nearly the same result.

"In order to calculate with some accuracy the value of this body of wealth, we cut out blocks of the clay, and found that on an average, a cubic foot, as it lies in the ground, weighs 120 pounds, as near as may be; making the specific gravity 1.92. The assay gives seven-tenths of a grain, say three cents' worth of gold to the cubic foot. Assuming the data already given, we get 4180 millions of cubic feet of clay under our streets and houses, in which securely lies 126 millions of dollars. And if, as is pretty certain, the corporate limits of the city would afford eight times this bulk of clay, we have more gold than has yet been brought, according to the statistics, from California and Australia.

"It is also apparent that every time a cartload of clay is hauled out of a cellar, enough gold goes with it to pay for the carting. And if the bricks which front our houses could have brought to their surface, in the form of gold leaf, the amount of gold which they contain, we should have the glittering show of two square inches on every brick."

At this same meeting Professor Lesley, (later State Geologist of Pennsylvania) remarked: "As all clays are made up chiefly of alumina and silica, derived from the disintegration of tertiary, secondary, and primary rocks in a long backward series of remanipulations, it should not excite surprise if all clays, without exception, should yield minute quantities of gold. And as all the primary metals have gangues containing silica, which enters as an impurity into the manufactured article, probably in the form of silicon, it is likewise almost inevitable that gold should appear with it."

---

\*Dubois and Eckfeldt, "On the Natural Dissemination of Gold." Proceedings of the American Philosophical Society, Vol. VIII, No. 65, January-June, 1861.

This is evidently a placer deposit in which the gold flakes are unattached to gangue. A modern gold dredge might profitably work a uniform deposit of this character.

Bucks County: In the paper by Dubois and Eckfeldt previously mentioned,\* the following passage occurs: "The most curious result was obtained from the galena of New Britain, in Bucks County, Pennsylvania, where gold was found in the proportion of  $2\frac{1}{2}$  grains, not quite ten cents, to the ton. This represents one part in 6,220,000, and may serve as a remarkable example of refinement in the art of assaying. The operation was performed on five ounces of the ore. The speck of gold which resulted is visible to a good eye, and is exhibited in the Cabinet of the Mint."

In considering this statement it must be remembered that this small quantity of gold represents the amount per ton of galena, not per ton of ore as mined. Miller\*\* states that galena from the New Galena (or New Britain) deposit "had yielded 10 to 15 ounces of silver and 10 cents in gold per ton." The New Britain (or New Galena) deposits occur in Triassic shales near or at a diabase intrusion. This connection is again noteworthy.

Another occurrence of gold in Bucks County is reported by Wherry\*\*\* who says: "Near Rockhill Station, in Bucks County (loc. 10), there is a small area of unusually coarse-grained diabase (gabbro) in which a find of  $3\frac{1}{2}$  ounces of gold to the ton was reported in the local newspapers. It developed later that this was a fraud, but, strange to say, the rock actually did prove to contain gold, assays made under the writer's direction, upon material collected by himself, yielded about \$1.00 to the ton." At this occurrence the association of gold with the diabase is definite and positive.

Recently local newspapers have featured a "find" near Yardley, Bucks County. This locality was known as gold-bearing at least as far back as 1895, for in the Final Summary Report of the Second Pennsylvania Geological Survey, published that year, occurs the following passage\*\*\*\*: "Traces of gold are said to have been found in the very pebbly rock at the southern edge of the field on Mr. Henry Haviland's farm, near Lizette Station, and a mile south of Yardleyville; but no thoroughly trustworthy tests of the matter appear to have been made. At the same time, it may be said that the occurrence of traces of gold in this conglomerate derived from the adjacent Archean rocks is by no means impossible. It is, however, hardly probable that paying quantities of it, if existing, should not long ago have been discovered and utilized."

---

\*Dubois and Eckfeldt. Op. cit.

\*\*Miller, B. L., "Lead and Zinc Ores in Bucks County, Pennsylvania." Penna. Geol. Survey Bull. 69, page 4. Harrisburg, 1923.

\*\*\*Wherry, E. T. Op. cit.

\*\*\*\*Lyman, Benjamin Smith, "Report on the New Red of Bucks and Montgomery Counties," Second Pennsylvania Geological Survey; Final Summary Report, Vol. 3, part 2, page 2633. Harrisburg, 1895.

The writer has visited this locality and has seen specimens of a loosely-cemented conglomerate, the material which is reported to contain gold. The pebbles of the conglomerate are quartzite or milky quartz, subangular to rounded in form. Most of them are  $\frac{1}{2}$  inch or less in diameter, although a few exceeded this size. The cementing material is iron oxide. No gold was visible.

This Survey is not yet equipped with a research or an analytical laboratory; hence it is impossible to make such a study of this deposit as seems to be warranted. If the assay-reports received by the owners are truly representative, the deposit may attain economic importance.

Pike and Monroe Counties: In discussing the Oneida conglomerate (now named Juniata) in Pike and Monroe counties, White\* says: "This is a hard massive conglomerate, with some beds of gray sandstone in the upper part of the mass. The conglomerate layers are composed of quartz pebbles from the size of a walnut down to fine sand.

"Some of the lower beds of the conglomerate contain minute pyrite cubes, which, in some localities, are of large size and auriferous."

This same stratigraphic position is discussed by Lesley\*\*who remarks: "Although the lower beds of the Oneida are largely made up of gold-bearing quartz, of course they cannot be considered in any sense ancient glacial placer gravels; and free gold has never been reported. What gold exists is in the quartz pebble itself. It is perfectly certain that no gold mining can be successful in any of the mountains of No. IV in Pennsylvania."

In 1868 the State Geologist of New Jersey published some interesting information regarding the Oneida conglomerate\*\*\*. Although dealing with localities outside of Pennsylvania the reference is interesting in Pennsylvania, for the same stratigraphic conditions exist as are to be found in New Jersey.

"This strongly-marked member (Oneida Conglomerate) of the series of rocks is named from the place where it is well developed. It is the characteristic rock of the Shawangunk Mountain, and is frequently spoken of as the Shawangunk Conglomerate, or Shawangunk Grit.

"Its position, directly on the Hudson River Slates, as shown in the sections preceding, sufficiently defines its age.

"The rock is all a conglomerate or sandstone. The lower part is made up of quartz pebbles, from a fourth to three-fourths of an inch in diameter, cemented by a light-colored quartzose paste. The well known Esopus Millstones are made of this variety of the rock. As we get higher in the series of layers, the pebbles become smaller, until

---

\*White, I. C., "The Geology of Pike and Monroe Counties." Second Pennsylvania Geological Survey Report G6, p. 347, Harrisburg, 1882.

\*\*Lesley, J. P., Second Pennsylvania Geological Survey, Summary Final Report, Vol. 1, p. 679, Harrisburg, 1892.

\*\*\*Cook, George H. "Geology of New Jersey," page 146, 1868.

near the top of the formation, when they are scarcely distinguishable from the paste in which they are imbedded, and the whole has the appearance of a firm, compact quartzose rock. This rock is easily distinguished from the Green-Pond Mountain rock by its lighter color, though it is equally hard. It is in beds of considerable thickness, and from its hard and unyielding nature has undergone fewer changes in structure and position than any other of the Paleozoic Rocks. The section at the Water-Gap, Fig. 39, shows this hard conglomerate forming the crest and northwest face of the mountain, while the softer Hudson River Slates have been worn away on the southeast face, and only appear as they have been overlaid and protected by the unyielding conglomerate.

"This rock has not furnished any fossils. Some portions of it are pyriteous, and have been worked in for gold, and the bottom-beds of the coarse conglomerate yielded eleven dollars worth of gold to the ton, according to our assays, though some sanguine miners have put the yield two or three times as much as this. The occurrence of the iron pyrites is so common that localities need not be specified. Anywhere along the outcrop of the conglomerate at its meeting with the slate searches may be made, and whenever the extraction of gold is so perfected that these small quantities will pay, this rock may become valuable for its metallic riches."

Resume'. The foregoing occurrences may be easily divided into three general classes:

- (1) Occurrences related to diabase (trap).
- (2) Occurrences related to granites.
- (3) Placer deposits (either consolidated or unconsolidated).

The genesis of the deposits of the first two classes evidently is closely connected with the origin of the igneous rock-masses.

Deposits of the third class are due to the action of moving water. The gold was present in the rocks which were disintegrated and transported. In the Bridesburg occurrence the gold was amalgamated with mercury. In order that this could take place it was a prerequisite that the gold be either "free" (i.e., not enclosed within the pebbles which composed the gravel) or else have at least one surface exposed. If the former be the case it is not certain that the gold came from the same source as did the pebbles, sand, and clay, for in the present situation they may be merely a mechanical mixture. Each type of material may have come from a source different from the sources of the other types.

In the Juniata (Oneida) conglomerate the gold occurs in the pebbles (according to Lesley). Some of the pebbles are therefore probably weathered fragments of gold-bearing veins or gold-bearing lodes. These pebbles probably came from a land-mass to the east or northeast of their present situation. Similarly, the materials of the conglomerate near Yardley were derived from adjacent older rocks, although, in this area, the gold is reported to be entirely outside the pebbles.

Economic Conclusions. These observations were based on discoveries made 30 or more years ago. Since that time remarkable advances have been made in methods of mining and in ore-dressing. Gold-dredges are now operating profitably in ground carrying only a few cent's worth of gold in each cubic yard. Dredging might therefore be profitable on material of the Bridesburg type provided the deposit were sufficiently extensive, and provided also that the surface or the location was not valuable for other purposes.

The reported occurrence of \$11.00 worth of gold per ton in the Juniata (Oneida) conglomerate deserves a full investigation. Not enough is known concerning this occurrence. It may be valuable, or it may be merely a mineralogical curiosity.

The gold which occurs with the mixed ores may or may not be recovered during the ore-treatment processes, depending upon the quantity present per ton of ore.

The reported Yardley occurrence demands much greater study, not alone for itself but because a thorough study of this deposit would furnish information which would point the way to locating other similar deposits.

For the present, at least, the other occurrences of gold in Pennsylvania are merely interesting curiosities.