COMMONWEALTH OF VIRGINIA
STATE COMMISSION ON CONSERVATION AND DEVELOPMENT
VIRGINIA GEOLOGICAL SURVEY
ARTHUR BEVAN, *State Geologist*

Bulletin 44

Preliminary Report on
Gold Deposits of the Virginia Piedmont

By
C. F. PARK, Jr.

In Cooperation with the United States
Geological Survey

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COMMONWEALTH OF VIRGINIA

VIRGINIA GEOLOGICAL SURVEY

UNIVERSITY OF VIRGINIA

CHARLOTTESVILLE, VA., January 3, 1936.

To the State Commission on Conservation and Development:

GENTLEMEN:

I have the honor to transmit and to recommend for publication as Bulletin 44 of the Virginia Geological Survey series of reports the manuscript and illustrations of a *Preliminary Report on Gold Deposits of the Virginia Piedmont,* by Dr. C. F. Park, Jr., of the United States Geological Survey.

The field and laboratory work on which this report is based were done by the United States Geological Survey without cost to the State. The field studies were made under funds granted by the Public Works Administration. The report has been transmitted to the Virginia Geological Survey for publication.

This report should be of considerable value to all who are interested in the gold deposits of Virginia, either as landowners or as prospectors and mineral operators. It gives the latest information about certain of these deposits, derived from a close study of some active operations. Further, the report derives value and pertinence from the fact that the author has been engaged in similar investigations of other gold deposits in the Appalachian region.

Respectfully submitted,

ARTHUR BEVAN,
State Geologist.

Approved for publication:
State Commission on Conservation and Development,
Richmond Virginia, January 7, 1936.
R. A. GILLIAM, *Executive Secretary and Treasurer.*

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ABSTRACT

The gold deposits of the Virginia Piedmont lie in a narrow belt between the Blue Ridge on the west and the Coastal Plain sedimentary beds on the east. The deposits were worked intermittently from 1829 until 1912, but have been idle from 1912 until recently. The total gold production of Virginia from 1829 to 1934, inclusive, is given as $3,318,388.

The region is underlain by a series of recrystallized quartzites and schists which are considered to belong to the Wissahickon formation. These metamorphic rocks strike approximately N. 30° E. and dip steeply either southeast or northwest. The age of the Wissahickon formation is generally considered to be pre-Cambrian. Many intrusive bodies are present, and a few of the gold deposits occur in these igneous rocks.

The gold deposits are of two types—(1) lode deposits consisting mainly of lenses, either single or compound, and (2) replacement deposits. Any one ore body commonly exhibits both forms, with one predominant. The ore deposits are closely related to the underlying structure. Compressive stresses from the east have been relieved along northeastward-trending shear zones, and tension cracks that strike northwest have been developed. The ores have been deposited along the shear zones, especially in the more broken places where the shear zones are crossed by the tension cracks.

The mineralogy of the ores is simple. Quartz, sericite, and ankerite make up most of the gangue, and chlorite is an abundant constituent in the wall rocks. The ankerite persistently occurs between quartz and the sericitized or chloritized wall rocks. Pyrite is the most common sulphide, but a little chalcopyrite is generally present, and small amounts of other ore minerals may occur. Gold is the only mineral of economic importance at present. It is generally fine grained except in the near-surface ores and is intimately associated with the sulphides.

The oxidized or saprolite zone generally extends to a depth of 75 to 150 feet below the surface. Enrichment by the mechanical settling of the heavy gold particles is common in the near-surface ores. Some solution and redeposition of the gold have probably taken place. Evidence is advanced to show that part of the deeper ores recently worked in the Melville mine have not been noticeably enriched by gold from downward-percolating solutions.

Detailed descriptions of the accessible properties are given.

Preliminary Report on Gold Deposits of the Virginia Piedmont

By C. F. Park, Jr.[1]

INTRODUCTION

The gold deposits of Virginia are located along a narrow belt of the Piedmont region east of the Blue Ridge. They form the northern part of the mineralized belt that extends from Potomac River south into Alabama. Numerous publications describe the history and geology of the mines.[2]

The present investigation was begun October 1, 1934, by the United States Geological Survey under a grant of funds by the Public Works Administration. A month and a half was spent in the field, mapping the more accessible mines and prospects. The area was revisited in June, 1935, at which time about 2 weeks were spent in the field. Owing to the limited time and funds available, more important information could be collected by studying several properties in detail than by mapping of a more general nature. C. B. Reed and W. W. Simmons acted very capably as field assistants. The Virginia Geological Survey has cooperated in many ways to facilitate the work and William M. McGill has contributed free use of his unpublished notes. Thanks are also due to the property owners and operators for their whole-hearted cooperation.

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[1] Published by permission of the Director, U. S. Geological Survey.

[2] Whitney, J. D., Metallic wealth of the United States, described and compared with other countries, pp. 124-129, London, Lippincott, Grambo & Co., 1854.

Becker, G. F., Gold fields of the southern Appalachians: U. S. Geol. Survey 16th Ann. Rept., pt. 3, pp. 251-319, 1895.

Watson T. L., Gold and silver *in* Mineral Resources of Virginia: pp. 549-567. Virginia Jamestown Exposition Commission, Lynchburg, Va. J. P. Bell Co., 1907.

Taber, Stephen, Geology of the gold belt of the James River Basin, Virginia: Virginia Geol. Survey Bull. 7, 1913.

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Lonsdale, J. T., Geology of the gold-pyrite belt of the northeastern Piedmont, Virginia: Virginia Geol. Survey Bull. 30, 1927.

McGill, Wm. M., Gold-mining operations in northern Virginia: Min. Cong. Jour., October, 1934, pp. 12-16, 28.

Vivian, C. H., The gold hunt in Virginia continues: Compressed Air Mag., January, 1935, pp. 4618-4623.

GEOGRAPHY

Most of the gold deposits of Virginia are confined to a belt less than 20 miles wide, which extends from the vicinity of Great Falls, on Potomac River, southwestward through Chancellorsville, Mineral, and Tabscott into Buckingham County. With a short interruption, the belt can be followed through Virgilina into North Carolina. (See Fig. 1.)

The Piedmont region of Virginia lies between the Blue Ridge on the west and the Coastal Plain sediments on the east. Most of the area is between 250 and 500 feet above sea level. It is well drained by streams that flow southeastward, transverse to the regional structure of the rocks. The uplands between the major drainage channels consist of gently rolling country, with hilltops usually 50 to 75 feet above the intervening hollows.

The Piedmont region is ideally situated for mining. Transportation facilities are good, both by rail and by road. Timber and water are sufficient for most purposes. The vegetation is chiefly second-growth oak and several varieties of pine, with local areas of thick underbrush and small stands of other trees. Climatic conditions are mild during most of the year, although surface work is disagreeable during part of the winter. The annual rainfall averages between 50 and 60 inches.

Labor is abundant and cheap, but much of it must be recruited from neighborhood farms and is unskilled in the use of mining equipment.

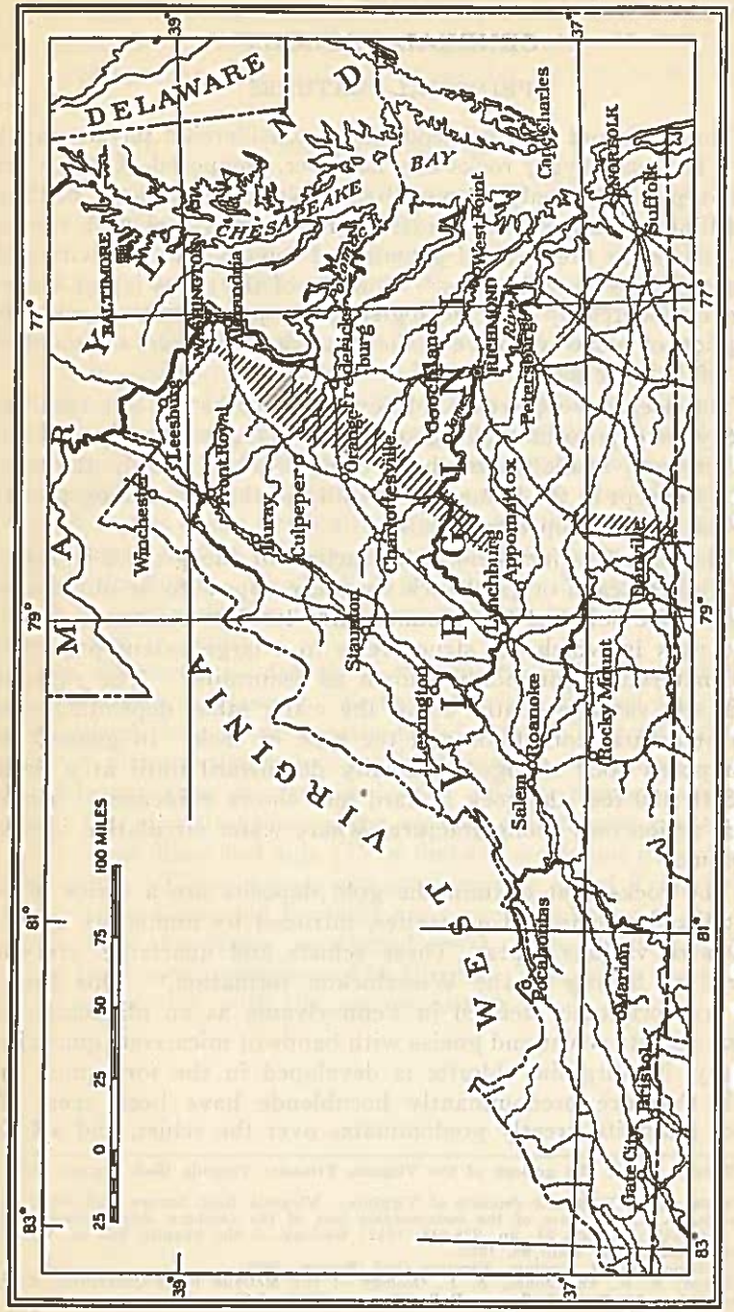


Figure 1.—Index map of Virginia showing the location of the Piedmont gold deposits.

GENERAL GEOLOGY

PRINCIPAL FEATURES

The Piedmont region is commonly considered a physiographic unit. The underlying rocks are, however, composed of many different types, commonly recrystallized. No detailed study of these crystalline rocks has been made. A few papers deal with the region but are in the form of generalized reports treating with particular features or rock types.[3] The age of the rocks is not known but is considered by most geologists to be pre-Cambrian, with the exception of some intrusive bodies and down-faulted sedimentary beds of Triassic age.

The deeply weathered condition of the rocks and the resulting scarcity of exposures make geologic mapping extremely difficult. No time was available, in the present work, to study the areal geology except in the immediate vicinity of the few mining properties that were mapped in detail.

The first few feet below the surface of the ground is soil in which all traces of original rock structure appear to be obliterated. Between the soil and the ground-water level is a zone of decomposed rock in which the structure is to a large extent preserved. This material is commonly known as "saprolite." The saprolite persists to variable depths below the water table, depending upon local structural conditions and the type of rock. In general the decomposed rock changes gradually downward until at a depth of 75 to 150 feet the rock is hard and shows evidence of atmospheric action only along fractures where water circulation is most vigorous.

The rocks that contain the gold deposits are a series of recrystallized schists and quartzites, intruded by numerous igneous masses of various types. These schists and quartzites are considered to belong to the Wissahickon formation.[4] This formation was originally defined in Pennsylvania as an oligoclase-biotite-muscovite schist and gneiss with bands of micaceous quartzite.[5] Locally, in Virginia, chlorite is developed in the formation, and bands that are predominantly hornblende have been seen. In places quartzite greatly predominates over the schist, and a large

[3] Roberts, J. K., The geology of the Virginia Triassic: Virginia Geol. Survey Bull. 29, 1928.
Pegau, A. A., Pegmatite deposits of Virginia: Virginia Geol. Survey Bull. 38, 1932.
Jonas, A. I., Structure of the metamorphic belt of the southern Appalachians: Am. Jour. Sci., 5th ser., vol. 24, pp. 228-243, 1932; Geology of the kyanite belt of Virginia: Virginia Geol. Survey Bull. 38, 1932.

[4] Geologic map of Virginia, Virginia Geol. Survey, 1928.

[5] Knopf, E. B., and Jonas, A. I., Geology of the McCalls Ferry-Quarryville district, Pennsylvania: U. S. Geol. Survey Bull. 799, pp. 25-35, 1929.

area of this rock is correlated with the Peters Creek quartzite. The schistosity of the rocks strikes approximately N. 30° E. and dips steeply, commonly to the southeast but locally to the northwest.

IGNEOUS ROCKS

Numerous types of igneous rocks in the Wissahickon formation are shown on the geologic map of Virginia and in the reports already cited. Few of these igneous rocks are associated intimately with the ore deposits, and of the properties visited only the veins at the Franklin mine, in Fauquier County, and several at the United States mine are in intrusive rocks.

The intrusive rock at the Franklin mine is a somewhat sheared and highly altered greenish-mottled rock. Thin sections show mainly altered plagioclase and fine-grained quartz, probably recrystallized. The feldspar outlines are preserved, and a few twinning bands can be seen. The mineral is probably near oligoclase in composition but is too much altered to be identified with certainty. A fine-grained mat of chlorite, carbonate, clinozoisite, epidote, and quartz is developed. The rock is probably a silicified and altered diorite or quartz diorite. No other areas of igneous rocks have been studied in detail.

The difference in degree of metamorphism of the intrusive bodies is a striking feature. Some bodies are sheared and partly recrystallized; others are mostly undeformed. This variation in degree of metamorphism has led investigators in the past to assign different ages to various bodies. Some masses were apparently intruded after most of the regional deformation had ceased.

Intrusive dikes and sills (?) of diabase are found near several of the mines. These masses are considered to be of Triassic age. Slightly altered rounded boulders are commonly found at the surface, even in the deeply weathered areas. The Triassic diabase has not been seen underground in Virginia; it appears to have no genetic connection with the ore deposits.

ECONOMIC GEOLOGY

HISTORY OF MINING

Gold was first authentically reported from Virginia in 1782.[6] Rogers in 1836 reported a number of mines working in Spotsylvania, Orange, Louisa, Fluvanna, and Buckingham counties.[7] Whitney listed 12 mines working in 1854.[8]. Of these 12 mines only the Vaucluse is being worked at present (1935). Gold-mining operations stopped entirely during the War between the States, but the properties were reopened shortly afterward. Mining gradually decreased as the richer oxidized and placer ores were exhausted. Practically no mining had been done since 1912 until the recent revival of activity.

PRODUCTION

The total estimated gold production of Virginia from 1829 to 1934 is given as $3,318,388 by the United States Bureau of Mines.[9] Table 1 gives the production figures of the Bureau of the Mint from 1829 to 1879 and of the United States Geological Survey and Bureau of Mines from 1880 to 1934. These figures show the amount of gold sent to the mints up to 1879 and the amount mined after 1879. The total of these figures is $1,894,865, or a difference of $1,423,523 from the estimated total production given in the Minerals Yearbook. This difference was made apparently to allow for unrecorded production during the early boom days. Figure 2 shows graphically the yearly gold production based on the known data from the sources mentioned.

No information is available concerning production records of the individual properties. Watson says that the Whitehall mine, in Spotsylvania County, produced $1,800,000 from its discovery in 1806 to 1881.[10] This statement has not been verified, but if it is correct the source of a very large part of the total Virginia gold production has been accounted for.

[6] Jefferson, Thomas, Notes on the State of Virginia, 2d ed., p. 82, Philadelphia, Nov. 12, 1794.
[7] Rogers, W. B., Report on the geological reconnaissance of the State of Virginia, p. 67, 1836.
[8] Whitney, J. D., Metallic wealth of the United States, pp. 127-128, 1854.
[9] Minerals Yearbook, 1934, p. 197, U. S. Bur. Mines, 1934. Advance Summary, 1935.
[10] Watson, T. L., Mineral resources of Virginia, Virginia Jamestown Exposition Commission, Lynchburg, Va., J. B. Bell Co., p. 555, 1907.

TABLE I.—*Gold Production of Virginia*

YEAR	Ounces	Value	YEAR	Ounces	Value
1829	121	$ 2,500	1883	339	$ 7,000
1830	1,161	24,000	1884	121	2,500
1831	1,258	26,000	1885	169	3,500
1832	1,645	34,000	1886	194	4,000
1833	5,031	104,000	1887	706	14,600
1834	3,000	62,000	1888	363	7,500
1835	2,922	60,400	1889	199	4,113
1836	3,000	62,000	1890	314	6,496
1837	2,521	52,100	1891	324	6,699
1838	2,661	55,000	1892	242	5,002
1839	2,787	57,600	1893	299	6,190
1840	1,887	38,995	1894	370	7,643
1841	1,245	25,736	1895	305	6,303
1842	2,040	42,163	1896	215	4,435
1843	2,329	48,148	1897	207	4,280
1844	1,964	40,595	1898	246	5,075
1845	4,199	86,783	1899	374	7,729
1846	2,687	55,538	1900	172	3,558
1847	3,277	67,736	1901	313	6,465
1848	2,800	57,886	1902	208	4,295
1849	6,259	129,382	1903	216	4,465
1850	3,193	65,991	1904	186	3,853
1851	3,341	69,052	1905	241	4,982
1852	4,046	83,626	1906	718	14,832
1853	2,525	52,200	1907	401	8,288
1854	1,138	23,514	1908	119	2,451
1855	1,513	31,265	1909	181	3,750
1856	1,380	28,535	1910	43	888
1857	195	4,036	1911	148	3,064
1858	913	18,878	1912	11	218
1859	782	16,156	1913	29	604
1860	1,045	21,607	1914	21	429
1861	536	11,069	1915	26	534
1862	15	316	1916	43	885
1863	3	69	1917	65	1,343
1864	0	0	1918	19	400
1865	44	911	1919	0	0
1866	503	10,398	1920	0	0
1867	494	10,206	1921	37	763
1868	542	11,205	1922	34	706
1869	601	12,426	1923	0	0
1870	567	11,716	1924	6	116
1871	333	6,891	1925	3	68
1872	318	6,562	1926	11	220
1873	117	2,424	1927	0	0
1874	105	2,164	1928	0	0
1875	72	1,493	1929	0	0
1876	161	3,323	1930	0	0
1877	133	2,751	1931	0	0
1878	357	7,374	1932	31	637
1879	708	14,627	1933	32	824
1880	556	11,500	1934	667	23,315
1881	484	10,000			
1882	726	15,000	Totals	91,208	$ 1,894,865

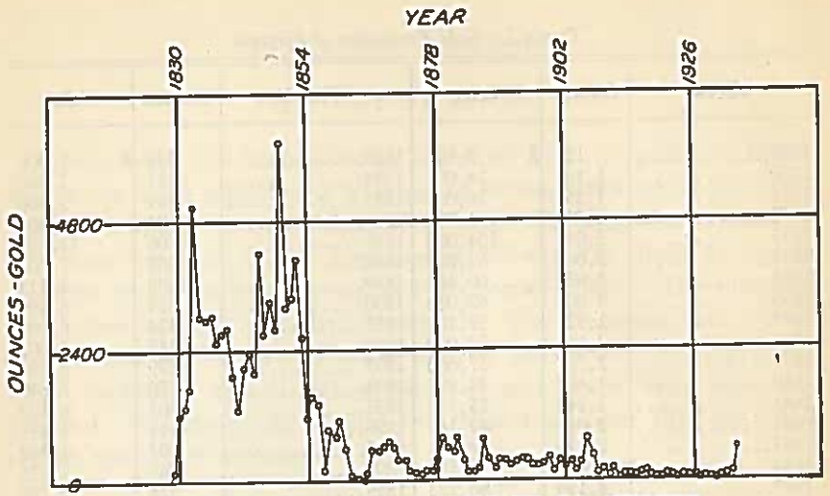


Figure 2.—Yearly production of gold in Virginia, 1829-1934.

PRIMARY DEPOSITS

STRUCTURAL FEATURES

The gold deposits of Virginia are for convenience classified as lode deposits and replacement deposits. These types are gradational into each other, and any one mineralized body may exhibit both forms, with one commonly predominant.

The lode deposits consist of quartz and carbonate lenses of all sizes from microscopic dimensions to more than 100 feet long. In some places the lenses are connected by thin stringers of quartz; in others they are not connected. Taber's report on the gold deposits of the James River Basin contains some excellent illustrations of the lode deposits and especially the discontinuous lenses at the Young American mine, in Goochland County.[11] Some of the lode deposits are best described as compound lenses, with the lenses separated by thin layers or bands of sericitic schist. Figure 3 shows the types of the quartz bodies found in the Laird prospect.

The lenses in the lodes are commonly arranged along lines of shearing or movement. Gradations from scattered lenses to compound lenses and to veins are found. In the best-defined veins, such as the Franklin vein, in Fauquier County, compound lenses exist, and even the massive quartz contains thin curving layers of sericite schist. In none of the deposits has comb structure, or

[11] Taber, Stephen, Geology of the gold belt in the James River basin, Virginia: Virginia Geol. Survey Bull. 7, figs. 6, 7, 8, 9, 11, 13, 14 and 15, 1913.

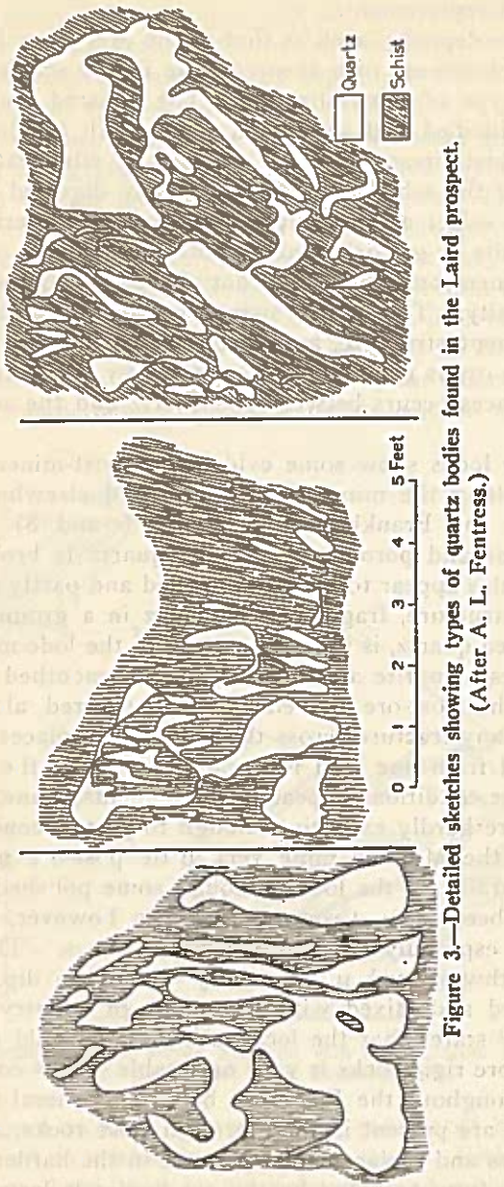


Figure 3.—Detailed sketches showing types of quartz bodies found in the Laird prospect. (After A. L. Fentress.)

any feature that would suggest open fissure filling, been seen. The lode deposits usually exhibit some structural features characteristic of replacement.

In some deposits, such as that of the Melville mine, in Orange County, replacement of a sheared zone in the schist has been the dominant type of mineralization. The sheared zones consist of intensely silicified and sericitized schist with the banding of the original schist preserved. All degrees of silicification and sericitization of the schist are seen and partly digested remnants and shadows of schist are present in the quartz and sericite. Locally massive white or grayish quartz occurs in stringers or lenses, with the long dimensions usually but not always parallel to the strike of the schistosity. The quartz stringers show little or no inherited or replacement structure, and their means of emplacement is obscure. The ore is generally accompanied by white ankerite, which in many places occurs between the quartz and the sericitized wall rock.

All the lodes show some evidence of post-mineral movement, in places along the mineralized zones, and elsewhere across the zones. At the Franklin mine (Plates 6 and 8) much of the lode is loose and porous; locally the quartz is broken and individual nodules appear to have been rolled and partly recrystallized. A mortar structure, fragments of quartz in a groundmass of fine recrystallized quartz, is present in some of the lode material. Individual cubes of pyrite are in many places smoothed and polished. Much of the post-ore movement has occurred along the lode, although many fractures cross the lode and in places fractures can be followed from one wall into, but not across, the lode. Somewhat similar conditions appear in the Vaucluse mine, although the workings are hardly extensive enough to permit conclusions to be made. In the Melville mine very little post-ore movement has occurred parallel to the lode, although some polished pyrite specimens have been seen. Cross-fracturing is, however, conspicuously developed, especially in the wider ore zones. This fracturing strikes northwestward and is nearly vertical in dip. The quartz is brecciated and mixed with fragments of country rock.

Taber[12] states that the localization of the gold deposits in or near the more rigid rocks is very noticeable. This condition seems to hold throughout the Piedmont belt. In general the discontinuous lenses are present in the more schistose rocks, and the better defined lodes and replacement zones are in the harder, more brittle rocks. The form assumed by the ore bodies is largely a function of the physical properties of the enclosing rocks.

[12] Taber, Stephen, op. cit., p. 281.

MINERALOGY

The mineralogy of the ores is simple. The suite is considered to be characteristic of the upper part of the hypothermal or deep-vein zone and may grade into the intermediate or mesothermal zone. The mineralogic study of the deposits is not completed, and additional mineral species may later be identified.

Gangue minerals.—Quartz is the most abundant gangue mineral. It occurs in fine-grained aggregates that have replaced the wall rocks and in coarser masses in veins and lenses. The quartz below the water level is commonly white or light gray, although in a few places it is dark bluish gray and has a very vitreous appearance. Near the surface the quartz shows several forms. Some is clear and glassy; some is sugary and ranges in color from white through pink to a reddish brown. The color is caused by thin seams of iron oxides around the borders of the quartz grains and in cracks through them. The more highly colored sugary quartz

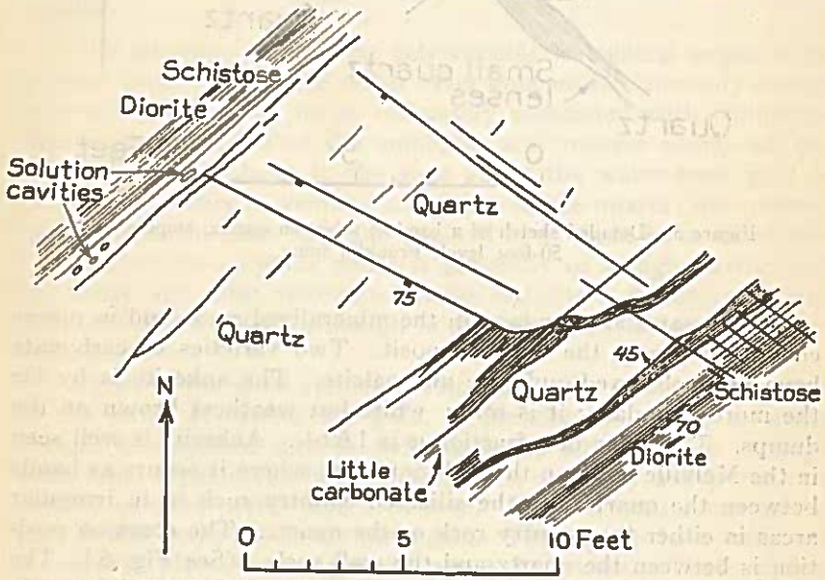


Figure 4.—Detailed sketch across Franklin vein 60 feet from the northeast face on the 50-foot level, Franklin mine.

is locally known as "rose quartz" and is considered by the miners to be the most favorable for high gold tenor. Rich gold seams have, however, been seen in the pale-pink and white sugary varieties. The clear glassy-appearing quartz is commonly barren,

although in a few places small flakes of gold have been seen in it. Some specimens of the clear quartz show well-defined bands, generally spaced a few millimeters apart; the exact nature of these bands has not yet been determined.

Sericite is, next to quartz, the most abundant gangue mineral in the veins. It commonly occurs in the walls of the veins and lenses and, with quartz, forms most of the replacement bodies. Irregular streaks and bands of sericite are common in all the quartz bodies. Figures 4 and 5 show typical modes of occurrence of sericite in quartz.

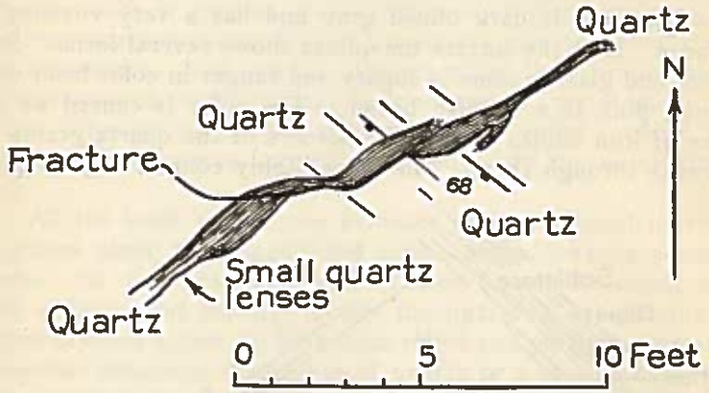


Figure 5.—Detailed sketch of a band of schist in quartz, stope above 50-foot level. Franklin mine.

Carbonates are common in the mineralized areas and in places constitute nearly the entire deposit. Two varieties of carbonate have been observed, ankerite and calcite. The ankerite is by far the more abundant; it is milky white but weathers brown on the dumps. The index of refraction ω is 1.69+. Ankerite is well seen in the Melville mine on the 220-foot level, where it occurs as bands between the quartz and the silicified country rock or in irregular areas in either the country rock or the quartz. The common position is between the quartz and the wall rock. (See Fig. 6.) The relative ages of the ankerite and quartz have not been satisfactorily established but part of the ankerite was deposited in fractures through the quartz. Pink calcite, with an index ω of 1.67, is found in nodules in the Franklin vein on the 150-foot level but was not obtained from other properties visited.

Chlorite is common in all the deposits seen. Near quartz or silicified bands the country rock is largely changed to sericite,

but some chlorite may remain, and a few irregular bands of sericite and chlorite have been seen in the quartz (Pl. 2).

In a few places biotite, garnet, tourmaline, and hornblende occur in the wall rocks adjacent to the veins. No direct relation between these minerals and the lodes is established, although in a few places the minerals seem to be coarser near the lodes than elsewhere. Actinolite, barite, kyanite, feldspar, and selenite have previously been reported as gangue minerals but have not been identified during the present investigation. Taber[18] reports soda-lime feldspars common in the veins of the James River district. Feldspars have as yet been identified only in the wall rocks of the lodes studied.

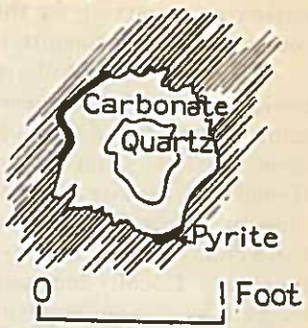


Figure 6.—Sketch of a carbonate lens, 150-foot level, Franklin mine.

Ore minerals.—Gold is the only valuable ore mineral sought at the present time. Below the water level gold most commonly occurs in small particles in, or so intimately associated with, sulphides that a concentration of the sulphides will recover nearly all the gold. In many places in the zone above the water level gold is coarse and occurs in veinlets and flakes in the quartz; not uncommonly it can be seen with the unaided eye. Gold from either the oxidized or the sulphide zones is generally of a high purity, and the assay and mint returns available indicate a fineness customarily of 0.850 to 0.900, although both higher and lower grades are reported.

Pyrite is the most abundant sulphide in the ores, and in many of the mines it carries the gold. Commonly it occurs in small crystals disseminated through the quartz and sericite schist, although some large crystals (about 1 centimeter on an edge) and pockets or nodules of solid pyrite have been seen. Small crystals occur in the chlorite wall rocks but do not carry gold. Tiny crystals have been seen in several places forming thin layers in cracks. These pyrite crystals are so small that a mass of them has a greenish-black color; they are considered to have been formed by circulating ground water.

Chalcopyrite is present in very small quantities in the ores of nearly all the properties studied. Galena and sphalerite have been seen in specimens from several of the workings, and pyrrho-

[18] Taber, Stephen, op. cit., p. 218.

tite has been identified in Melville and Vaucluse ores. Ilmenite, magnetite, tetradymite, and arsenopyrite have previously been reported as occurring in the ores but were not observed in the recent work. Molybdenite is found in the ore at the Franklin mine.

Hydrous iron oxide is common near the surface of all the deposits. A few manganese oxide stains occur, and in the Franklin mine a few greenish copper stains were seen. Pyromorphite has been obtained from specimens on the dump at the Moss mine, in Goochland County. Native copper and wulfenite have been previously reported but were not seen in the available material. A little chalcocite occurs just below ground-water level in the Franklin mine. Locally marcasite is common; it is thought to have been formed by descending surface waters.

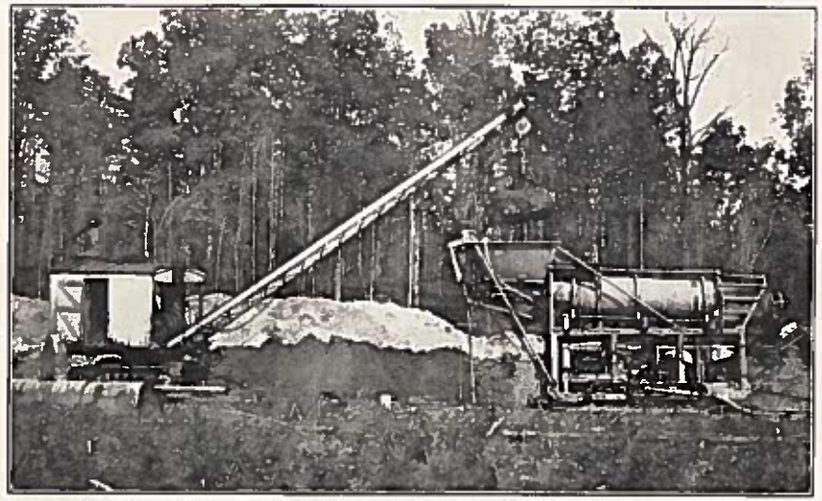
OXIDATION AND ENRICHMENT OF THE ORES

The physiographic history of the Piedmont region indicates that it has been continuously exposed to erosion for a long period. At the present time lowering of the surface proceeds very slowly, and the process is dominantly one of rock decomposition and solution. Hence, the gold mines have been located where conditions for shallow enrichment are especially favorable. The solution and re-deposition of gold, or supergene enrichment, therefore, is of vital importance to the future of the mines. The data obtained furnish some information on this subject but are admittedly less complete than desired.

The water level in all the properties visited is shallow. At the Melville and Vaucluse mines water was about 30 feet below the surface, and at the Franklin mine water was reported about 8 feet below the collar of the shaft when the property was recently reopened. As discussed previously, the decomposed rock or saprolite changes gradually below the water level to unaltered rock, as a rule at a depth of 75 to 150 feet.

During the early days of gold mining in Virginia the placers and mechanically enriched soils and saprolites probably furnished most of the gold. Where coarse gold is found at the surface and it becomes finer in depth, the coarse material can reasonably be interpreted as reworked gold.

The Melville mine contains good, although limited, exposures of mineralized rock. On the 220-foot level of this mine two stopes have recently been worked where the ore-bearing bands widen. Each stope exposes faults that offset the ore a few feet. (See pp. 22-24.) These faults are later than the ore zones, and the fractures in and adjacent to the main breaks contain marcasite and,



A. Collins placer, dragline and gold-saving machine. On Little Byrd Creek about 4 miles south of Tabscott, Goochland County.

B. Open cut at the Vaucluse mine, near south end of area shown on Plate 1.

more rarely, very finely divided pyrite, both of which are considered to have been deposited by downward-circulating waters. The unbroken ore farthest removed from the faults is not different in appearance from the mineralized material in the narrow bands between the stopes. The mine assay maps show almost no changes in gold content as the faults are approached.

Several samples were taken on the 220-foot level of the Melville mine in order to furnish possible information about enrichment. The results obtained from assaying these samples are given below. No. 1 was fine-grained pyrite from a fracture favorably situated to be enriched by waters circulating along the adjacent fault zone. No. 2 was a small pocket of coarse pyrite in an isolated mass of quartz. No evidence of fracturing could be seen, and the pyrite was taken as a sample of material most likely to be of primary origin. No. 3 was marcasite from the fault zone in the north heading of the west drift. The evidence obtained, although not conclusive because of the slight extent of the workings available for study, indicates that the Melville ores were deposited by ascending fluids and that supergene enrichment has not greatly changed the value of the deeper ores.

TABLE 2.—*Assays of samples from the 220-foot level, Melville mine, in ounces to the ton*

[By E. T. Erickson, U. S. Geological Survey]

	Gold	Silver
1	0.01	None
2	2.96	0.44
3	.01	None

1. Quartz and fine-grained pyrite from crack in east wall parallel to and south of small post-mineral fault, south stope.
2. Isolated mass of coarse pyrite in a salient pocket of quartz in west wall, north stope.
3. Marcasite from stringers near fault, north fault on west drift.

In several places it has been noticed that as the cross faults in the Melville mine are approached the chloritic wall rock gradually gives way to sericite, and small fractures parallel to the faults contain narrow sericite bands that fade laterally into chlorite. It was thought that possibly some enrichment of gold had been caused by hydrothermal solutions circulating along the cross breaks. No field evidence to indicate more than one generation of mineralized quartz has been seen, and polished slabs of the ore etched with hydrofluoric acid show one type of quartz with a few thin seams of white quartz probably of later age.

GENESIS OF THE ORES

The genesis of the ores of the southern Appalachian region, including those of Virginia, has been much discussed. The views advanced, especially those that attempt to explain the origin of the lenses in the deposits, are extremely diverse. Becker[14] attributed the lenses to fillings of openings formed by small normal fault movements. Graton[15] suggested that the openings were formed by the mineralizing solutions under pressure and that deposition was caused by changes in equilibrium and concentration of the solutions. Taber[16] discussed the genesis of the ores in considerable detail and concluded that the ores were brought in by magmatic solutions and the lenses and veins were formed by the force of growing crystals. It is beyond the scope of this preliminary report to discuss the various theoretical considerations of the subject of the emplacement of the quartz. The views expressed above encounter serious objections, and the subject is considered far from settled.

The origin of the gold deposits is intimately related to the structure of the Piedmont region. Compressive stresses from the east would tend to be relieved by a slight rotation of the crustal blocks and shearing along northeast trending zones. The northeast direction would therefore be the direction of elongation, and tension cracks striking northwest would develop in and near the shear zones. This condition is best illustrated in the Melville-Vaucluse shear zone (Pl. 1). The mineralizing fluids ascended the shear zones after most of the movement had stopped and deposited their loads in the most favorable places. These places were the northwestward-striking tension cracks and in other places where the rocks were broken and the fluids could most readily penetrate.

The genetic relation between granite intrusives and the gold deposits, as suggested by Taber[17] and Laney,[18] although probable, has not been convincingly demonstrated in Virginia.

ORE SHOOTS

Sufficient underground workings were not accessible to justify generalizations concerning localization of ore shoots, but the work at the Melville and at other mines in the southern Appalachian region seems to indicate that some relation of importance exists between the northwestward-striking tension cracks (or cross faults) and the best ores. The faults, in general with a throw of only a few feet, brecciate the ore and, in the Melville mine, contain rotated fragments of the country rock. The fact that the ore-bearing zones widen near the breaks indicates that some condition existed there that was favorable for ore deposition. It is likely that the ore was deposited along brecciated zones where faults crossed the main shear zone. The present breaks are, then, the expression of small post-mineral movement along older fault zones.

Fluting or grooving is common in all the lodes examined. Locally this grooving appears to have had an important controlling influence on the deposition of the ores. In many places the ore shoots are essentially pencil-shaped and dip in the lode at relatively flat angles, parallel to the grooving.

[14] Becker, G. F., Reconnaissance of the gold fields of the southern Appalachians: U. S. Geol. Survey 16th Ann. Rept., pt. 8, pp. 270-272, 1895.
[15] Graton, L. C., Gold and tin deposits of the southern Appalachians: U. S. Geol. Survey Bull. 298, pp. 69-73, 1906.
[16] Taber, Stephen, op. cit., pp. 219-232.
[17] Taber, Stephen, op. cit., pp. 216-217.
[18] Laney, F. B., op. cit., p. 90.

PLACER DEPOSITS

The placer deposits of Virginia are of two classes—stream deposits and residual or saprolite deposits. Placer deposits are in general more accessible than lode deposits, they are more cheaply and easily worked, and in Virginia they were commonly richer than the sulphide ores. For these reasons the placer deposits were first worked, and in some places gravel and saprolite have been rewashed several times. It is probable that very little new placer ground will be discovered, although a few such discoveries are possible. Small gold production may be recorded from gravel and saprolite deposits for years, but it is expected that the bulk of the future gold production of Virginia will come from the lode deposits. A further change in the value of gold may make heretofore unprofitable deposits workable.

The old Collins placer is in the valley of Little Byrd Creek about 4 miles south of Tabscott, Goochland County. The operations are controlled by the Powhatan Mining Co., and are in charge of Lewis L. Stirn. The property was visited in October, 1934, and again in June, 1935. A considerable extent of the bottom land along the branch has been cleared of timber and brush. A portable machine for recovering placer gold and a steam drag line were operating; about 1,000 cubic yards of alluvium are handled in one shift of 8 hours. The gravels are reported to run about 40 cents a cubic yard. Plate 3, A, is a view of the drag line and gold-saving machine. The machine is designed to use a minimum of water. A number of pannings of the heads and tails were made and the machine appeared to be making a clean separation.

Mr. William P. Crawford has recently found gold on Neabsco Creek and a tributary known as Jack Patterson's Run, about 4 miles north of Dumfries, in Prince William County. The deposit is about 1¼ miles west of the main Richmond-Washington highway (U. S. No. 1). So far as is known gold has not previously been reported from this locality.

The material being worked is stream gravel. The gold is slightly rounded to angular and has probably not been transported far. Quartz stringers and lenses can be seen along the banks of the stream above the present workings. This quartz, in places, is reported to carry some gold and is probably the source of the material in the gravel. Diorite (?) forms the bed of the stream where the gravels are being washed (June, 1935), but the country rock which contains the quartz stringers is a series of schists and slates. The stream bed is covered by a layer of soil and gravel that averages 3 to 4 feet thick. The average value of the gravel is not known, but such work as has been done is reported to indicate about 75 cents a cubic yard for part of the material. The gravel is loose and clean and is easily handled; a washer is not necessary. A small amalgam plate, mechanical pans, and sluice boxes are used to recover the gold.

SUMMARY

The gold deposits of the Virginia Piedmont lie in a narrow belt between the Blue Ridge and the Coastal Plain. The region is underlain by a series of recrystallized quartzites and schists which make up the Wissahickon formation, probably of pre-Cambrian age.

The deposits occur as lodes and replacement bodies. The ores are localized along northeastward trending shear zones and especially where these zones are cut by cross-fractures. The rigid and brittle rocks are likely to contain larger deposits than the more schistose types.

The mineralogy is simple; quartz, sericite, ankerite, and chlorite are the most abundant constituents. Gold is the only mineral of economic importance.

Enrichment by mechanical settling of the heavy gold particles is common in the near-surface ores. Evidence is advanced to show that the deeper ores in the Melville mine have not been noticeably enriched by gold deposited from downward-percolating solutions.

Placer deposits at present are of slight importance. Most of the future production will probably be from the primary deposits, below the water level.

THE MINES

Owing to the recent increase in price of gold a considerable impetus has been given to the mining industry in the Southeastern States. Very little detailed geologic information concerning these deposits is available, and the present activity offered an exceptional opportunity to obtain useful data. The State maps and reports on Piedmont Virginia, exclusive of the Virgilina district, list 99 small gold mines and prospects. The study of these old mines is difficult, for several reasons. Most of the properties have been abandoned for years, and the overgrown brush-covered dumps and scattered caved pits furnish the only evidence of the extent and nature of the former workings. The surfaces of the old mines are too cut up with pits to be cleared for farm lands; the large trees have been logged off, and the result is an especially thick mat of underbrush and tree slashings. Rock outcrops are rarely seen except in the valleys of the larger streams. The type of rock on one or two old dumps is the only information obtainable at some properties.

A few mines and prospects have recently been cleaned out, and development and exploratory work is being done. Most of the field work for this report was confined to these active properties.

MELVILLE MINE

The Melville mine is in northeastern Orange County about 18 miles west of Fredericksburg and about 3 miles northwest of the Wilderness Store, which is on the Fredericksburg-Culpeper highway (State No. 3). The Melville tract of 844 acres is leased by the Rapidan Gold Corporation, of which E. L. Flannigan was manager when this study was made. At the time of writing, June, 1935, underground work was temporarily discontinued, but the mine was kept unwatered.

The Melville workings are situated on a well-defined shear zone that has been prospected from Rapidan River on the north to a point more than 1,000 feet south of the area shown on the Melville-Vaucluse map (Pl. 1). The Culpeper property, in Culpeper County, north of Rapidan River, is possibly on a continuation of the same shear zone.

The property is developed by two shafts 125 and 240 feet deep. A level connects the two shafts at 110 feet, and a deeper level at 220 feet has been driven. The total length of accessible drifts is about 1,800 feet. Old workings on and above the 110-foot level were driven from the 125-foot shaft but are now mostly caved and inaccessible.

The water level at the Melville, before the mine was reopened, is reported to have been about 30 feet below the collar of the 125-foot shaft. The mine makes about 90 gallons of water a minute, which is used

in the mill and in drilling operations. The mine water is reported to be consistently alkaline.

The rocks above the 110-foot level are almost completely decomposed, although on this level it is generally possible to distinguish between sericitized and chloritized schists. Below the 110-foot level the amount of decomposition of the rock in the shear zone gradually decreases. On the 220-foot level, except along fractures, the country rock is hard and appears fresh. In the stopes and raises about 50 feet above the 220-foot level the rocks are slightly softer than below, and iron oxide stains and solution cavities are seen, but the rock is much fresher than on the 110-foot level.

Very little information was obtained by mapping the numerous old shafts and pits on the surface. The distribution of the old workings shows the location of the main shear zone, and a very general idea of the extent of the underground developments may be had from the size of the dumps. The old miners in the region located and worked all the known ore shoots that cropped out. The size and extent of the old surface workings are therefore usually considered fair indicators of what may be expected in the sulphide zone. A few exposures of saprolitic schist in the pits and a study of fragments of quartz and country rock on some of the dumps show that the nature of the shear zone and mineralization is, in general, the same throughout the property.

The 220-foot level (Pl. 2) is described before the 110-foot level, as the rocks are fresher and exposures are much better. The 240-foot shaft was sunk in the country rock a short distance west of the main shear zone, and the 220-foot level was driven S. 62° E. from the shaft, in order to cut the shear zone at an angle of about 90°. The level was started in a dark greenish-gray schist that consists mostly of quartz and biotite with some chlorite. Numerous thin bands and small crystals of pyrite are present throughout the country rock. The strike of the schist is about N. 40° E., and the dip 70° NW. As the shear zone is approached sericite is developed, generally along bands that fade laterally into the chloritized schist. Thin silicified streaks are commonly present in the sericite bands.

The mineralized zone where intersected by the level is about 60 feet wide. The strike of the zone is about N. 30° E. and the dip is steep (85° ±) to the east. The hanging wall and footwall are arbitrarily chosen, as in places the sericite and chlorite schists grade into each other. The best ore is as a rule confined to two streaks, one near the footwall and one near the hanging wall of the shear zone. Between these two ore streaks is partly silicified and sericitized chloritic schist. The ore streaks are well shown in northeast and southwest drifts.

The ore consists of quartz and intensely silicified sericite schist with the banding of the original schist preserved. It is thought that

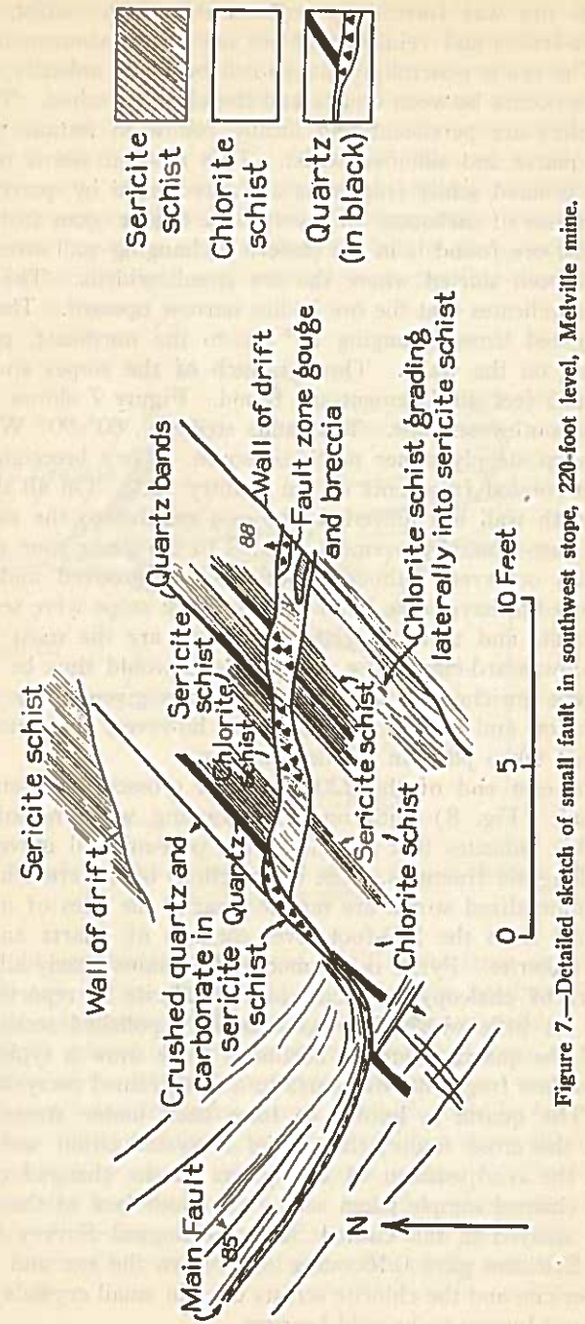


Figure 7.—Detailed sketch of small fault in southwest stope, 220-foot level, Melville mine.

most of the ore was formed by replacement of the schist, although some quartz lenses and veinlets that are not of replacement origin are present. The ore is generally accompanied by white ankerite, which in many places occurs between quartz and the silicified schist. These carbonate borders are persistent and locally follow in minute detail between the quartz and silicified schist. This relation seems to be true also where isolated schist fragments are surrounded by quartz. Some irregular masses of carbonate with very little quartz occur in the schist.

The best ore found is in the eastern or hanging-wall streak. Two stopes have been started where the ore streak widens. The development so far indicates that the ore bodies narrow upward. They appear to be elongated lenses plunging 35° ± to the northeast, parallel to the grooving on the walls. Through each of the stopes small faults of less than 6 feet displacement are found. Figure 7 shows the small fault in the southwest stope. The faults strike N. 60°-90° W. and are vertical or dip steeply either north or south. They brecciate the ore and contain rotated fragments of the country rock. On all the breaks seen the north wall has moved to the east relative to the south wall. Very little post-mineral movement parallel to the shear zone (about N. 30° E.) has occurred, although specimens of grooved and polished pyrite reported to have come from the southwest stope were seen.

The faults and their associated fractures are the most favorable paths for downward-circulating solutions and would thus be favorable for supergene enrichment of gold. The assays given under the heading "Oxidation and enrichment" indicate, however, that such enrichment has not taken place in the deeper ores.

On the east end of the 220-foot level crosscut is a small post-mineral fault (Fig. 8) with no corresponding widening of the ore streak. This indicates that not all of the post-mineral movement has occurred along old fractures. The intersections of the cross breaks and the main mineralized streak are not necessarily the sites of ore bodies.

The ore from the 220-foot level consists of quartz and sericite with some ankerite. Pyrite is common and contains nearly all the gold. Small spots of chalcopyrite occur, and sphalerite is reported by the operators. A little pyrrhotite was seen in a polished section. Thin sections of the quartz from the northeast stope show a typical mortar texture—broken fragments of quartz in a fine-grained recrystallized aggregate. The quartz is known to have been under stress, as it is broken by the cross faults; the partial recrystallization was probably caused by the readjustment of the quartz to the changed conditions. An 8-foot channel sample taken across the south face of the southwest stope and assayed in the United States Geological Survey laboratory by E. T. Erickson gave 0.16 ounce of gold to the ton and no silver. Both the sericite and the chlorite schists contain small crystals of pyrite, which are not known to be gold-bearing.

Observations on the 110-foot level of the Melville mine (Pl. 4) confirm those made on the 220-foot level. The rocks are soft and partly decomposed; hydrous iron oxide stains are common, and timber is necessary to keep the ground open. The same mineralized streaks along the east and west walls of the shear zone are present, and, as in the lower level, the best ore is found in the east streak. The old stopes are caved, and it is not possible to determine whether or not faults are present, but in the accessible western mineralized streak there has been faulting on a scale similar to that on the lower level. The faults are generally tight and inconspicuous, possibly due to the heavy ground and numerous joints.

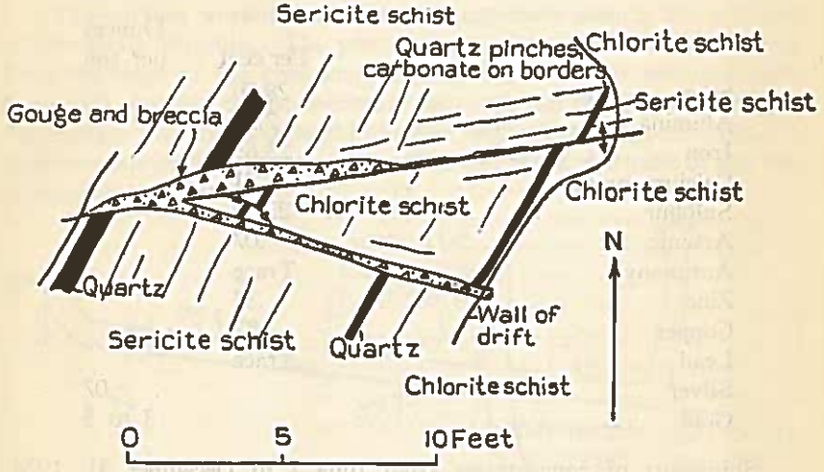


Figure 8.—Detailed sketch of small fault in east face of crosscut, 220-foot level Melville mine.

It is not possible to project the small faults from one level to the other with any degree of certainty. Under the heading "Genesis of the ores" it was suggested that the northwestward-striking breaks are tension cracks related to a northeastward-trending shear zone. If this interpretation of the structure is correct, the faults are most likely to be a series of *en echelon* fractures, a zone of which could be followed downward but any one of which might die out within a short distance.

The schistosity on the 110-foot level strikes N. 25°-40° E., and the common dip is steep to the west. In a few places the dip is steep to the east. Grooving can be seen in places on the walls. It strikes within 5°, commonly northwest, of the strike of the schistosity and dips 25°-35° N.

The mineralized bands are similar to those in the deeper workings. Carbonates are mostly leached out, and the numerous solution cavities probably show their former positions. Pyrite is generally altered to hydrous iron oxide, and a little marcasite has been seen.

A small mill, equipped to handle a maximum of about 75 tons of ore a day, has been built. The mill is a modern flotation plant and is reported to recover slightly more than 90 per cent of the gold. The mill and surface plants have been described by Anderson[19] and McGill.[20] McGill gives a partial analysis of the concentrates, which is reproduced below.

Analysis of concentrates from Melville mine, Orange County

	Per cent	Ounces per ton
Silica	28.70	
Alumina	7.57	
Iron	25.65	
Calcium oxide	.21	
Sulphur	25.59	
Arsenic	.07	
Antimony	Trace	
Zinc	.37	
Copper	.32	
Lead	Trace	
Silver		.07
Gold		3 to 5

Shipments of concentrates from June 7 to December 31, 1934, were made to the American Metal Co.'s smelter at Parteet, N. J. These shipments total about 529 ounces valued at $18,489.

VAUCLUSE MINE

The Vaucluse tract of 200 acres in Orange County was recently purchased by the Rapidan Gold Corporation from Henry Ford. It is planned to develop the property in conjunction with the work at the Melville mine. The Vaucluse working shaft is on the southwestward continuation of the same shear zone exposed in the Melville and is about 2,600 feet from the Melville shaft.

The Vaucluse mine was first worked in 1832 and was operated for several years on the decomposed surface material before the lodes

[19] Anderson, C. S., Mining lode gold in Piedmont Virginia: Eng. and Min. Jour., September, 1934, p. 404.
[20] McGill, Wm. M., Gold-mining operations in northern Virginia: Min. Cong. Jour., October, 1934, pp. 15-16.

were discovered. In 1844 the property was obtained by an English company, which, previous to 1852, worked the lodes through two open cuts, each about 60 feet deep, 75 feet wide, and about 120 feet long.[21] In 1854, six shafts had been sunk and extensive underground development was being done. This English company installed one of the most complete surface plants in the country at that time and is reported to have extracted 556.3 ounces of gold of a fineness of 0.943½ during 80 days of running in 1853. In December, 1853, the mill was crushing 50 tons a day, and the average value of the ore was estimated to be $8 a ton. The mine discontinued operations during the War between the States, and but little has been done since that time. The old machinery was recently removed by Henry Ford to his museum in Dearborn, Mich.

The surface workings are the most extensive seen in the gold belt of Piedmont Virginia. The pits continue about 1,000 feet southwest from the edge of the area mapped (Pl. 1). A shaft with the shaft house still standing can be seen near the south end of the workings, and the surface pits are comparable in size with those mapped. Plate 3, B, shows one of the Vaucluse cuts. The fluting on the walls of the lode is especially noticeable.

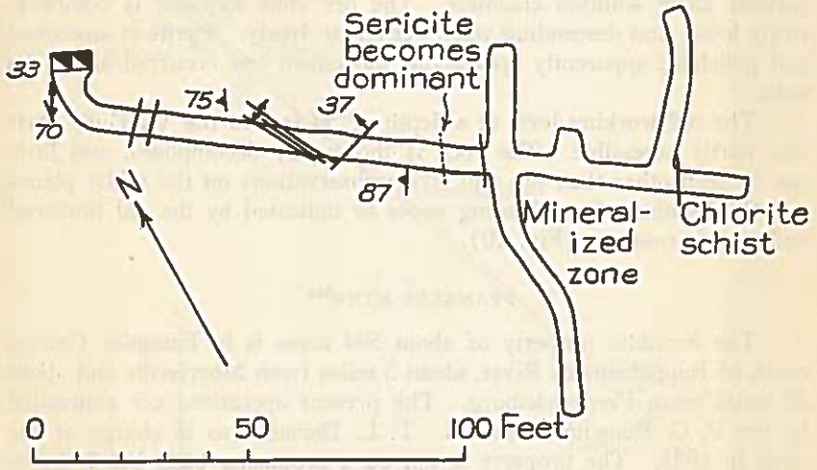


Figure 9.—The 110-foot level, Vaucluse mine.

The old shaft west of the shear zone has been cleaned out and deepened to about 200 feet. A level at 110 feet (Fig. 9) has been driven from the shaft and has crosscut the mineralized zone, but very little drifting on the zone has been done. It is planned to drive an-

[21] Private report of O. Matthews and a committee to the board of directors of the Vaucluse mine, 1847, on file in U. S. Geological Survey library.
Gold mines in Virginia: Am. Jour. Sci., 2d ser., no. 7, pp. 295-299, 1849.
Whitney, J. D., Metallic wealth of the United States . . . . , p. 126, 1854.

other crosscut at the 200-foot level and, if the mineralized zone merits it, to develop further.

The country rock in the Vaucluse shaft is similar to that in the Melville but somewhat more massive. Quartz, biotite, and chlorite are the most common constituents. A little sericite is generally present and in the shear zone is locally the most abundant mineral. Less quartzitic schistose bands occur in the level. They strike N. 25°-40° E.; near the shaft the dip seems to be eastward, but about 25 feet toward the shear zone the dip reverses and throughout the remainder of the level is about 80°-85° W.

Near the mineralized zone sericite becomes prominent. The mineralized zone is not tight, as at the Melville, but consists of numerous small composite lenses of quartz, carbonate, and pyrite, separated by thin curving bands of sericite. Where the level cuts the west border of the main shear zone the management reports channel samples over a width of 22 feet that average 0.16 ounce of gold to the ton.

The rock in the Vaucluse appears fresher than at a similar depth in the Melville, possibly because of its more massive character. Thin seams of marcasite are common, and iron oxide stains and cavities are formed along solution channels. The ore zone exposed is comparatively loose, and descending waters circulate freely. Pyrite is smoothed and polished; apparently appreciable movement has occurred along the lode.

The old working level at a depth of 50 feet in the Vaucluse shaft was partly accessible. The rock is thoroughly decomposed, and little can be seen other than dip and strike observations on the schist planes and the location of ore-bearing zones as indicated by the old timbered and caved crosscuts (Fig. 10).

FRANKLIN MINE[21a]

The Franklin property of about 594 acres is in Fauquier County north of Rappahannock River, about 3 miles from Morrisville and about 26 miles from Fredericksburg. The present operations are controlled by the P. G. Benedum interests. T. L. Darnell was in charge of the mine in 1935. The property is not on a producing basis but is being developed to determine whether or not sufficient ore is available to support a mill.

The country rock in the Franklin mine is an altered, and in places sheared, diorite or quartz diorite. Near the veins the intrusive rock becomes more schistose than elsewhere; sericite is developed, and at the veins the rock is entirely sericitized and silicified, and pyrite and carbonates are locally abundant.

[21a] Since the preparation of this report operations at the Franklin mine have been discontinued.

Part of the surface workings are shown on Plate 5. There are two strong quartz veins—the House vein and the Franklin vein. Several other unexplored veins occur north and east of the workings and can be seen in a few shallow pits. Most of the upper parts of the House and Franklin veins have been mined, but the House vein shows one of the few natural vein outcrops in the region. This quartz is exposed on the north wall of the pits, as a ledge about 6 to 8 feet high. The quartz in the pits is light gray or white and is commonly vitreous and massive; not sugary except in local areas. Bands and layers of sericite schist and a little chlorite are common. A few cavities filled with hydrous iron oxide and fractures stained with hydrous iron oxide and manganese oxide are present. The wall rocks are badly altered, but in many places granitoid texture can be recognized. South of the House vein rounded boulders of a diabasic rock are found. These boulders are typical of the Triassic dikes that are known throughout the region.

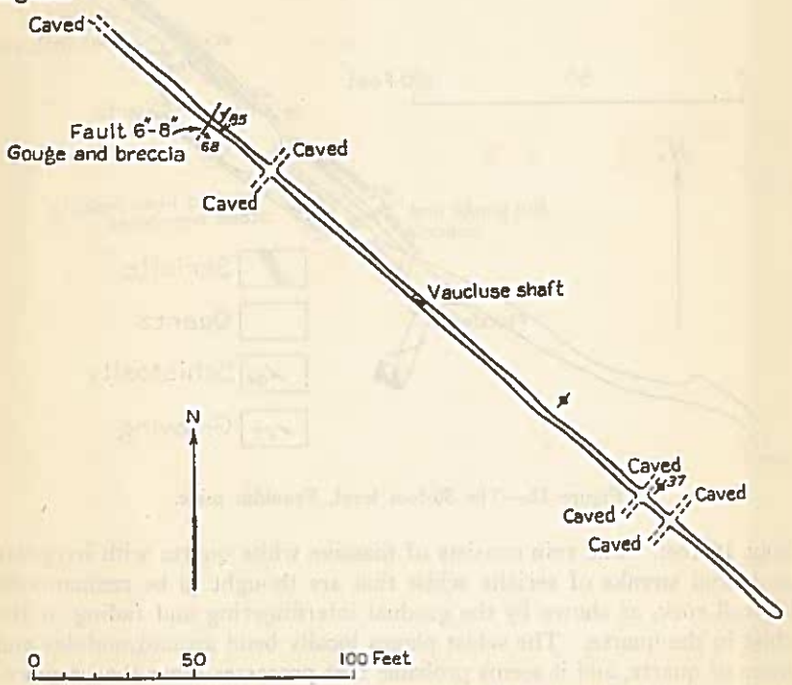


Figure 10.—The 50-foot level, Vaucluse mine.

The accessible underground workings consist of a shaft about 300 feet deep, a 50-foot level about 240 feet long that is caved in the western part, a pumping station at 81 feet below the collar of the shaft,

a 150-foot level containing 1,300 feet of workings that are being actively extended, and a 290-foot level containing 950 feet of drifting which is also being extended.

The water level is reported to have been about 8 feet below the collar of the shaft before the property was reopened. Oxidation is shallower in the intrusive material than in other rocks of the Piedmont region. The 50-foot level shows considerable rock alteration; the walls are soft, and brown iron oxide is abundant. In the pumping station at a depth of 81 feet a little iron oxide is seen. On the 150-foot level the only evidence of supergene activity is marcasite in seams and iron oxide along water courses in the Franklin vein.

Most of the work so far has been done on the Franklin vein. The vein is well exposed for about 100 feet along the strike on the 50-foot level and in an old stope above the level (Fig. 11). The width is

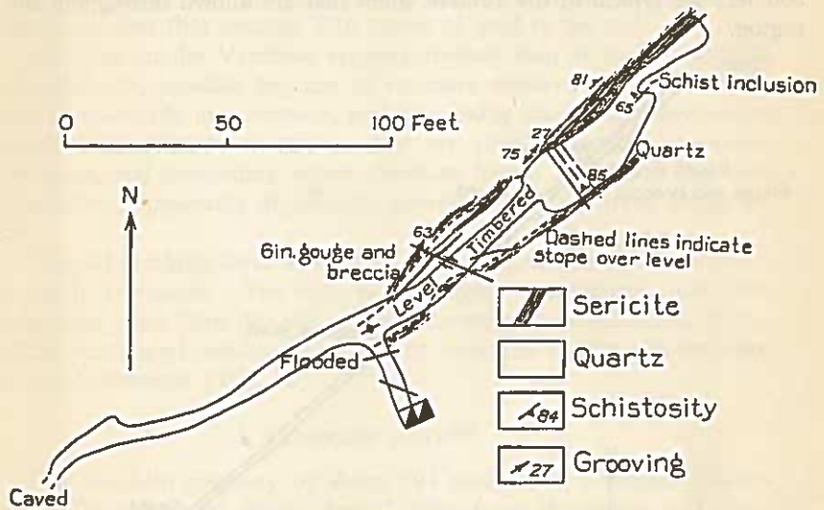
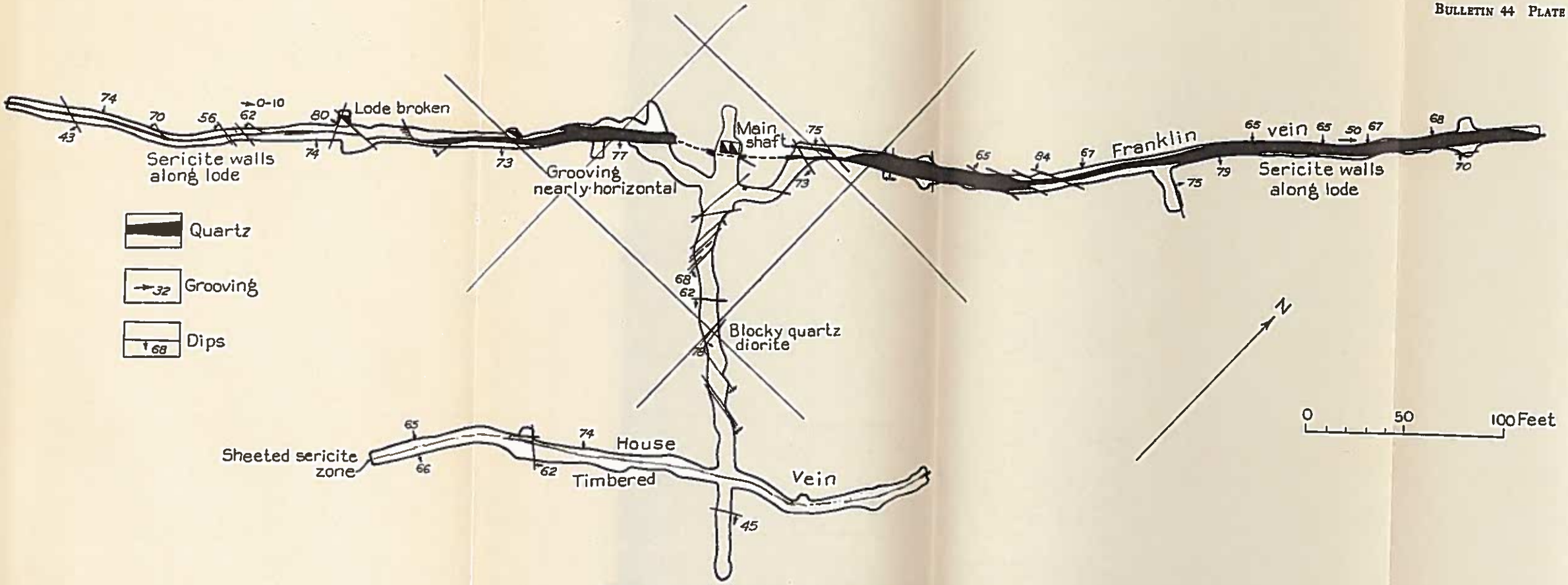


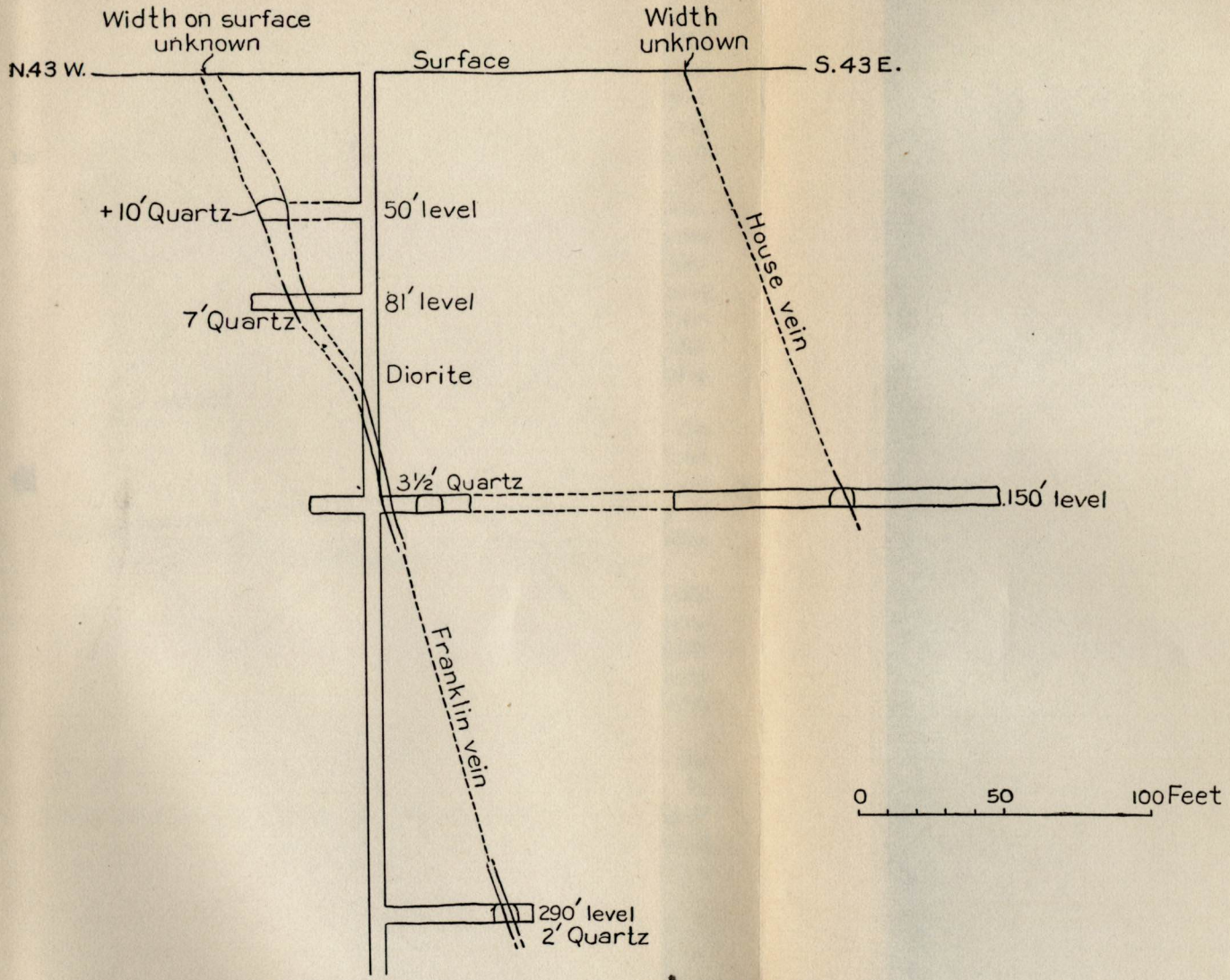
Figure 11.—The 50-foot level, Franklin mine.

about 16 feet. The vein consists of massive white quartz with irregular bands and streaks of sericite schist that are thought to be remnants of the wall rock, as shown by the gradual interfingering and fading of the schist in the quartz. The schist planes locally bend around nodules and lenses of quartz, and it seems probable that processes other than replacement were also active during the vein formation.

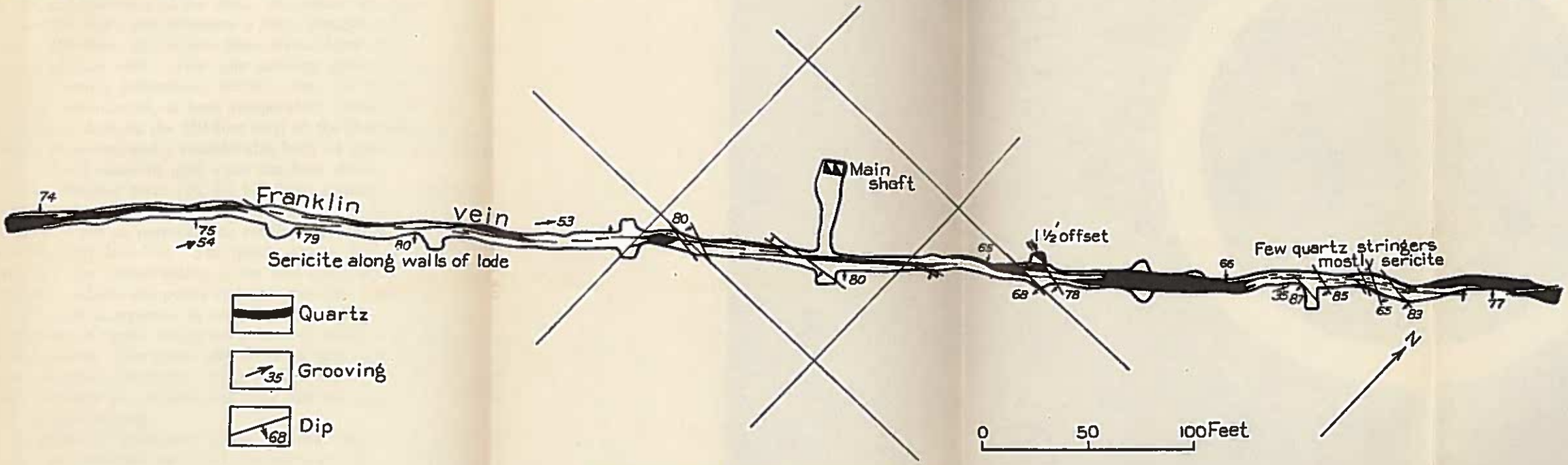
The most abundant constituents of the vein are quartz and sericite, but locally carbonates, ankerite and a little calcite, are prominent. On the 50-foot level some pyrite remains, but this mineral appears to have been mostly altered to iron oxide. A little chalcopyrite and chalcocite



THE 150-FOOT LEVEL, FRANKLIN MINE



CROSS SECTION THROUGH SHAFT, FRANKLIN MINE



THE 290-FOOT LEVEL, FRANKLIN MINE

and a few green copper stains have been seen, and one specimen showing free gold was obtained.

The pumping station at a depth of 81 feet extends 36 feet from the shaft. The vein is well exposed but has narrowed to a width of about 8 feet. The exposure is similar to those shown on the 150-foot level.

Just above the 150-foot level the shaft intersects the Franklin vein. At this point the quartz is reported to pinch out entirely, but the sericite schist zone continues, and on the 150-foot level as much as 7 feet of quartz is found. Plate 6 is a plan of the 150-foot level, and Pl. 7 is a cross section through the shaft that shows the general attitude and thickness of the vein. A crosscut has been driven S. 35° E. from the shaft and intersects a vein, thought to be the House vein, at about 160 feet. Drifts have been driven from this crosscut along the supposed House vein. This vein contains almost no quartz but consists of a weakly mineralized sericitic zone. Work on the House vein has been discontinued, at least temporarily. About 780 feet of drifting has been done on the 150-foot level of the Franklin vein. The lode is fairly persistent and a considerable body of quartz reported to carry about 0.15-0.2 ounce of gold a ton has been shown.

The 290-foot level (Pl. 8) has been confined to drifting on the Franklin vein which is exposed for about 920 feet. The quartz on this level is not as persistent as on the 150-foot level; the bodies are more distinctly lens-like. The quartz varies from 5 or more feet in width to a few inches within a few feet along the strike. It is milky white and contains less pyrite and gold than the bodies above.

The gold is reported to occur almost entirely in the large crystals and kidneys of pyrite, which are present in bands and areas in the sericite and quartz. The pyrite appears to be more common near the walls of the veins than elsewhere. As in the Melville mine, ankerite commonly occurs between the sericite wall rock and the quartz; a little pinkish calcite is also present.

Evidence of movement along the vein fissures is shown by the sheared and schistose nature of the intrusive rock near the veins. In places the quartz of the veins is broken and partly recrystallized; small kidneys have apparently been rolled and recrystallized and pyrite crystals are, in many specimens, smeared and highly polished. Figure 12 shows the type of movement in and across the lode.

The Franklin and House veins are exceptionally strong, well-defined veins for the Piedmont region, although they pinch and swell and in places grade into typical silicified replacement and lenticular bodies. The quartz in the Franklin vein narrows from 16 feet on the 50-foot level to practically zero at 130 feet; on the 150-foot level it is a maximum of 7 feet wide. On the 290-foot level lenses are more prominently developed than elsewhere.

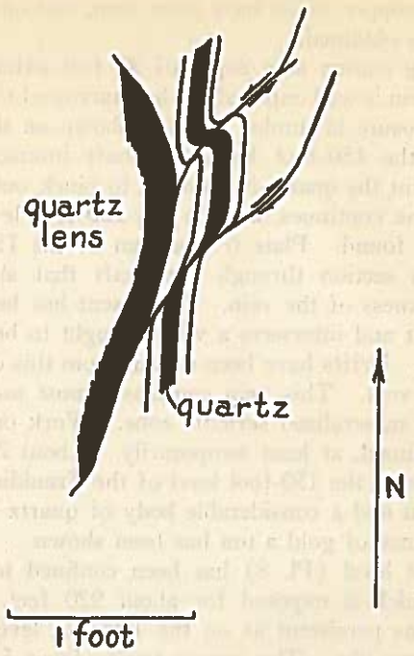


Figure 12.—Sketch showing type of movement in and across the Franklin lode.

No evidence of banding or comb structure has been seen in the quartz, although it is possible that enough recrystallization has occurred to obliterate such features if they were originally present. No vugs have been seen except in the upper level, where they were probably formed by leaching of the carbonate and pyrite.

Samples taken by the recent operators are reported to show a body of ore running about 0.15-0.2 ounce of gold to the ton. A channel sample of 7 feet, taken across the Franklin vein in the west heading of the 150-foot level, was assayed by E. T. Erickson in the United States Geological Survey laboratory and gave 0.17 ounce of gold and 0.06 ounce of silver to the ton.

UNITED STATES MINE

The United States mine is in western Spotsylvania County on the south side of Rappahannock River near the old United States ford, about 12 miles from Fredericksburg. The property was prospected during 1934 by the North American Mining Co., Inc., in charge of W. S. Hutchinson, Jr. Work was discontinued early in 1935.

Plate 9 is a plane-table sketch map of the workings on this property. The operators cleaned out an old shaft near the northeastern part of the property and extended a crosscut about 75 feet eastward. The shaft was flooded at the time of visit. It is reported to be 120 feet deep and to have a short drift on a vein about 8 inches wide that strikes N. 30° E. and dips about 45° NW. The recent work was confined to sinking prospect pits and shafts in order to expose the veins. An effort was made to explore the property thoroughly and to determine, if possible, whether or not it would be worthy of a more extensive development program.

The country rock on the dump of the 120-foot shaft consists of dark-gray sheared quartzite with numerous bands of chlorite and hornblende, generally less than 1 centimeter thick. Some specimens of the hornblende schist are almost completely silicified; only remnants of hornblende and a little sericite remain in a dense, fine-grained quartz rock. Dark-red garnet and pyrite are commonly seen. This rock, as a rule badly decomposed, is recognized in most of the workings near the shaft. In one pit north of the shaft a streak of granitic pegmatite about 6 inches wide was seen.

The quartz found on the shaft dump is gray to bluish gray and has a vitreous luster. It commonly contains small discontinuous parting planes filled with sulphides and chlorite. A small number of specimens show sericite. Ankerite is common; it is white on a fresh surface but becomes brown on weathering. Sulphides recognized on the dump are pyrite, marcasite, chalcopyrite, and sphalerite. Maury[22] mentions in addition galena, wulfenite, and vanadinite.

A much decomposed diorite (?) forms the country rock in the northern group of workings west of those near the shaft. The diorite (?) where seen in place is almost entirely altered to saprolite; the texture is preserved, but the mineral composition has been completely changed. The pits in the southwestern part of the area mapped show a somewhat fresher igneous rock, a fine-grained bluish-gray material that contains small phenocrysts of quartz in a clayey matrix. This rock resembles a rhyolite or a quartz dacite. The easternmost pits near the southern part of the workings are in the typical quartz-chlorite schist common in the region. This schist is much fresher than the igneous rocks and in places requires blasting to sink below 10 to 15 feet. The strike of the schist is N. 25°-45° E., and the dip is about 75° NW. One of the pits in the schist was sunk about 10 feet through clay that had a 1- to 2-foot layer of water-worn cobbles near the base. This material may be a remnant of some of the Coastal Plain deposits that overlie the country to the east.

[22] Maury, M. F., Am. Jour. Sci., vol. 32, pp. 325-330, 1937.

The gold occurs in quartz veins and stringers. The veins and stringers have a decided tendency to form lenses, and, as shown by the many old shallow workings uncovered during the recent prospecting, many of these lenses have been mined near the surface. The veins now uncovered are small, generally less than 2 feet wide, and are, with few exceptions, pinches between the mined-out parts. The veins strike N. 30°-40° E. and, with the exception of the westward-dipping vein reported in the shaft, dip about 75° E.

Two types of quartz are recognized. One is a clear glassy material that, in hand specimens, exhibits no structural or textural features except, in a few pieces, a well-defined banding that has been described in the section treating with mineralogy. The second type of quartz has a pronounced sugary texture and ranges in color from milky white through pink to a deep reddish brown.

The gold has a tendency to be coarse, and many specimens showing small specks of free gold were picked up on the dumps and in the pits. The gold commonly occurs in small fractures and around grain particles in the sugary quartz. A minor part appears to be located in quartz grains and has no obvious relation to visible fractures. The gold customarily is in the sugary quartz, and the reddish and pink varieties are considered to be more favorable than the white. A little gold was seen in one specimen of the glassy quartz.

No definite information was obtained that would indicate the amount of supergene enrichment. It seems probable, however, that in the shallow zone where prospecting is being done, considerable mechanical enrichment and possibly chemical enrichment also have occurred.

MOSS MINE

The Moss property is about 1½ miles southwest of Tabscott, in Goochland County. Silliman visited the property shortly after its discovery and took three samples that gave $7.39 per 100 pounds of ore.[23] Numerous attempts have been made to work the property since that time. Figure 13 shows the extent of the surface workings. Old reports say that two veins traverse the property and extend from 1,500 to 2,500 feet along the strike.[24] Only one vein was seen during the present study, and, although the mineralized zone may continue, the vein itself could not be traced beyond the limits of the surface workings.

The Moss workings were partly cleaned out in December, 1931, by J. C. Williams. A new inclined shaft was sunk on the vein to a depth of 106 feet, where work was discontinued because of lack of capital.

[23] Silliman, B. J., Am. Jour. Sci., vol. 32, pp. 99-180, 1837.
[24] Froehling & Robertson, A handbook of the minerals and mineral resources of Virginia, p. 51, 1904.
Watson, T. L., Mineral resources of Virginia: Virginia Jamestown Exposition Commission, Lynchburg, Va., J. P. Bell Co., p. 560, 1907.

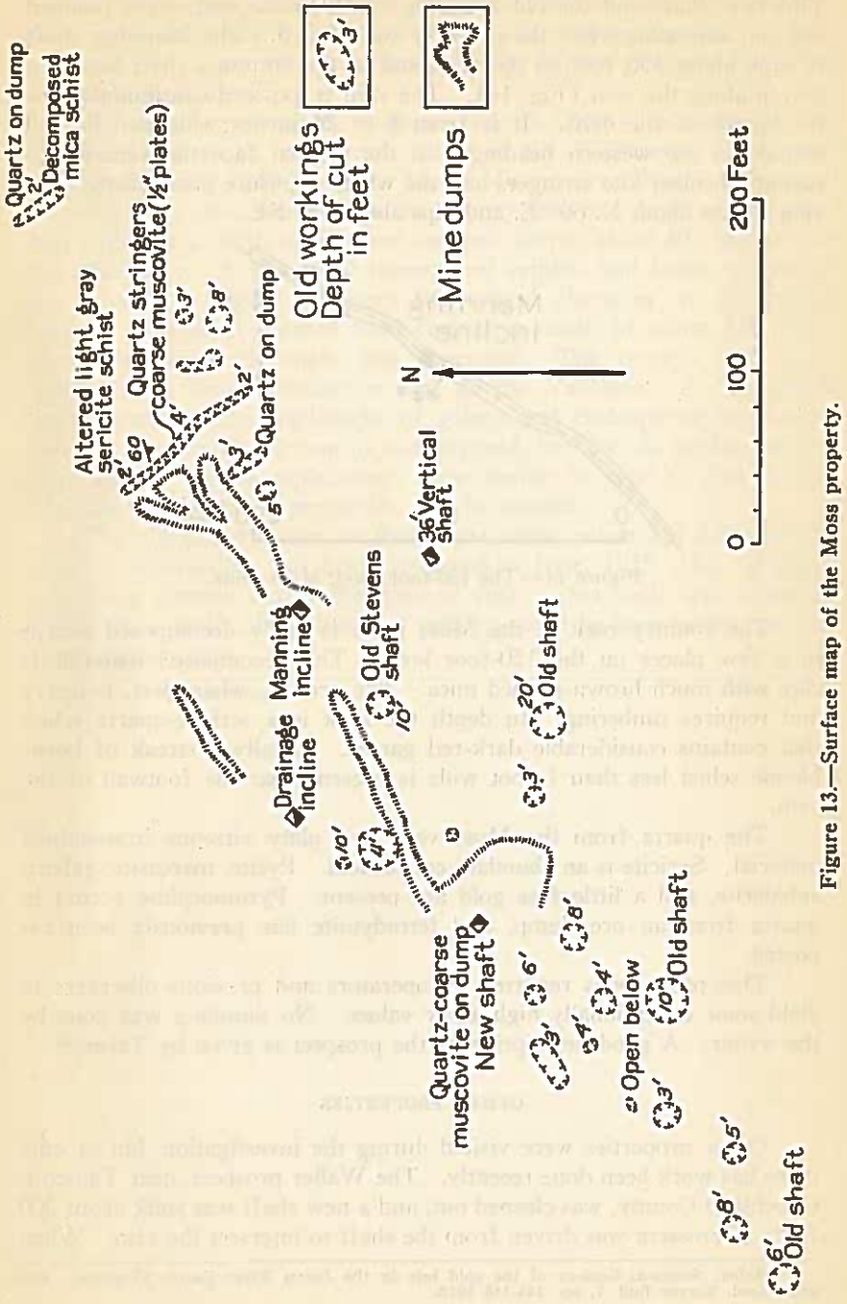


Figure 13.—Surface map of the Moss property.

This new shaft and the old Manning shaft, to the east, were pumped out and accessible when the property was visited. The Manning shaft is sunk about 150 feet on the vein, and at the bottom a drift has been driven along the vein (Fig. 14). The vein is exposed continuously for the length of the drift. It is from 8 to 24 inches wide and is well defined in the western heading. In the eastern face the vein is apparently broken into stringers and the whole exposure is silicified. The vein strikes about N. 60° E. and dips about 45° SE.

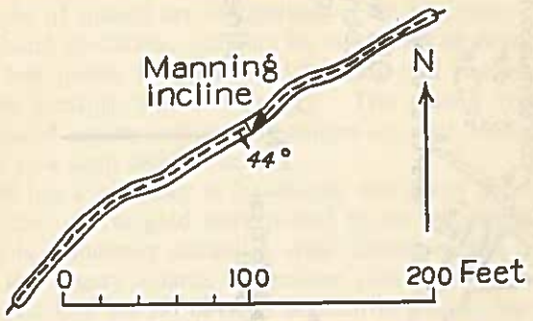


Figure 14.—The 150-foot level, Moss mine.

The country rock at the Moss mine is badly decomposed except in a few places on the 150-foot level. The decomposed material is clay with much brown-stained mica. The ground, where wet, is heavy and requires timbering. In depth the rock is a sericite-quartz schist that contains considerable dark-red garnet. Locally a streak of hornblende schist less than 1 foot wide is present near the footwall of the vein.

The quartz from the Moss vein is a platy vitreous iron-stained material. Sericite is an abundant constituent. Pyrite, marcasite, galena, sphalerite, and a little free gold are present. Pyromorphite occurs in quartz from an ore dump, and tetradymite has previously been reported.

This property is reported by operators and previous observers to yield some exceptionally high assay values. No sampling was done by the writer. A good description of the prospect is given by Taber.[25]

OTHER PROPERTIES

Other properties were visited during the investigation, but at only three has work been done recently. The Waller prospect, near Tabscott, Goochland County, was cleaned out, and a new shaft was sunk about 300 feet. A crosscut was driven from the shaft to intersect the vein. When

[25] Taber, Stephen, Geology of the gold belt in the James River Basin, Virginia: Virginia Geol. Survey Bull. 7, pp. 144-146 1918.

visited the property was flooded, but it is reported that the vein was thin and barren where cut. Work was discontinued because of lack of capital to pursue the development. The Waller property has been described by Taber.[26]

The Laird property, in northern Orange County, southeast of the Vaucluse and about half a mile north of the Wilderness Store, was developed during 1934-35 by the Melba Mining Co. (Paul G. Benedum interests). A shaft was sunk in the country rock to a depth of 317 feet, and a level at a depth of 300 feet has been driven about 400 feet across the schistosity. A few small mineralized veinlets and lenses of quartz are exposed. Figure 3 shows the typical character of the quartz bodies. The shaft entered hard rock at a depth of about 110 feet; above this level the shaft was concreted. The country rock is a quartz-biotite schist similar to that at the Vaucluse. A few small quartz lenses containing specks of galena and chalcopyrite have been found. A mineralized zone is not exposed, but the old surface workings indicate that a replacement zone similar in type to that in the Melville and Vaucluse properties may be present.

The old Liberty mine, in Fauquier County, about 3½ miles southwest of Morrisville, was being reopened in June, 1935. An old shaft was being cleaned out at the time of visit. This shaft was timbered solidly to a depth of 35 feet and nothing could be seen except the old caved surface pits.

[26] Op. cit., pp. 148-151.

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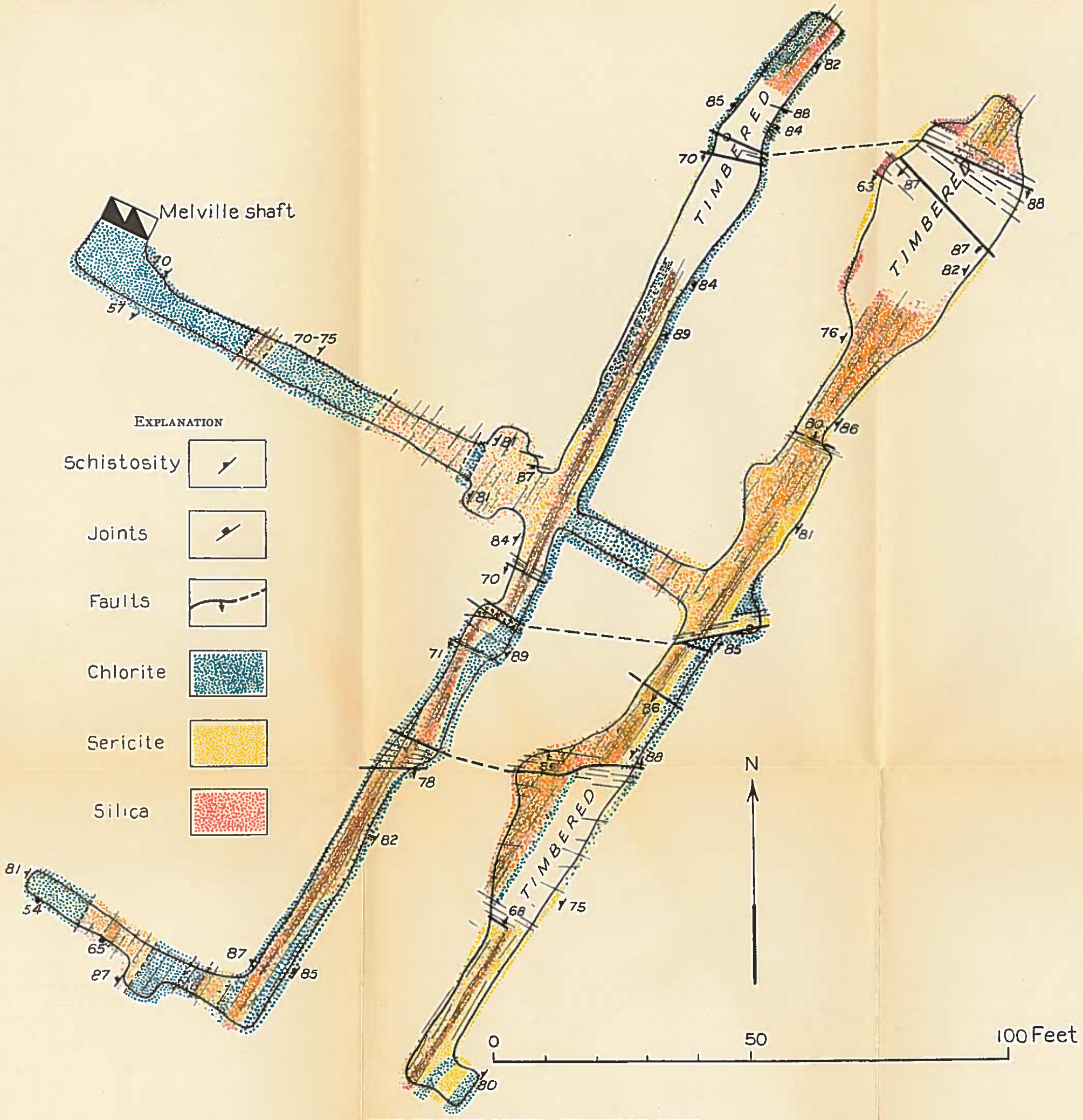
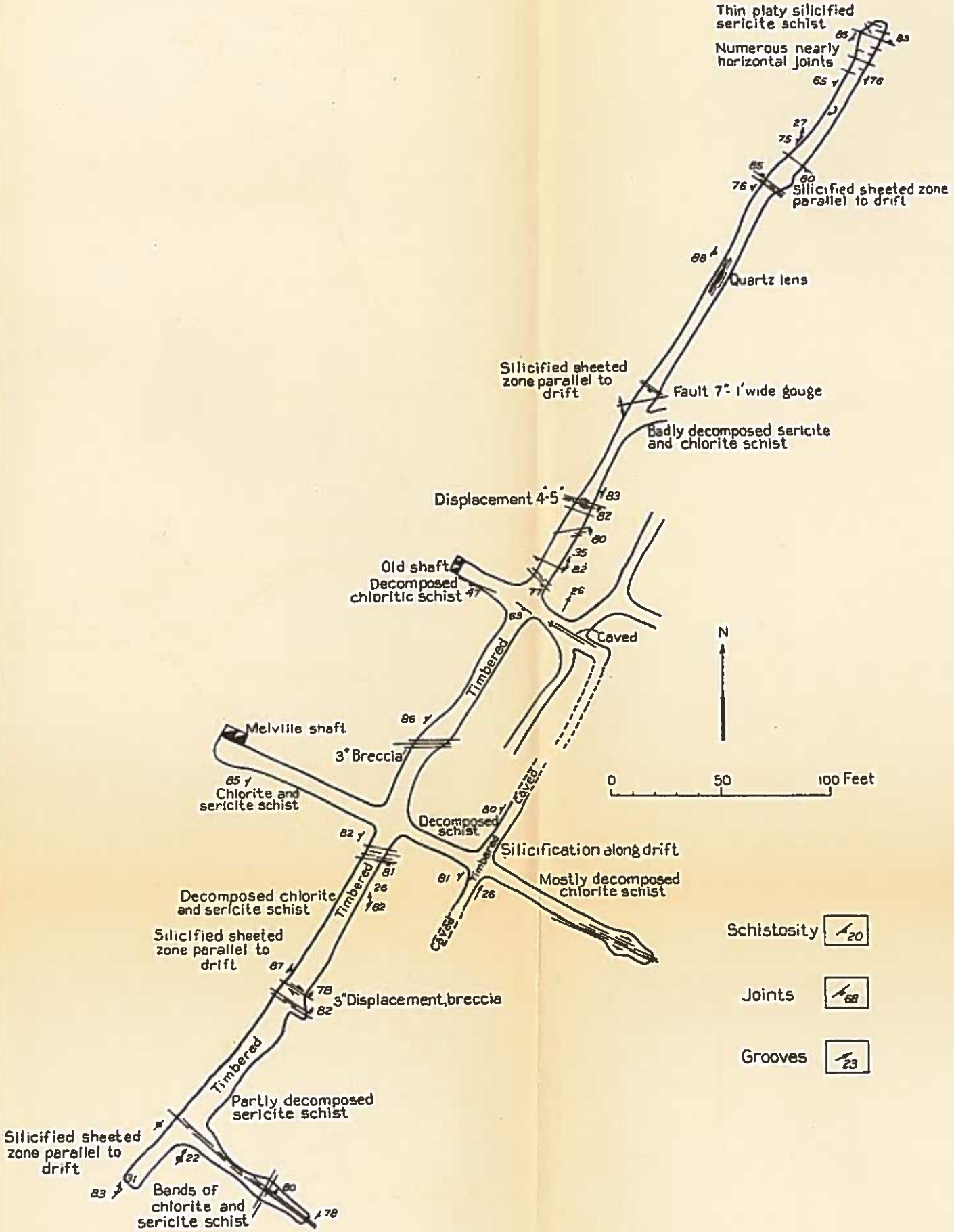
TOPOGRAPHIC AND GEOLOGIC MAP OF PART OF THE MELVILLE-VAUCLUSE SHEAR ZONE.



THE 220-FOOT LEVEL, MELVILLE MINE



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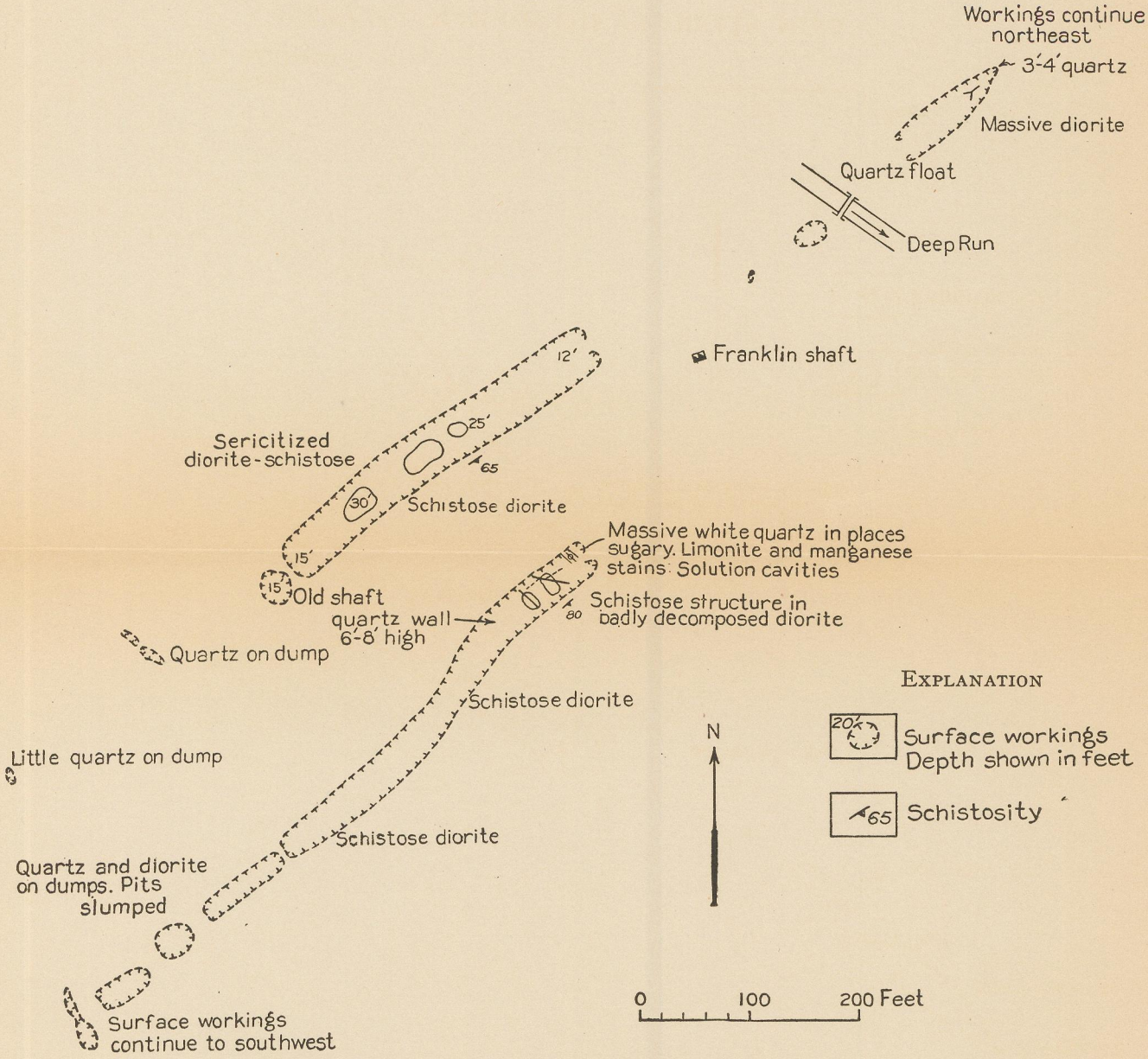
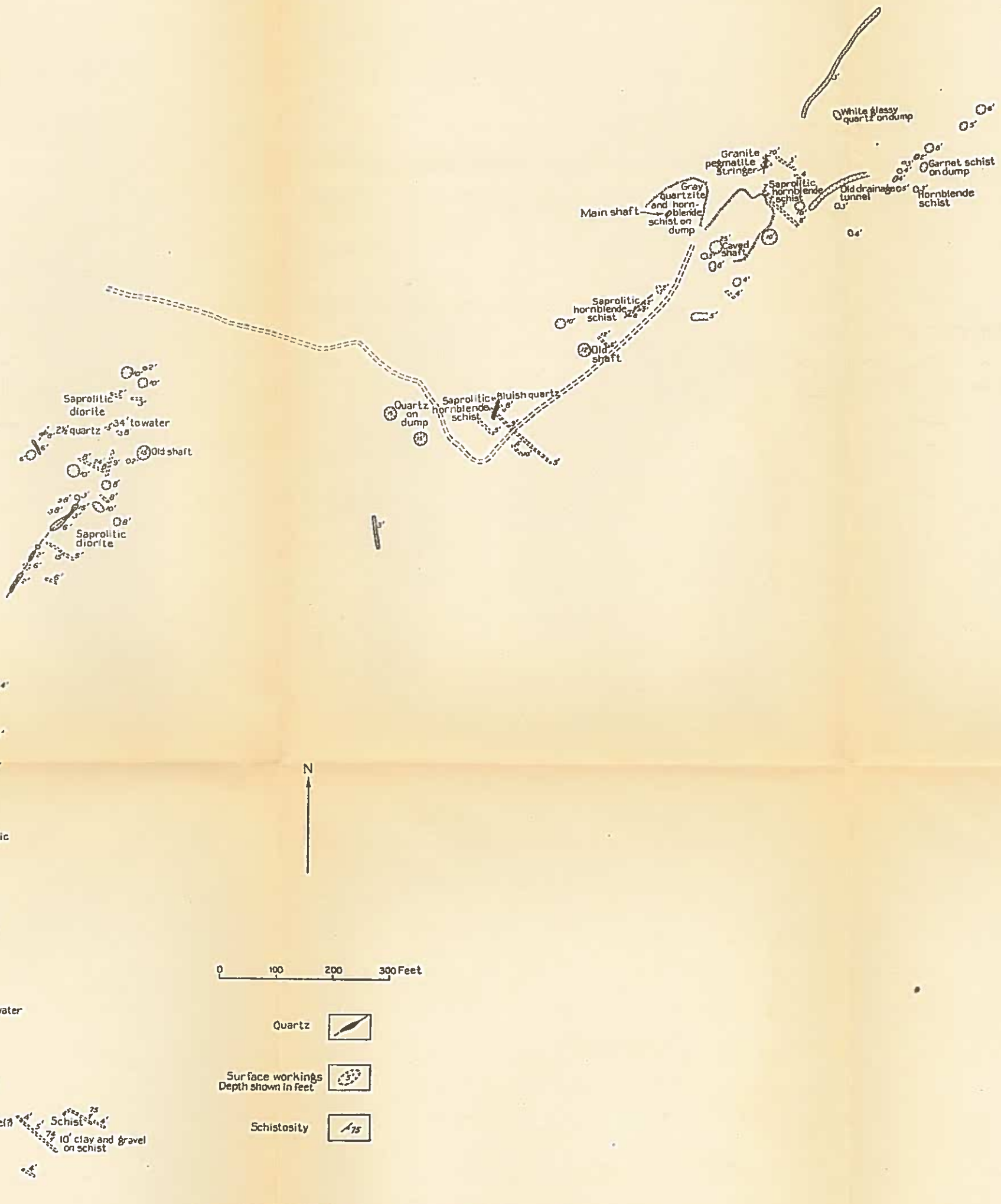


SURFACE MAP OF THE FRANKLIN MINE



SURFACE MAP OF THE UNITED STATES MINE