GEOLOGY
OF
MERCER COUNTY
IN BRIEF

NEW JERSEY GEOLOGICAL SURVEY

The cover for the Mercer County in Brief illustrates the Mercer oak under which General Mercer was allegedly mortally wounded at the Battle of Princeton. The Battle of Princeton culminated the Ten Day Christmas Campaign during which Washington's troops defeated on 26 December 1776 three regiments of Hessians at Trenton, fought a delaying action against the advancing British, known as the Battle of the Assunpink or the second Battle of Trenton, on 2 January 1777, and then, after a night march around the flank of the entire British Army, severely mauled three British regiments at Princeton shortly after dawn on 3 January 1777.

BOOKS OF INTEREST AVAILABLE FROM THE BUREAU OF GEOLOGY

Richards, Horace G., et al, 1958, The Cretaceous Fossils of New Jersey, Parts I and II, Bulletin 61

Widmer, Kemble, 1964, The Geology and Geography of New Jersey, D. VanNostrand, Princeton, v.19,193 p.

COUNTY SERIES:

Geology of Bergen County in Brief, Carol S. Lucey, Sr. Geologist
Geology of Burlington County in Brief, K. Widmer and C. S. Lucey
Geology of Essex & Union Counties in Brief, Carol S. Lucey, Sr.Geologist
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STATE OF NEW JERSEY

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GEOLOGY OF MERCER COUNTY IN BRIEF

by

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State Geologist

June, 1977

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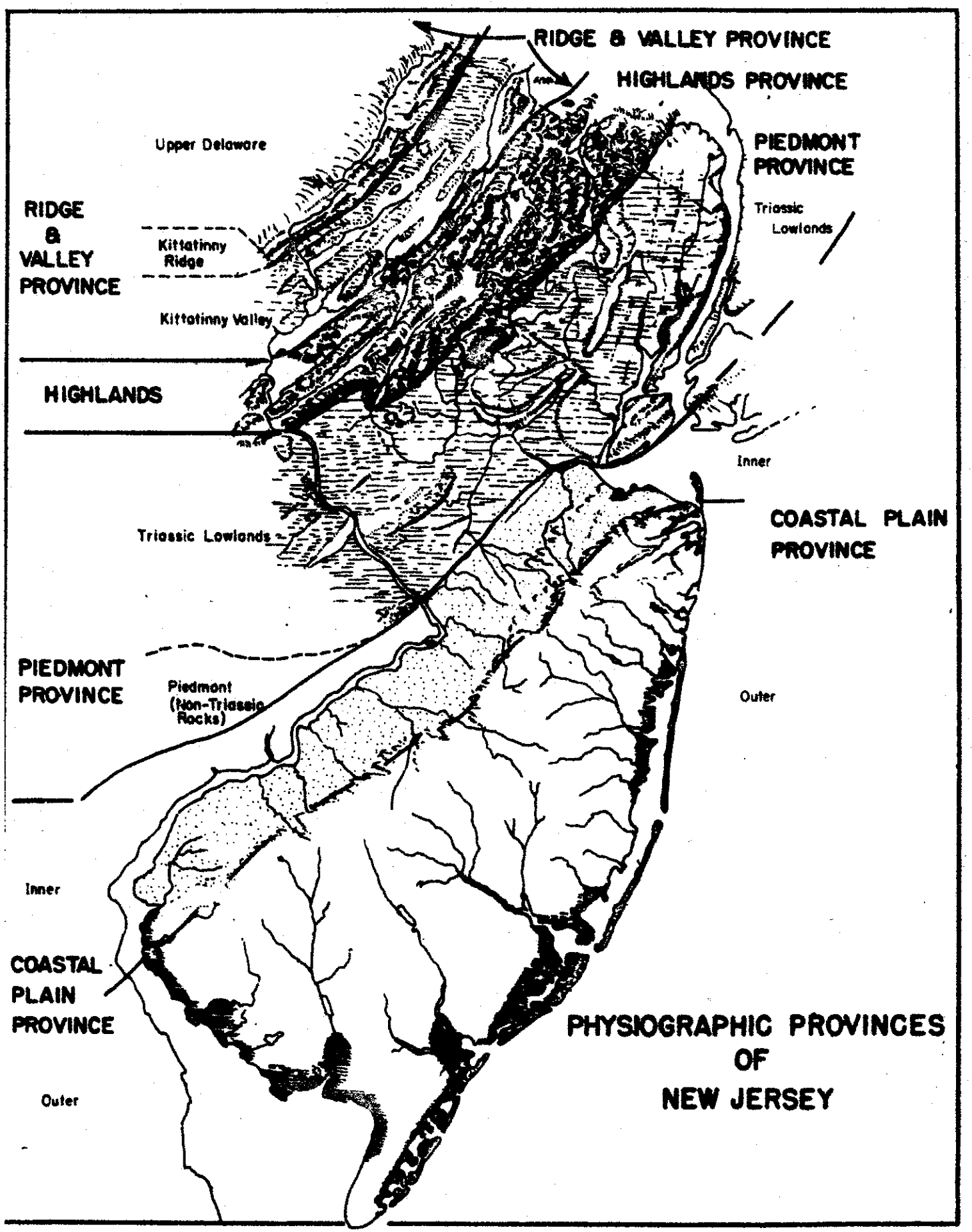
GEOLOGY OF MERCER COUNTY IN BRIEF

Topography

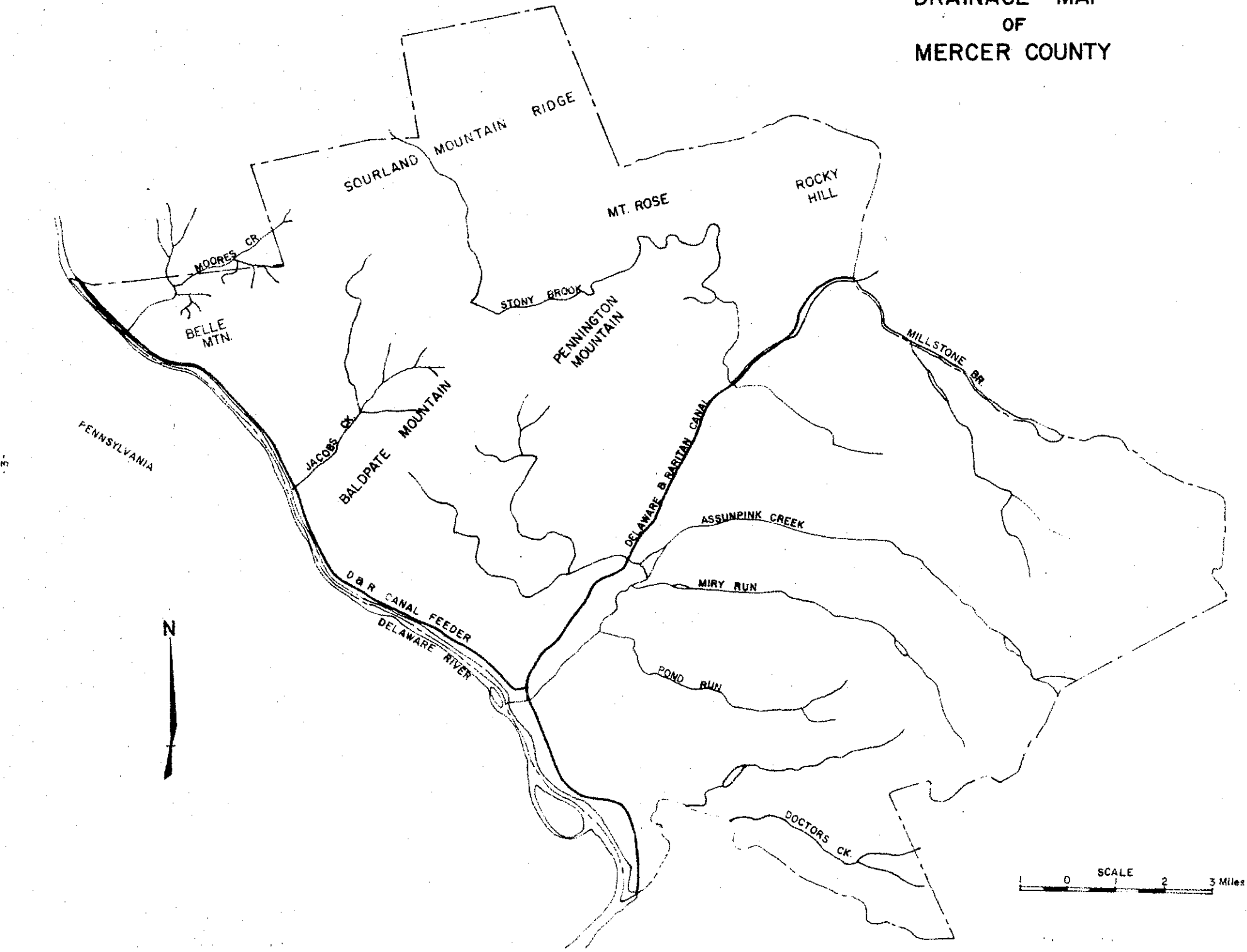
Mercer County contains a low ridge of pre-Triassic quartzites, gneisses and schists, which crops out in the Delaware River and forms the falls of Trenton. This low ridge extends eastward at or very close to the surface as far as Princeton Junction. These crystalline rocks, which form the so-called "basement," underlie the northwesterly dipping sandstone, argillites and shales of the Triassic Newark Group of the Piedmont Physiographic Province of northern Mercer County. They also underlie the southeasterly dipping Cretaceous and Tertiary Continental Shelf sediments of southern Mercer County's Coastal Plain Physiographic Province. Thus, Mercer County's topography is a reflection of two physiographic provinces: the Piedmont and the Coastal Plain.

There are only four Coastal Plain Formations exposed in the part of Mercer County within the Coastal Plain Province. Approximately half of this section of the county is underlain by the Magothy and Raritan Formations; a series of alternating clays and sands.

Most of the county within the Coastal Plain Physiographic Province lies between elevations of sixty and one hundred feet. Streams generally flow northwestward until they join the Delaware River or the Assunpink Creek. The Delaware as well as the Assunpink turn and flow westward near Trenton, generally along the northern boundary of the Coastal Plain which is parallel to the strike of the formations. The relatively flat terrain and the sandy soil of the Coastal Plain Province has led to the rapid growth of housing developments in southern Mercer County (Hamilton, Washington, East and West Windsor Townships). Many areas underlain by clays


RIDGE & VALLEY PROVINCE
HIGHLANDS PROVINCE
PIEDMONT PROVINCE
Triassic Lowlands
Upper Delaware
RIDGE & VALLEY PROVINCE
Kittatinny Ridge
Kittatinny Valley
HIGHLANDS
Inner
COASTAL PLAIN PROVINCE
Triassic Lowlands
PIEDMONT PROVINCE
Piedmont (Non-Triassic Rocks)
Outer
Inner
COASTAL PLAIN PROVINCE
Outer
PHYSIOGRAPHIC PROVINCES OF NEW JERSEY

DRAINAGE MAP OF MERCER COUNTY



close to the surface are very swampy and remain wooded, while the sandier soils have been cleared for agricultural purposes.

Northern Mercer County in the Piedmont Physiographic Province is underlain by the Stockton sandstone and the Brunswick shale which rise to an elevation of about one hundred sixty feet and are cut by streams which flow into the Delaware, the Shabakunk, or Stony Brook. The areas underlain by Lockatong argillite or diabase intrusives form the highest terrain in the county, with flat-topped ridges that reach the general elevation of two hundred feet. The main argillite zone extends from Scudder's Falls on the Delaware River to and through Princeton Borough. The diabase intrusives of Pennington Mountain and of Baldpate Mountain on the Delaware in the northern part of the county reach elevations of just over four hundred sixty feet. The westward extension of the Palisades sill forms Mt. Lucas north of Princeton and Mt. Rose south of Hopewell. This ridge, reaching elevations of four hundred fifteen feet, was a barrier to the Reading Railroad on its route from West Trenton to Bound Brook. The railroad was forced to follow the high ground near Pennington and to loop around the trap ridge just west of the Borough of Hopewell. The Stockton sandstone belt north of Hopewell and north of the trap ridges was protected from erosion both by the above-mentioned diabase intrusives to the south and a wide band of Lockatong argillite to the north. The Sourland Mountains form the high ground, with a general elevation in excess of three hundred feet, in the northern part of the county in the vicinity of Harbourton, Woodsville and north of Hopewell. They are underlain by sandstone, argillite or diabase.

Geologic History

Proterozoic Era

Precambrian Period - The gneisses and schists of Mercer County may be either Precambrian or highly metamorphosed early Paleozoic rocks. They are equivalent to the rocks found on Manhattan Island. Frequently, they are quartz-mica-schists and are similar to the Wissahickon schists of Pennsylvania.

Except for the rock exposures in the bed of the Delaware River, the few outcroppings close to the river and some badly weathered outcrops in the vicinity of Colonial Lakes east of Trenton are rapidly being obliterated by suburban development. Exposures of the Precambrian are extremely rare. Much of the information about the Precambrian is from excavations and well records. The same is true for the Cambrian-Hardyston quartsite which crops out along the northern edge of this small exposed area of basement rocks. The pre-Triassic rocks range from gabbros to granite and pegmatites and from schists to gneisses. The Cambrian-Hardyston quartsite, a highly metamorphosed Paleozoic sediment, underlies a wide band north of the Precambrian gneisses.

Paleozoic Era

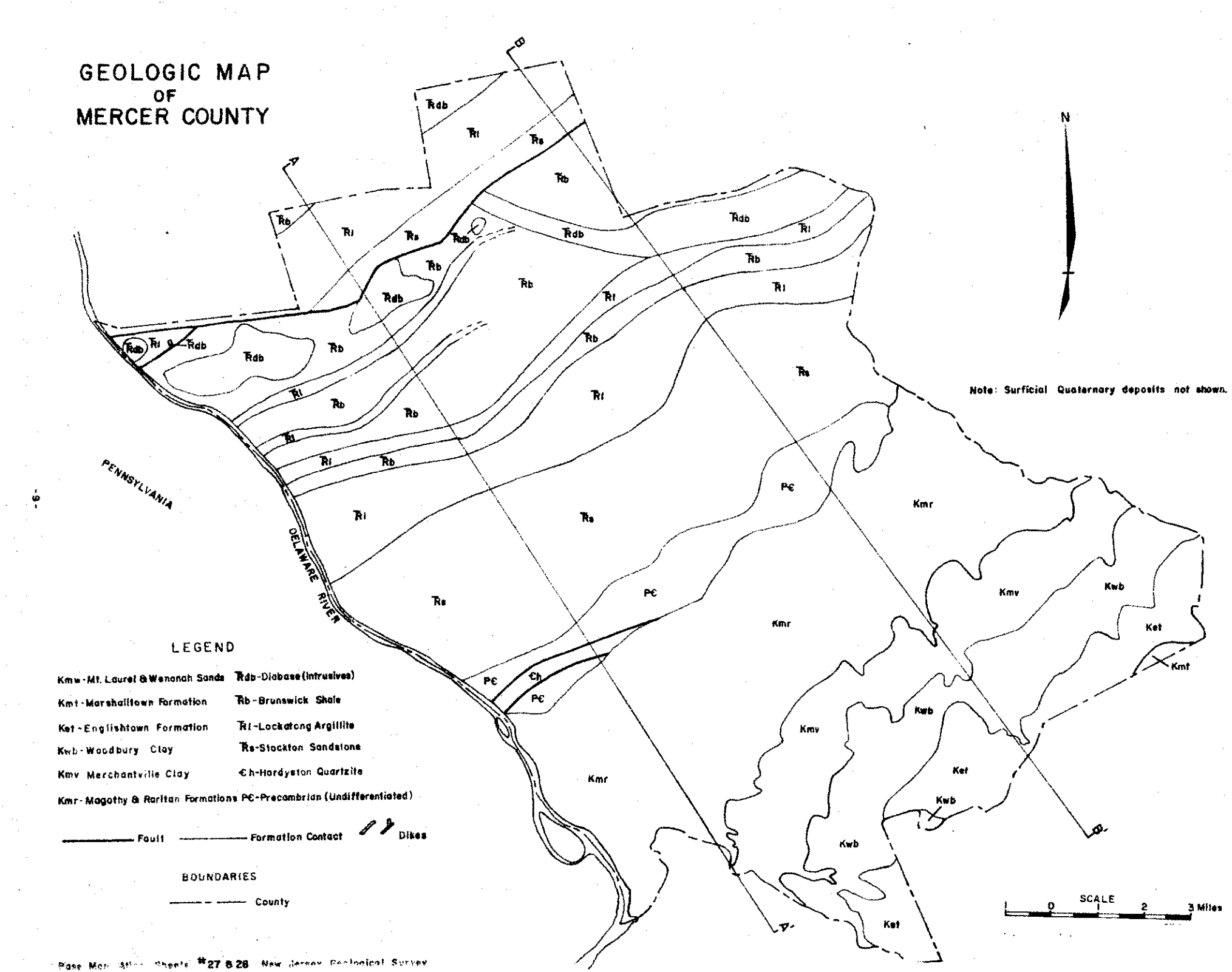
Cambrian Period - The quartzite rocks found in Mercer County are considered equivalent to the New Jersey Hardyston Formation or the Chickies quartzite of Pennsylvania.

The zone of pre-Triassic, Precambrian, and Cambrian crystalline rocks of the Trenton area continues west of the Delaware River into and beyond the Philadelphia region.

Mesozoic Era

There is a normal sequence of Triassic strata dipping northwestward.

GEOLOGIC MAP OF MERCER COUNTY



LEGEND

Kmw - Mt. Laurel & Wenonah Sands
Kmt - Marshalltown Formation
Ket - Englishtown Formation
Kwb - Woodbury Clay
Kmv Merchantville Clay
Kmr - Magothy & Raritan Formations
Trdb - Diabase (intrusives)
Trb - Brunswick Shale
Trl - Lockatong Argillite
Trs - Stockton Sandstone
Ch - Hardyston Quartzite
Pℂ - Precambrian (Undifferentiated)

Fault — Formation Contact — Dikes

BOUNDARIES

County

Base Map Sheets #27 & 28 New Jersey Geological Survey

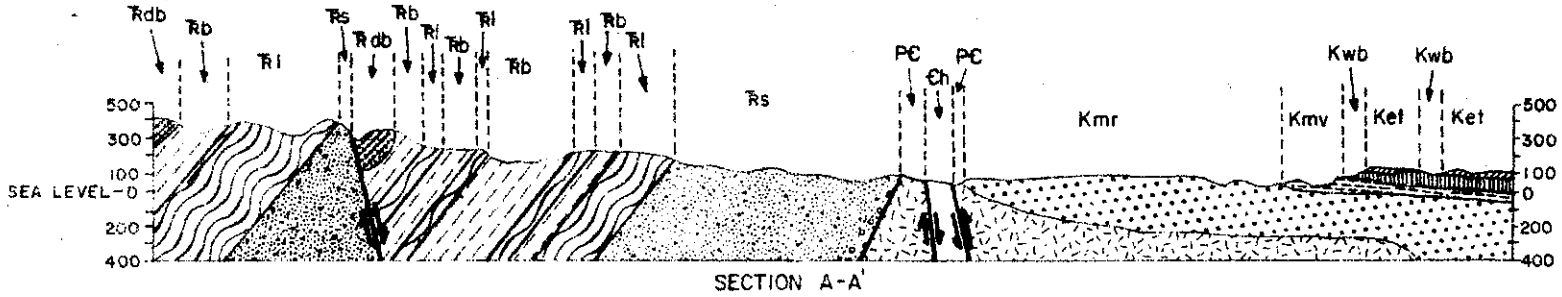
GEOLOGIC CROSS-SECTIONS
OF
MERCER COUNTY

New Jersey Geological Survey 1977

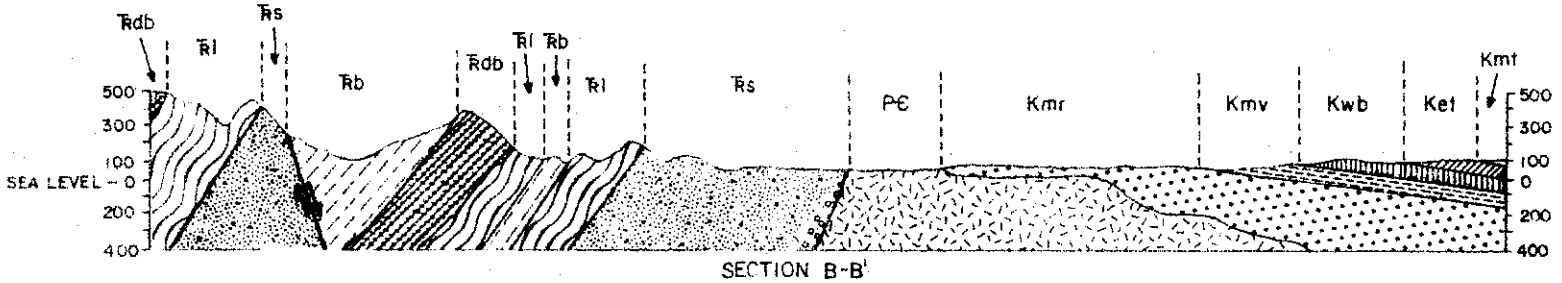
Horizontal Scale: 1" = 3 Miles

Vertical $\frac{1}{10}$" = 100 Feet

Thin mantle of Pleistocene not shown



SECTION A-A'



SECTION B-B'

LEGEND

Kmt - Marshalltown Formation	Trb - Brunswick Shale
Ket - Englishtown Sand	Trl - Lockatong Argillite
Kwb - Woodbury Clay	Trs Stockton Sandstone
Kmv - Merchantville Clay	Ch - Hardyston Quartzite
Kmr - Magothy and Raritan Formation	PC - Precambrian (Undifferentiated)
Trdb - Diabase (Intrusive)	

Bureau of Geology and Topography 1977

The Piedmont part of Mercer County, as in other parts of the state, has developed more as a suburban residential area than as a farming area. Most of the farms in the area are devoted to dairy or grain farming, but those in the area which are underlain by the Stockton sandstone and Brunswick shale have, in general, better soil conditions than farms on the Lockatong argillite ridges. Most of the diabase ridges have been left in woods. Cretaceous and Tertiary clays, sands, and gravels dip southeastward from the above-mentioned outcrop of crystalline rocks that extends from Trenton to Princeton. A major fault in the Triassic on the north side of Hopewell Borough (the Sourland Mountains) causes the repetition of the Triassic sequence in most of northern Mercer County. Minor faults occur near the west end and on the south sides of the diabase intrusives of Mt. Rose, Pennington Mt., and Baldpate Mt. The fault zones in Mercer County's rock areas seem to be better than average sites for large yields of water supply.

Dinosaur footprints, worm tubes and castings, and fossil fish have been found in the Triassic rocks near Princeton.

Cretaceous Period - Cretaceous landslide structures have been found in the Raritan Formation as well as the younger formations near Crosswicks.

The sand beds and lenses in the Raritan Formation, particularly when they are well sorted and free of interstitial clay and silt, are extremely important as aquifers. The sands of the Magothy Formation are frequently satisfactory for domestic household well supplies; but it is the coarser, thick, well sorted sands of the Raritan Formation which provide water to most of the industrial wells along Route 130 and the Conrail freight line from Bordentown. Southeastward of the Conrail freight line from Bordentown to South Amboy and Route 130, the Merchantville and Woodbury clays underlie

most of the county. In the extreme southeastern tip of the county, the Englishtown sands are found at the surface.

Cenozoic Era

Pleistocene Period - Pleistocene deposits range from thick sheets of windblown loess in the Stony Brook watershed near Pennington to the coarse yellow gravels of the Pensauken Formation of the southern section of Mercer County. They conceal the bedrock and the Coastal Plain Formations in much of the county. The pre-Triassic crystalline rocks are capped and masked by a veneer of Pleistocene sediments.

The Pleistocene deposits have some interesting properties: 1) they act as a sponge and store water; 2) they tend to increase the permeability and the fertility of the soil; and 3) in a few places they are thick enough (up to 110 feet) to be used as either aquifers or gravel sources.

At the turn of the century a mastodon tusk (now in the Rutgers Geology Museum) was recovered from the Pleistocene gravels near the Conrail station in Trenton.

MINERAL PRODUCTION AND HISTORY

Mercer County has been a commercial and industrial center since colonial days. Its topography and natural resources made it the "commercial crossroads" of the Eastern Seaboard.

Located where the Coastal Plain and Piedmont Plateau meet (referred to as the "Fall Line"), most of its streams form rapids along the Fall Line and are important geographic centers. For example, the Delaware River's head of navigation is at "Trenton Falls."

The basic needs of industrial growth were available in the county; there was access to raw materials and markets as well as an abundant supply of water and water power. The first industry was a grist mill which was established around 1679. Later, pottery, brick, tile, iron, and rubber became the major enterprises. Fire clay for the ceramic industry was extracted from the Raritan Formation. Bog iron ore came from South Jersey and magnetite was shipped down the Delaware from Easton. Coal came from eastern Pennsylvania. Lockatong argillite, available along the Delaware River as well as inland, was a source of building stone.

The red or brownish Stockton sandstone is named for its outcrops at Stockton in Hunterdon County on the Delaware River, where the stone is quarried for decorative stone today. This sandstone, or "brownstone," has been used as dimension building stone for many famous and historic buildings in New Jersey. Quarries operated for a few years in Mercer County along the Delaware River near Wilburtha. The red Brunswick shale found in the Raritan River Valley near New Brunswick underlies much of the northern part of the county, but has no economic significance as a mineral resource.

Mercer County still manufactures ceramic, iron, steel, and rubber products. However, the clays for the ceramic industry are generally from outside New Jersey.

Originally in the Trenton area, and even now in other parts of the state, the clays of the Raritan Formation were used for the manufacture of pottery and terracotta. There ar no longer any forges, furnaces, or metal producers.

Sandstone and argillite are no longer quarried. Diabase (trap rock) is extracted for road metal and concrete aggregate and is now the county's most valuable mineral raw material. The Kingston Trap Rock Company quarry at Pennington Mt. and the Mercer County Work House quarry on the Delaware River are extracting substantial tonnages from the diabase intrusives. The quarry swimming hole near Hopewell and the Moore's quarry on the Delaware River mark the former site of other traprock operations in Mercer County.

GEOLOGIC TIME SCALE

Geologic time intervals are unequal subdivisions of the earth's history corresponding to earth's geologic events. Eras are the longest divisions of time and contain many periods which are further subdivided into epochs. Formations, which are mappable units of rock or sediments, usually have lithology or characteristic distinctions and are assigned to that period or epoch during which they are formed.

A formation's place within the stratigraphic column is determined by the predominant form of life preserved as fossils within the rocks or sediments. If fossils are lacking, a formation's location in the time scale may be determined by its relationship to previously dated units. Only recently have geologists been able to place an absolute date on these relative time units by radioactive methods.

The geologic column is used throughout the world, although some regional modifications may be used for greater clarity.

In the accompanying stratigraphic column, the rock type given after the name is the most common variety found in the county. There may be variation of lithology within the formation from place to place.

GEOLOGIC TIME SCALE OF MERCER COUNTY

Era	Period	Formation or Rock (approx. thickness)	No. of Million Years Ago
CENOZOIC	Recent Quaternary Pleistocene	Soil and Alluvium Glacial Deposits	0-1
	Tertiary	Not present in county	1-70
MESOZOIC	Cretaceous	Marshalltown Formation (30-40 ft.) Englishtown Formation (20-140 ft.) Woodbury Clay (50 ft.) Merchantville Formation (50-60 ft.) Magothy-Raritan Formation (25-300 ft.)	70-135
	Jurassic	Not present in state	135-180
	Triassic	Brunswick Formation (6000-8000 ft.) Lockatong Formation (3500 ft.) Stockton Formation (2300-3100 ft.)	180-225
PALEOZOIC	Permian	Not present in state	225-270
	Penn. Carboniferous Miss.	Not present in state	270-350
	Devonian	Not present in county	350-400
	Silurian	Not present in county	400-440
	Ordovician	Not present in county	440-500
	Cambrian	Hardyston Quartzite (5-200 ft.)	500-600
PRECAMBRIAN		Gabbros; pegmatites; gneisses; schists (? ft.)	600+

MERCER COUNTY STATISTICS

Major Municipality	Area (sq.mi.)	Population (1975 Census)	Population Density (per sq.mi.)
East Windsor Township	15.60	20,115	1,289.42
Ewing Township	15.13	33,460	2,211.50
Hamilton Township	39.38	82,880	2,104.62
Hightstown Borough	1.23	5,610	4,560.97
Hopewell Borough	.75	2,295	3,060.00
Hopewell Township	58.00	10,540	181.72
Lawrence Township	21.87	20,025	915.64
Pennington Borough	.99	2,165	2,186.87
Princeton Borough	1.76	12,245	6,957.39
Princeton Township	16.25	14,065	865.54
Trenton City	7.50	106,625	14,216.67
Washington Township	20.70	3,500	169.08
West Windsor Township	26.84	7,375	274.78
Total	226.00	320,900	

Average Population Density - 2,999.55

Average Population Density excluding Trenton - 2,064.79

In 1974, 30.2% of the land was devoted to farming, a 3.1% reduction from 1969 when 33.3% of the county was farmed. In 1974, there were 291 farms, 152 acres average, which sold products valued at $9,750,000. In 1959, 5% of Mercer County's land was forested, but most of the woodland was on farms. A major portion of the areas underlain by argillite or diabase have remained in forests. In 1959, only 2% of the land was utilized for industry.

SELECTED REFERENCES

Bascom, F., et al., Geologic Atlas of New Jersey, Trenton Folio, No. 167, U. S. Geological Survey, 1909.

This folio has long been out of print but may be consulted at some of the larger libraries. The area covered includes all of Mercer County and parts of adjacent counties in New Jersey and Pennsylvania within the 30-minute quadrangle north of latitude 40° North and east of longitude 75° West. This folio is frequently quoted at length where there is reason to provide a summary of the geology of the Trenton area.

Dorf, Erling, Editor, Guidebook for Field Trips, Atlantic City Meeting 1957, Geol. Soc. Amer. Field Trip No. 1, Cretaceous and Cenozoic of the New Jersey Coastal Plain; Field Trip No. 2, Triassic Formations in the Delaware Valley; and Field Trip No. 5, Crystalline Rocks of the Philadelphia Area.

Summarizes the latest concepts and indicates the problems pertaining to the geologic formations of New Jersey which are also found in Mercer County and adjacent areas.

Lewis, J. F. and Kummel, H. B., The Geology of New Jersey, Bulletin 50, Revised and rewritten by H. B. Kummel (1938-1940), Trenton, New Jersey.

This bulletin has been out of print since about 1948 but may occasionally be found in second-hand book stores or antique shops, or it may be consulted in the larger libraries.

Widmer, Kemble, Geology of the Ground Water Resources of Mercer County, Geologic Report Series No. 7, New Jersey Geological Survey, Trenton, New Jersey, 1965.

_____, The Geology and Geography of New Jersey, Volume 19, The New New Jersey Historical Series, D. Van Nostrand Company, Inc., Princeton, New Jersey, 1964.