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National Park Service
Natural Resource Stewardship and Science Directorate
Geologic Resources Division

Fire Island National Seashore

GRI Ancillary Map Information Document

Produced to accompany the Geologic Resources Inventory (GRI) Digital Geologic Data for Fire Island National Seashore

fiib_geology.pdf

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Geologic Resources Inventory Map Document for Fire Island National Seashore

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Geologic Resources Inventory Map Document

Fire Island National Seashore, New York

Document to Accompany Digital Geologic-GIS Data

fiib_geology.pdf

Version: 8/22/2013

This document has been developed to accompany the digital geologic-GIS data developed by the Geologic Resources Inventory (GRI) program for Fire Island National Seashore, New York (FIIS).

Attempts have been made to reproduce all aspects of the original source products, including the geologic units and their descriptions, geologic cross sections, the geologic report, references and all other pertinent images and information contained in the original publication.

National Park Service (NPS) Geologic Resources Inventory (GRI) Program staff have assembled the digital geologic-GIS data that accompanies this document.

For information about the status of GRI digital geologic-GIS data for a park contact:

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About the NPS Geologic Resources Inventory Program

Background

Recognizing the interrelationships between the physical (geology, air, and water) and biological (plants and animals) components of the Earth is vital to understanding, managing, and protecting natural resources. The Geologic Resources Inventory (GRI) helps make this connection by providing information on the role of geology and geologic resource management in parks.

Geologic resources for management consideration include both the processes that act upon the Earth and the features formed as a result of these processes. Geologic processes include: erosion and sedimentation; seismic, volcanic, and geothermal activity; glaciation, rockfalls, landslides, and shoreline change. Geologic features include mountains, canyons, natural arches and bridges, minerals, rocks, fossils, cave and karst systems, beaches, dunes, glaciers, volcanoes, and faults.

The Geologic Resources Inventory aims to raise awareness of geology and the role it plays in the environment, and to provide natural resource managers and staff, park planners, interpreters, researchers, and other NPS personnel with information that can help them make informed management decisions.

The GRI team, working closely with the Colorado State University (CSU) Department of Geosciences and a variety of other partners, provides more than 270 parks with a geologic scoping meeting, digital geologic-GIS map data, and a park-specific geologic report.

Products

Scoping Meetings: These park-specific meetings bring together local geologic experts and park staff to inventory and review available geologic data and discuss geologic resource management issues. A summary document is prepared for each meeting that identifies a plan to provide digital map data for the park.

Digital Geologic Maps: Digital geologic maps reproduce all aspects of traditional paper maps, including notes, legend, and cross sections. Bedrock, surficial, and special purpose maps such as coastal or geologic hazard maps may be used by the GRI to create digital Geographic Information Systems (GIS) data and meet park needs. These digital GIS data allow geologic information to be easily viewed and analyzed in conjunction with a wide range of other resource management information data.

For detailed information regarding GIS parameters such as data attribute field definitions, attribute field codes, value definitions, and rules that govern relationships found in the data, refer to the NPS Geology-GIS Data Model document available at: http://science.nature.nps.gov/im/inventory/geology/GeologyGISDataModel.cfm

Geologic Reports: Park-specific geologic reports identify geologic resource management issues as well as features and processes that are important to park ecosystems. In addition, these reports present a brief geologic history of the park and address specific properties of geologic units present in the park.

For a complete listing of Geologic Resource Inventory products and direct links to the download site visit the GRI publications webpage http://www.nature.nps.gov/geology/inventory/gre_publications.cfm

GRI geologic-GIS data is also available online at the NPS Data Store Search Application: http://irma.nps.gov/App/Reference/Search. To find GRI data for a specific park or parks select the appropriate park

(s), enter “GRI” as a Search Text term, and then select the Search Button.

For more information about the Geologic Resources Inventory Program visit the GRI webpage: http://www.nature.nps.gov/geology/inventory, or contact:

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The Geologic Resources Inventory (GRI) program is funded by the National Park Service (NPS) Inventory and Monitoring (I&M) Division.

GRI Digital Map and Source Map Citation

The GRI digital geologic-GIS bedrock geologic map for Fire Island National Seashore, New York (FIIS):

Digital Geologic Map of Long Island, New York (*GRI MapCode FIIB*)

Source Map:

Fuller, M.L., 1914, Geology of Long Island, New York, U.S. Geological Survey, Professional Paper 82, 1:125,000 scale (Historical Geology of Long Island). (*GRI Source Map ID 3072*).

Source citation note: Due to the poor condition of the paper copy of the map the resulting digital image was very difficult to georeference. To improve georeferencing the full map image was cut into several pieces which were then georeferenced individually. In some areas this improved georeferencing, but in other areas notable offset, distortion and/or displacement of map features was still present. Where possible an effort was made to adjust or correct this using an adjacent image. In some cases small offshore islands were moved to better align with aerial imagery.

Additional information pertaining to each source map is also presented in the GRI Source Map Information (FIISMAP) table included with the GRI geology-GIS data.

Map Unit List

The geologic units present in the digital historical geologic-GIS data produced for Fire Island National Seashore, New York (FIIS) are listed below. Units are listed with their assigned unit symbol and unit name (e.g., Rb - Beach deposits). Units are listed from youngest to oldest. No description for water is provided. Information about each geologic unit is also presented in the GRI Geologic Unit Information (fiibunit) table included with the GRI geology-GIS data.

Cenozoic Era

Recent
Rb - Beach deposits
Rd - Dune sand
Rsm - Swamp and marsh deposits

Pleistocene series, Wisconsin stage
PEtmf - Thin till, Manhasset Formation
PEtmfm - Thin till, Manhasset Formation, Montauk Till Member
PEtmg - Thin till, Mannetto Gravel
PEtt - Thick till
PEro - Retreatal outwash
PEoc - Outwash in channels
PEhmf - Harbor Hill Drift, Manhasset Formation
PEhmg - Harbor Hill Drift, Mannetto Gravel
PEhmo - Outwash from ice along Harbor Hill Drift
PEhomf - Thin outwash from ice along Harbor Hill Drift, with outcrops of Manhasset Formation
PEou - Undifferentiated outwash
PErmf - Ronkonkoma Drift, Manhasset Formation
PErmfm - Ronkonkoma Drift, Montauk Till Member of Manhasset Formation
PErmg - Ronkonkoma Drift, Mannetto Gravel
PErmo - Outwash from ice along Ronkonkoma Drift
PEromf - Thin outwash from ice along Ronkonkoma Drift, with outcrops of Manhasset Formation

Pleistocene series
PEmf - Manhasset Formation
PEmfm - Montauk Till Member of Manhasset Formation
PEjg - Jacob Sand and Gardiners Clay
PEmg - Mannetto Gravel

Cretaceous
Kcs - Clays and sands of many colors

Note: The Harbor Hill Drift and Ronkonkoma Drift are referred to as the Harbor Hill moraine and Ronkonkoma moraine, respectively, on the source map and report. These unit names were changed in this document, as well as in the GRI digital geologic-GIS data, to their present day recognized unit names, however, the embedded map report scan (see Geology of Long Island Report) still refers to these units by their original source names.

Map Unit Descriptions

Descriptions of all geologic map units, generally listed from youngest to oldest, are presented below.

Rb - Beach deposits (Recent)

Gravelly near bluffs but nearly free from pebbles at a distance, carry magnetite and garnet.

The beach is composed mainly of quartz sand, although some garnetiferous and magnetic materials are seen. Pebbles are generally scarce, but some are seen where the beaches connect with the main island, as near Southampton and Westhampton. The surface above high-water mark is generally covered with dunes from 5 to 20 or even 30 feet in height, among which are scattered many small fresh marshes. The movement of materials by the waves is plainly westward, the chief source being between Southampton and Montauk, where the coast, as has been seen, has suffered considerable erosion. It is possible, also, that a part of the material has been thrown up from the shallow sea bottom of the vicinity by the action of waves. Practically no sand is contributed by the streams of the island at the present time.
(*GRI Source Map ID 3072,* Historical Geology of Long Island)

Rd - Dune sand (Recent)

Mainly quartz sand but with some magnetite and garnet, generally high on coasts but locally very thin in interior.

The dune sands consist almost entirely of fine quartz grains, well rounded, and little stained by iron. Some garnet and magnetite and here and there grains of other minerals occur, and minute fragments of shells are not rare. The magnetite sands are sometimes rather conspicuous on the sand surfaces after a long-continued period of winds with velocities just sufficient to move the lighter quartz grains but not strong enough to transport the heavier magnetite. The dunes generally rest on a black loamy soil zone, if they are of recent formation, or on a brownish oxidized zone from which the organic matter has been leached, if they are among the older dunes.
(*GRI Source Map ID 3072,* Historical Geology of Long Island)

Rsm - Swamp and marsh deposits (Recent)

Includes both fresh and saltwater accumulation.

Fresh Marshes
Marshes of the south shore form since there are almost no streams on these plains, except near the coast, all the rainfall entering the porous sand and making its way seaward as groundwater. Near the places where the plains reach sea level this water emerges at the surface, converting the edge of the plains into a marsh. The landward edge of the marsh is usually a luxurious meadow, which grades off with an intermingling of fresh and brackish water vegetation into a salt marsh, yielding great quantities of salt hay. Marshes are found in nearly every valley of the south shore where the groundwater level is cut at some distance from the coast, and considerable volumes of water emerge along the valleys, forming extensive marshes and even streams of some size. Freshwater marshes are also found along artificial ponds and reservoirs and channels obstructed by drift left by the ice in advance after their formation since they accumulate surface water in these former stream beds. Fresh marshes also occur in kettles, behind beaches, and interdune areas.

Salt Marshes
On the south shore, moving Inland from the edge of the fresh marshes, at a distance depending on the slope of the surface and the amount of seepage emerging, there is a change from fresh to salt water vegetation owing to contact with the waters of the ocean. Outward from this line to open water the marshes are for the most part salt meadows. Besides the marginal marshes just described, large areas of marsh have been built up from the bottoms of the shallow bays of the south shore. Marshes of the north-shore reentrants differs in no essential particular form from the formation of marshes in the more extensive waters of the south shore already described except that more of them have probably resulted from the comparatively recent incursion of the sea over fresh-water accumulations.
(*GRI Source Map ID 3072,* Historical Geology of Long Island)

PEtmf - Thin till, Manhasset Formation (Pleistocene series, Wisconsin stage)

Generally less than 5 feet thick, loose and oxidized, rarely banded.

The patterns of the glacial deposits are printed over the colors representing the Manhasset and Mannetto Formations, the extent of which under cover is thus shown.

Thin till covering the Manhasset Formation. See the Map Unit Descriptions 'PEtt - Thick till' and 'PEmf - Manhasset Formation' to read a list of characteristics for these units.
(*GRI Source Map ID 3072,* Historical Geology of Long Island)

PEtmfm - Thin till, Manhasset Formation, Montauk Till Member (Pleistocene series, Wisconsin stage)

Generally less than 5 feet thick, loose and oxidized, rarely banded.

The patterns of the glacial deposits are printed over the colors representing the Manhasset and Mannetto Formations, the extent of which under cover is thus shown.

Thin till covering the Manhasset Formation. See the Map Unit Descriptions 'PEtt - Thick till' an 'PEmfm - Montauk Till Member of Manhasset Formation' to read a list of characteristics for these units.
(*GRI Source Map ID 3072,* Historical Geology of Long Island)

PEtmg - Thin till, Mannetto Gravel (Pleistocene series, Wisconsin stage)

Generally less than 5 feet thick, loose and oxidized, rarely banded.

The patterns of the glacial deposits are printed over the colors representing the Manhasset and Mannetto Formations, the extent of which under cover is thus shown.

Thin till covering the Manhasset Formation. See the Map Unit Description 'PEtt - Thick till' and 'PEmg - Mannetto Gravel' to read a list of characteristics for these units.
(*GRI Source Map ID 3072,* Historical Geology of Long Island)

PEtt - Thick till (Pleistocene series, Wisconsin stage)

Generally more than 5 feet thick, loose and oxidized, rarely banded.

It is composed of unsorted mixtures of clay, sand, and boulders, the nature of which differs greatly in different parts of the island. In western Long Island granitic material commonly constitutes 5 to 10 percent of the pebbles, though in some localities nearly half of the pebbles are granitic. In other places, however, quartz pebbles predominate, it being in fact almost impossible to find granitic materials in some of the outcrops. Toward the central part of the island, beyond the Cretaceous and Mannetto remnants of Eaton Neck, the percentage of quartz rapidly decreases and that of granitic pebbles and boulders increases. In the eastern portion of the island pebbles and boulders of the granite type usually predominate in the till. In general it may be said that the till varies in composition with the character of the underlying materials over which the ice had recently passed. This explains the quartzose character of the till in the vicinity of the Cretaceous deposits and the Mannetto Gravel, the gravelly or sandy character over the Herod Gravel Member of the Manhasset Formation, and the more clayey character and local red coloration that it has where resting upon portions of the Montauk Till Member of the Manhasset Formation containing Triassic material. At several points, especially on Jessup Neck west of Sag Harbor and on Montauk Point, the till appears to have been formed locally of reworked sand dunes, and it is not improbable that many of the sandy phases of the north shore are of similar origin.
(*GRI Source Map ID 3072,* Historical Geology of Long Island)

PEro - Retreatal outwash (Pleistocene series, Wisconsin stage)

Irregular sand plains of kettle-plain type formed north of Harbor Hill Drift.

The final retreat of the ice from its position upon the surface of the gravels of the Manhasset Formation appears to have been accompanied by no considerable outwash, the deposits that were left on the surface during the retreat being composed of till rather than gravel. In some of the cliff sections a few feet of gravel rests on the till and it is believed to represent outwash deposits of the final retreat. Such deposits, however, are more commonly absent than present. Some of the swells breaking the regularity of the plateau-like Manhasset surfaces may represent low, flat outwash fans of this stage, but the number of boulders lying upon most of the surface seems to indicate that the top deposits are mainly of till. Channels cut by streams issuing from the ice sheet during its retreat persist at several points.
(*GRI Source Map ID 3072,* Historical Geology of Long Island)

PEoc - Outwash in channels (Pleistocene series, Wisconsin stage)

Includes deposits occupying channels cut in outwash deposits associated with both moraines.

In the later part, or at the end of the Harbor Hill substage of outwash deposition, the outflowing glacial waters where no longer overloaded with debris, and hence ceased to deposit and began to erode. As a result numerous well-defined and some large channels leading southward toward the sea were cut in the surface of the outwash. The greater number of these channels start at or near the Harbor Hill Drift and cross the island to the south coast, but some start at the moraine and become indistinct before reaching the sea and others begin several miles south of the moraine.
(*GRI Source Map ID 3072,* Historical Geology of Long Island)

PEhmf - Harbor Hill Drift, Manhasset Formation (Pleistocene series, Wisconsin stage)

Carries much till, especially at west end of island, many large boulders on north fluke.

Till is much more abundant in the Harbor Hill Drift as a whole than in the earlier Ronkonkoma Drift. This is especially true in the region west of the point where the Harbor Hill Drift crosses the Ronkonkoma Drift. From this point stratified materials rapidly decrease in amount, and till becomes more conspicuous, and from Jamaica westward nothing but till is seen in most of the exposures, even where these are 25 to 30 feet or more in depth. The moraine in this part of the island is, in fact, composed practically of till, consisting largely of Triassic material brought from the northwest across Hudson River. Boulders abound in this region.

See the Map Unit Description 'PEmf - Manhasset Formation' to read a list of characteristics for this unit.

The patterns of the glacial deposits are printed over the colors representing the Manhasset and Mannetto Formations, the extent of which under cover is thus shown.
(*GRI Source Map ID 3072,* Historical Geology of Long Island)

PEhmg - Harbor Hill Drift, Mannetto Gravel (Pleistocene series, Wisconsin stage)

Carries much till, especially at west end of island, many large boulders on north fluke.

Till is much more abundant in the Harbor Hill Drift as a whole than in the earlier Ronkonkoma Drift. This is especially true in the region west of the point where the Harbor Hill Drift crosses the Ronkonkoma Drift. From this point stratified materials rapidly decrease in amount, and till becomes more conspicuous, and from Jamaica westward nothing but till is seen in most of the exposures, even where these are 25 to 30 feet or more in depth. The moraine in this part of the island is, in fact, composed practically of till, consisting largely of Triassic material brought from the northwest across Hudson River. Boulders abound in this region.

See the Map Unit Description 'PEhmg - Mannetto Gravel' to read a list of characteristics for this unit.

The patterns of the glacial deposits are printed over the colors representing the Manhasset and Mannetto Formations, the extent of which under cover is thus shown.
(*GRI Source Map ID 3072,* Historical Geology of Long Island)

PEhmo - Outwash from ice along Harbor Hill Drift (Pleistocene series, Wisconsin stage)

Sloping sandy plains, the deposits generally of no great thickness, lying on the Manhassett Formation, which shows through here and there.

The deposition of the Harbor Hill ridge*, like that of the earlier moraine, was accompanied by the formation of a more or less extensive outwash deposit. In composition this deposit shows no material difference from the outwash from the ice along the earlier (Ronkonkoma) moraine** already described (p. 166 of the full report), varying in the same manner from point to point according to the nature of the materials over which the ice passed. The sources of the materials of the two outwash deposits are practically identical, and so far as can be seen, the mode of deposition and character of the bedding

(flow and plunge structure, etc.) are likewise the same. The brownish sandy or pebbly loam and clayey sand (comparable with the so-called Jamesburg loam of New Jersey), described as locally forming superficial coatings over the outwash from ice along the Ronkonkoma Drift, are likewise present in places on the outwash from ice along the Harbor Hill Drift, the most conspicuous developments being (1) in the easterly of two outwash channels northeast of High Hill, (2) in the region southeast of Elwood and northeast of the Dix Hills, (3) in the district north of Coram, (4) at points between Wardencliffe and Ridge, and (5) in the region south of Manorville. It is also found locally near Jamaica. Like the outwash from ice along the Ronkonkoma Drift, the outwash from ice along the Harbor Hill Drift rests upon the eroded surface of gravels of the Manhasset Formation, and being, as a rule, relatively thin, in many places fails to hide the Manhasset topography, which is made apparent to the eye by the numerous kettle valleys or by elevations rising above the outwash level. The topography of the outwash differs in no essential way from that of outwash along the Ronkonkoma Drift.
(*GRI Source Map ID 3072,* Historical Geology of Long Island)

PEhomf - Thin outwash from ice along Harbor Hill Drift, with outcrops of Manhasset Formation (Pleistocene series, Wisconsin stage)

Very thin deposits, forming sandy plains, underlying Manhasset Formation shows through and in places controls the topography.

See the Map Unit Description 'PEhmo - Outwash from ice along Harbor Hill Drift' to read a list of characteristics for this unit.
(*GRI Source Map ID 3072,* Historical Geology of Long Island)

PEou - Undifferentiated outwash (Pleistocene series, Wisconsin stage)

Includes materials from Ronkonkoma and Harbor Hill Drift, where separation is impracticable.

The outwash is the most extensive of the Wisconsin deposits on Long Island. At first sight, in fact, it appears to cover fully two-thirds of the surface of the island, but closer examination shows that the great plains stretching southward from the morainal ridges are in reality composite surfaces made up of outwash and projecting swells of older materials (Manhasset). Notwithstanding its wide extent, the outwash as a whole is riot normally developed, the :Manhasset Formation even where buried exerting through its kettle valleys and allied features (p. 42 of full report) a considerable influence on the topography. Locally, however, especially near the moraines, several typical forms of outwash plains are represented.

See the Map Unit Description 'PEhmo - Outwash from ice along Harbor Hill Drift' to read a list of characteristics for this unit.
(*GRI Source Map ID 3072,* Historical Geology of Long Island)

PErmf - Ronkonkoma Drift, Manhasset Formation (Pleistocene series, Wisconsin stage)

Prevailingly gravelly or sandy, strong kettle and knob topography.

The Ronkonkoma Drift exhibits marked variations in character in its different parts, ranging from almost pure till to fine sands. In a given area, however, its character is fairly uniform. The till phase is most

largely developed in western Long Island, where certain sections reveal many feet of this material. Even here, however, the till is likely to alternate with gravels, indicating water action. In the western part of the island the gravels are commonly very coarse, with only faint traces of banding, and resemble the tumultuous esker deposits of New England and elsewhere. Finer sands and gravels, some of them distinctly stratified, are present in places.

See the Map Unit Description 'PEmf - Manhasset Formation' to read a list of characteristics for this unit.

The patterns of the glacial deposits are printed over the colors representing the Manhasset and Mannetto Formations, the extent of which under cover is thus shown.
(*GRI Source Map ID 3072,* Historical Geology of Long Island)

PErmfm - Ronkonkoma Drift, Montauk Till Member of Manhasset Formation (Pleistocene series, Wisconsin stage)

Prevailingly gravelly or sandy, strong kettle and knob topography.

The Ronkonkoma Drift exhibits marked variations in character in its different parts, ranging from almost pure till to fine sands. In a given area, however, its character is fairly uniform. The till phase is most largely developed in western Long Island, where certain sections reveal many feet of this material. Even here, however, the till is likely to alternate with gravels, indicating water action. In the western part of the island the gravels are commonly very coarse, with only faint traces of banding, and resemble the tumultuous esker deposits of New England and elsewhere. Finer sands and gravels, some of them distinctly stratified, are present in places.

See the Map Unit Description 'PEmfm - Montauk Till Member of Manhasset Formation' to read a list of characteristics for this unit.

The patterns of the glacial deposits are printed over the colors representing the Manhasset and Mannetto Formations, the extent of which under cover is thus shown.
(*GRI Source Map ID 3072,* Historical Geology of Long Island)

PErmg - Ronkonkoma Drift, Mannetto Gravel (Pleistocene series, Wisconsin stage)

Prevailingly gravelly or sandy, strong kettle and knob topography.

The Ronkonkoma Drift exhibits marked variations in character in its different parts, ranging from almost pure till to fine sands. In a given area, however, its character is fairly uniform. The till phase is most largely developed in western Long Island, where certain sections reveal many feet of this material. Even here, however, the till is likely to alternate with gravels, indicating water action. In the western part of the island the gravels are commonly very coarse, with only faint traces of banding, and resemble the tumultuous esker deposits of New England and elsewhere. Finer sands and gravels, some of them distinctly stratified, are present in places.

See the Map Unit Description 'PEmg - Mannetto Gravel' to read a list of characteristics for this unit.

The patterns of the glacial deposits are printed over the colors representing the Manhasset and Mannetto Formations, the extent of which under cover is thus shown.
(*GRI Source Map ID 3072,* Historical Geology of Long Island)

PErmo - Outwash from ice along Ronkonkoma Drift (Pleistocene series, Wisconsin stage)

Sloping sand plains, the deposit lying on Manhasset Formation, which show through in places.

The material of the outwash plain ranges from the moderately coarse gravel with pebbles as much as' 2 inches in diameter found along the margin of the moraine to fine sand at the south shore. The relative percentage of quartz and granite pebbles varies greatly, all gradations being found from a pure quartz gravel not much different from portions of the Cretaceous and Mannetto, except that the staining is less conspicuous, to granitic gravels in which quartz pebbles form a very small part. In general, as in the older formations, the amount of quartz varies with the proximity to Cretaceous or Mannetto masses. West of the Dix Hills the percentage of quartz is especially high and in some places a granitic pebble can be found only with difficulty.

Because of the flatness of the deposits sections are extremely rare, but from the few shallow excavations it appears that all gradations from nearly horizontal stratification to a highly complicated flow and plunge structure exist. The materials are in few places weathered or stained and are not known to be cemented either by iron oxide or otherwise, even locally. Certain parts of the outwash plain have a thin superficial coating of dark-brownish loam, consisting in some places largely of sand, but in others of pebbles intermixed with a certain amount of finer silt. It is this finer material, which is oxidized, that gives the color to the deposits. The depth is in some places only a few inches and was nowhere seen to exceed 1½ feet. No trace of lamination was noted in the deposits seen by the writer. The contact with the underlying material is usually sharp, and the material has the aspect of being a separate formation, apparently not greatly different from the so-called "Jamesburg loam" of New Jersey. The material is well developed in the Hempstead Plains and is seen near the moraine at points north of East Moriches and southeast of Sag Harbor.
(*GRI Source Map ID 3072,* Historical Geology of Long Island)

PEromf - Thin outwash from ice along Ronkonkoma Drift, with outcrops of Manhasset Formation (Pleistocene series, Wisconsin stage)

Very thin deposits, forming sandy plains, the underlying Manhasset Formation shows through in places controls the topography.

See the Map Unit Description 'PErmo - Outwash from ice along Ronkonkoma Drift' to read a list of characteristics for this unit.
(*GRI Source Map ID 3072,* Historical Geology of Long Island)

PEmf - Manhasset Formation (Pleistocene series)

Includes the Herod Gravel, Montauk Till, and Hempstead Gravel Members (listed in ascending order)

Hempstead Gravel Member (youngest)
The Hempstead Gravel Member is very similar to the Herod Gravel Member, showing the same variations in different parts of the island. In fact, there is nothing in its lithologic character by which it can be distinguished from the Herod Gravel Member and the description of the Herod given on page 121 (of the source report) applies almost equally well to the Hempstead. If there is any difference it is in the more

sandy character of the 'younger member. Because of their resemblance the beds can not be differentiated from one another except where they are associated with key beds, such as the Gardiners Clay, the Jacob Sand, or the Montauk Till Member of the Manhasset Formation.

Montauk Till Member (middle)
See the Map Unit Description 'PEmfm - Montauk Till Member of Manhasset Formation' to read a list of characteristics for this unit.

In the Riverhead district and farther east the till is much more clayey, clay constituting in some sections, especially on the South Fluke, a large part of the member. Through it, however, are scattered many pebbles and boulders, here largely of Triassic trap and sandstone. On the two flukes the till ranges from the faintly banded clay, sand, and boulder type, like that noted as occurring in the center of the island, to the clay type of the Riverhead district, the latter phase being especially common at the top of the member. Cretaceous fossils are found in the till at Montauk.

Herod Gravel Member (oldest)
The Herod Gravel Member varies greatly from point to point, in some places being prevailingly sandy and in others consisting largely of gravel. The change in character is abrupt in many places, both vertically and horizontally, sand beds giving place to gravel or gravel to sand within a distance of a few yards. In general sand is more likely to prevail near the contact with the underlying Jacob Sand, and gravel is more likely to become abundant as the horizon of the overlying Montauk Till Member is approached. In places beds of sand 10, 20, or even 30 feet thick, containing scarcely a pebble, are to be seen, but in its more normal phases the deposit consists of an alternation of thin layers of sand and gravel, the whole having a gravelly aspect. The pebbles are commonly small, those half an inch to 2 inches in size predominating, but in the upper part of the member they are considerably larger, 3 to 4 and even 6 inch pebbles being common. The character of the pebbles differs greatly in the different parts of the island.
(*GRI Source Map ID 3072,* Historical Geology of Long Island)

PEmfm - Montauk Till Member of Manhasset Formation (Pleistocene series)

Generally banded, cemented, unoxidized till, shown only where separable from other members.

The Montauk Till Member in the western third of the island appears at first sight to consist of coarse, roughly laminated sands, in which many pebbles and boulders are irregularly embedded. A closer examination, however, shows that the spaces between the visible sand grains are practically everywhere filled by a clay or quartz flour. At the west end of the island, west of Hempstead Harbor, the member abounds in boulders and is often spoken of as a boulder bed. The pebbles and boulders consist mainly of biotitic granite or gneiss and although many are much weathered they show signs of glaciation. Quartz pebbles, which are very common in the gravel beds above and below it, are scarce in the Montauk Till Member. Near the center of the island the boulders form a less conspicuous part of the member, which here consists mainly of faintly laminated sands with an irregular sprinkling of pebbles and of boulders 3 to 6 inches in diameter. The amount of clay present averages more than farther west, especially near the top of the member, where a pebbly clay is not uncommon. Boulders, though not conspicuous in the exposed sections, are nevertheless present in considerable numbers, being thickly strewn along the beaches and over the floors of the erosion amphitheaters. Most of the pebbles and boulders consist of acidic types of granites and gneisses.
(*GRI Source Map ID 3072,* Historical Geology of Long Island)

PEjg - Jacob Sand and Gardiners Clay (Pleistocene series)

Former: fine grayish clayey sands, etc. latter: stiff brown, gray, red, black plastic clay.

Jacob Sand
In its most characteristic form the Jacob sand consists of exceedingly fine sands, mainly quartz flour, but with many grains of white mica and some of dark-colored minerals. In color the sands commonly range from a very light gray to yellowish and buff tints, but where laminae of true clay are present they may be stained reddish externally. They are everywhere clearly stratified, although individual beds several feet thick and appearing structureless to the eye are encountered. When wet most of them are somewhat plastic but lack the toughness of true clay; all are decidedly gritty to the teeth and most of them to the touch. Interbedded with the fine varieties of the Jacob deposits are some more distinctly sandy beds, usually buff or yellowish, and several feet thick, in which particles of fairly fresh granitic minerals can be recognized. (extracted from pg 107 of source)

Gardiners Clay
On western Long Island, where the formation reaches its maximum development, the Gardiners Clay consists of irregular dark-colored beds alternating with layers or lenses of sand and fine gravel and attaining near Brooklyn an aggregate thickness of 150 feet. In this region the clays, unlike those in the localities farther east, grade downward through glauconitic and locally fossiliferous sand into the Jameco gravel, representing in fact transitional deposits. The clays themselves consist of a very fine silt, dark from the contained organic matter and carrying more or less lignitized wood. The included sandy layers are . commonly from 5 to 10 feet thick and at some places have yielded fossil remains. Some of them are thought to represent the from the adjacent land and others to be channel or shoreline deposits. The lignite fragments that they yield are rounded as if waterworn.

Toward the east the clays gradually lose their dark lignitic color, bluish tints taking its place, but, if well records are to be relied upon, they are still fossiliferous. Near the east end of the island the bluish tint is replaced by reds and greens, although black clay is to be seen locally on Gardiners Island. The red color is commonly of a brownish tinge and appears to be due to the presence of material derived from the Triassic area of Connecticut, indicating the
probable existence of Connecticut River in its present position. In some places a more intense red, similar to the color of the bright Mauch Chunk shale of eastern Pennsylvania, is to be seen. The amount of red material often appears to be in excess of what is actually present because of small quantities that have been washed down and form a coating over other deposits. In this region the formation is not a lithologic unit but consists of several alternating beds of clay and sand each from 5 to 10 feet or more in thickness. Probably the best illustration of this characteristic is afforded by the section figured by Mather in his report on the first geological district of New York. Mather's illustration is reproduced here as figure 61 (in the source report). Similar complexity is shown by many Gardiners Island sections. One of the features of this phase of the Gardiners Clay is the lack of persistence of the individual beds. A clay bed 10 feet in thickness may, for instance, disappear within a space of a few hundred feet, whereas in other sections, as in most of the exposures on the Massachusetts coast and islands, the formation is clayey throughout.

On Montauk Point the clay maintains a reddish tinge, although the color is nearer to chocolate than to the bright red of Gardiners Island, and is more likely to be interlaminated with fine sand. In fact, the material is intermediate between the deposits of Gardiners Island and those of Port Washington. On Plum and Fishers islands the clay is similar to that at Montauk, but on Block Island and Marthas Vineyard and at Truro it is blue-gray to nearly black. (extracted from pg 93-94 of source)
(*GRI Source Map ID 3072,* Historical Geology of Long Island)

PEmg - Mannetto Gravel (Pleistocene series)

Stained quartz gravel with rotten granite pebbles and boulders.

The Mannetto Gravel, as is indicated .in the table on page 21 (of source report), is the earliest of the Pleistocene deposits. It consists of stratified and in places cross-bedded gravels composed mainly of well-rounded pebbles of quartz from half an inch to an inch in diameter mixed with coarse yellowish quartz sand, but carrying everywhere a few deeply weathered granitic pebbles and scattered large boulders of crystalline rock, also deeply weathered or disintegrated. It includes a few thin intercalated beds of yellowish clay. The granitic fragments can usually be crushed by the fingers or by a slight blow of a hammer, and even the quartz is far more friable than fresh fragments. The quartzose and stained character of the gravels, the deep weathering of the pebbles, and the complex flow and plunge structure are the distinguishing feature's of the formation. (extracted from pg 80 of source report)
(*GRI Source Map ID 3072,* Historical Geology of Long Island)

Kcs - Clays and sands of many colors (Cretaceous)

The Cretaceous deposits of Long Island differ extremely in composition within short distances. One well may show several hundred feet of clay and an adjoining well may show an equal amount of sand. Nevertheless there appears to be a certain general sequence, which is shown in the columnar section forming figure 55.
(*GRI Source Map ID 3072,* Historical Geology of Long Island)

Historical Geology of Long Island

Fuller, M.L., 1914, Geology of Long Island, New York, U.S. Geological Survey, Professional Paper 82, 1:125,000 scale (*GRI Source Map ID 3072*).

Pleistocene Events Table

Stage.	Substage.	Character.	Represented by—	Thickness.	Probable time equivalents in Mississippi and Ohio valleys, etc.
Wisconsin.	Harbor Hill.	Glacial.	Harbor Hill or inner moraine, and associated till and outwash.	*Feet.*	Early Wisconsin.
	Ronkonkoma.	Glacial.	Ronkonkoma or outer moraine, and associated till and outwash.		
Vineyard.		Interglacial.	Great erosion unconformity, and Vineyard formation, consisting of marine deposits and peat.		Sangamon (?), Iowan (?), and Peorian (?).
Manhasset.	Hempstead.	Glacial.	Manhasset formation. Hempstead gravel member.	50–75	Illinoian.
			Ice erosion unconformity.		
	Montauk.		Montauk till member: 1. Till. 2. Gravel. 3. Till.	0–60+	
			Ice erosion unconformity.		
	Herod.		Herod gravel member.	50–75	
Jacob.		Transitional.	Jacob sand.		
Gardiners.		Interglacial.	Gardiners clay.		Yarmouth.
Jameco.		Glacial.	Jameco gravel.		Kansan.
Post-Mannetto.		Interglacial.	Great erosion unconformity.		Aftonian.
Mannetto.		Glacial.	Mannetto gravel.		Pre-Kansan.

Extracted from page 21 of GRI Source Map ID 3072, Historical Geology of Long Island

Cretaceous Columnar Section

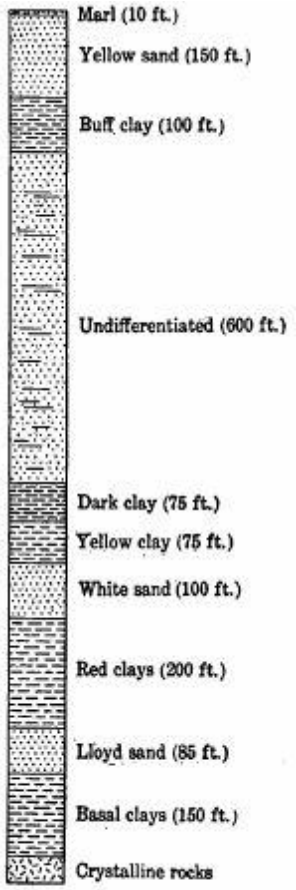
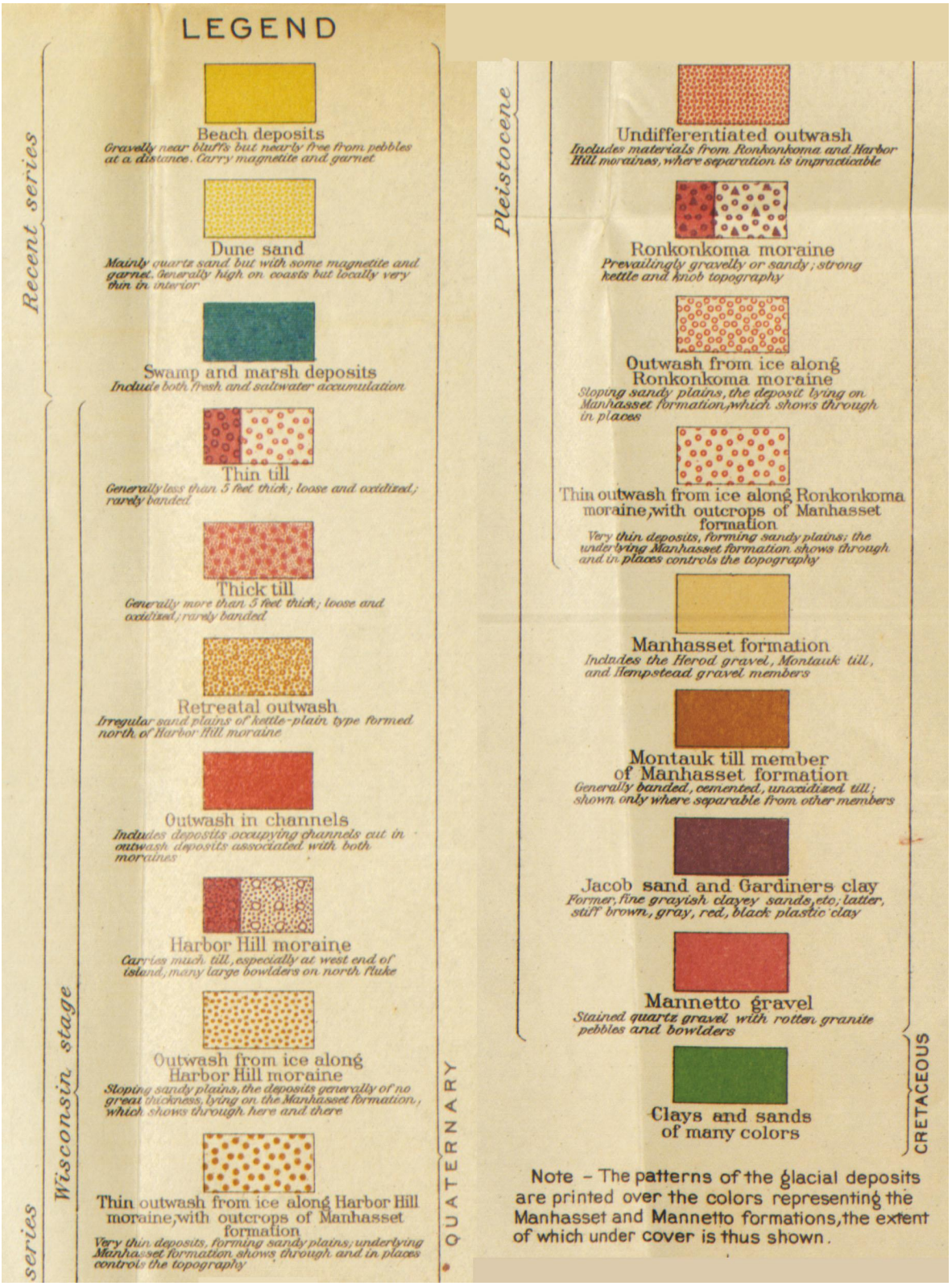


FIGURE 55.—Columnar section of the Cretaceous formations of Long Island.

Extracted from page 67 GRI Source Map ID 3072, Historical Geology of Long Island

Map Legend



Extracted from (*GRI Source Map ID 3072,* Historical Geology of Long Island)

Report

A scanned copy of the Geology of Long Island report by Fuller, 1914 is embedded with this pdf document. Please see this report for additional information pertaining to the geologic map and geology of Long Island.

Geology of Long Island Report ***double-click file link to open document*

(*GRI Source Map ID 3072,* Historical Geology of Long Island)

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This document was developed and completed by Andrea Croskrey (NPS GRD) for the NPS Geologic Resources Division (GRD) Geologic Resources Inventory(GRI) Program. Quality control of this document by Stephanie O'Meara (Colorado State University)

The information in this document was compiled from the source map, and is intended to accompany the digital geologic-GIS map and other digital data for Fire Island National Seashore, New York (FIIS) developed by Andrea Croskrey and Rachel Yoder (Colorado State University) from the source map (see the Historical Geology of Long Island section of this document for the source used by the GRI in the completion of this document and related GRI digital geologic-GIS map).

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