DEPARTMENT OF ENVIRONMENTAL PROTECTION GEOLOGIC MAP OF THE ADELPHIA AND FARMINGDALE QUADRANGLES DEPARTMENT OF THE INTERIOR DIVISION OF WATER RESOURCES MONMOUTH AND OCEAN COUNTIES, NEW JERSEY NEW JERSEY GEOLOGICAL SURVEY **GEOLOGIC MAP SERIES 91-1** UNITED STATES GEOLOGICAL SURVEY EXPLANATION OF MAP UNITS LITHOLOGY THICKNESS (FT) Pattern indicates formation concealed by surficial deposits at least 5 feet thick. Alluvium, colluvium and slope wash. Recent alluvial deposits occur in present-day stream channels and adjacent lowlands. Older alluvium occurs in terraces adjacent to stream channels and consists predominantly of quartz sand and gravel, with lesser amounts of glauconite sand. Peat deposits 2 to 3 feet thick occur in the Manasquan River valley and its tributaries, and along Mingamahone Brook. Radiocarbon dating of peat at a tributary of the Manasquan River near West Freehold yielded an approximate age of 9,000 years (Holocene). A younger age of approximately 2,600 years was determined from peat collected along Mingamahone Brook just north of Hurley Pond Road. **DEPOSITS** Colluvium and slope wash primarily border valleys and are generally derived from mass wasting of the Cohansey Formation and, to a lesser extent, the Kirkwood Formation. They Cohansey Formation consist predominantly of quartz sand and gravel, with lesser amounts of glauconite sand. UNCONFORMITY The thickest accumulation of surficial sediment occurs on two hills approximately 1.5 miles north of Georgia. The deposit, a light-reddish-brown sand and gravel, is as much as 30 feet thick. A deeply weathered profile indicates a possible pre-Pleistocene age. The contact of surficial sediments with the underlying formations is commonly marked by a Kirkwood Formation Sand, quartz, light-brown to dark-yellowish-orange and yellowish-gray to light-gray, medium- to very coarse-grained, with occasional pebbles. Cross-bedded (trough and planartabular) in its lower half and planar bedded in upper half. Average thickness of cosets is 0.5 to 2 feet. Contains rare to abundant Ophiomorpha burrows as much as 1 inch in diameter. UNCONFORMITY Dominantly an orthoquartzite with traces of feldspar. As much as 2 percent of the sand fraction consists of detrital heavy minerals, commonly concentrated along bedding planes In these concentrations, ilmenite dominates the opaque minerals; to a lesser extent zircon and sillimanite dominate the nonopaque minerals. Kaolinite dominates the clay-sized The formation is extensively eroded, and numerous outliers are isolated from the main outcrop belt. Exposures are poor except in excavations because of the loose sandy nature of the formation. However, the upper beds of the Cohansey commonly are cemented by iron oxides. Blocks of cemented ironstone 2 to 4 feet thick locally litter the surface of the Shark River Formation UNCONFORMITY The basal contact of the formation is placed at the unconformity between cross-bedded, medium-to-coarse sand of the Cohansey and massive, fine-grained micaceous sand of the Kirkwood Formation. The contact is well exposed at Carmerville and in small pits near Charleston Springs. A thin veneer of gravel commonly caps the Cohansey and is interpreted to be a lag gravel (partly colluvial) derived from the erosion and reworking of the formation. No datable material has been recovered from the Cohansey in these quadrangles. Cores taken near Mays Landing, New Jersey (Owens and others, 1989) show Cohansey and Kirkwood palynomorphs very similar to those reported by Rachele (1976) and Greller and Rachele (1983) and indicate that the two formations are close in age. As the upper part Manasquan Formation of the Kirkwood here is middle Miocene (Langhian), the Cohansey is also middle Miocene, most likely Serravallian. UNCONFORMITY Sand, typically light-colored, overlying dark-gray or brown clay-silt. The upper quartzose sand is predominantly massive, light-yellow, fine-grained, micaceous, generally burrowed, and has extensive iron oxide (Liesegang) banding. At the J&E Sand and Gravel Pit, one mile east of Fort Plains, the upper sand is as much as 32 feet thick. Locally, as at the Vincentown Formation Vogel pit in Howell, the uppermost 8 to 15 feet of the formation consists of thin interbeds of fine sand and dark-gray clay. The lowermost 30 to 40 feet of the Kirkwood, termed the Asbury Clay (Ries and others, 1904), is a dark, peaty, laminated clay-silt with lenses of massive to locally cross-bedded fine sand. Finely dispersed clay minerals include UNCONFORMITY kaolinite, illite, and illite/smectite. Sand consists mostly of quartz, with small amounts of feldspar and mica (mostly muscovite). Detrital heavy minerals are dominated by the opaques, especially ilmenite, with lesser amounts of nonopaques including zircon, staurolite, garnet, rutile, and tourmaline. Pyrite is common in the dark, clayey, organic-rich beds. reworked section at the base of the Kirkwood, typically 2 to 3 feet thick, is best developed in the northwest corner of the Farmingdale quadrangle. It consists of coarse glauconitequartz sand, with granules and occasional shark teeth. This basal bed rests unconformably upon the Vincentown, Manasquan, and Shark River Formations. The Kirkwood generally underlies broad gentle slopes and hilltops. The formation is well exposed along the Manasquan River. Numerous springs at the contact of the upper sand Hornerstown Formation and lower clay-silt feed headwaters of tributaries. UNCONFORMITY While no datable material has been recovered from the Kirkwood Formation in the Adelphia or Farmingdale quadrangles, the formation is known to be early Miocene to early Middle Miocene in age (Andrews, 1987). Woolman (1895) reported the diatom Actinoptychus heliopelta from the Kirkwood in a well at Asbury Park. This places the Kirkwood here, and probably in the Adelphia and Farmingdale quadrangles as well, within the East Coast Diatom Zone 1 (Abbott, 1978) of Burdigalian (late early Miocene) age. UNCONFORMITY Clay-silt, calcareous (where unweathered), grayish-olive-green to olive-gray, pale-olive, and moderate-olive-brown; massive to thick-bedded and extensively burrowed. Grades upward into a very fine quartz sand. Calcareous microfossils are abundant in the lower half of the formation; small, broken mollusk shells are present in the upper half. Glauconite, botryoidal, fine to medium, as much as 10 percent in some intervals, is disseminated in dominantly clay-silt matrix. However, in the NJGS Allaire State Park core hole, the lower Red Bank Formation 10 feet is a burrowed, massive, dark-gray glauconite sand. Clay minerals include illite, illite/smectite, kaolinite, and minor amounts of clinoptilolite. Krs Shrewsbury Member Krsh Sandy Hook Member The Shark River Formation crops out along the Manasquan River valley unconformably below the Kirkwood Formation. Here the Shark River is divisible into two facies: a lower grayish-olive glauconite sand, and an upper light-olive-gray clay-silt. At its type section along the Manasquan River, 1.1 miles northwest of Squankum, the formation consists of coarse to very coarse glauconite sand in a clay-silt matrix. Layers 1 to 2 feet thick are cemented with iron oxide and contain casts and molds of Venicardia antiquata. The contact with the underlying Manasquan Formation is unconformable and is placed at the boundary of the lower glauconite sand and pale-olive clay-silt of the Manasquan. It is marked by a sharp positive gamma-ray response on geophysical logs. Navesink Formation Calacreous nannofossils in split-spoon samples from the Bog Creek Farm well and core samples from NJGS Allaire State Park indicate the Shark River is middle Eccene UNCONFORMITY Clay-silt, dusky-yellow-green to pale-olive and grayish-green, extensively burrowed, massive to thick-bedded, calcareous (where unweathered), grading into very fine quartz sand. Mount Laurel Formation Cross-bedded laminae of very fine sand occasionally present. Fine glauconite sand is commonly dispersed throughout the dominantly clayey matrix. Clay minerals in outcrop and subsurface include illite, illite/smectite, and minor clinoptilolite. The outcropping Manasquan Formation is best seen in the Manasquan River valley and its tributaries. Clark (1894) defined the formation as the two lower members of the Upper Marl Bed of Cook (1868): the green marl composed of quartz-glauconite sand and the overlying ash-marl (a clay-silt to very fine sand facies). Enright (1969) renamed the green marl the Farmingdale Member and called the ash-marl the Deal Member. This practice is not followed in this map because these members are not continuous throughout the outcrop. In the NJGS Allaire State Park core hole, 2 to 3 miles downdip from the outcrop, the predominant ash-marl or clay-silt facies is 65 feet thick, whereas the lower glauconite Wenonah Formation sand, or Farmingdale Member equivalent, is 10 feet thick. The contact with the underlying Vincentown Formation is not exposed; in cores it is unconformable and is marked by Calcareous nannofossils in core samples from NJGS Allaire State Park and Bog Creek Farm indicate that the Manasquan is early Eocene (nannozones NP 10-13). Sand, light- to moderate-olive-brown and dark-reddish-brown where weathered; various shades of grayish-olive and dusky-yellow-green to greenish, dark-greenish, and oliveoutcrop only), and decreases to 2 to 3 percent at the top of the unit (in outcrop only). Silty sand at the base; sand coarsens upward from fine-to-medium at base to medium-tocoarse with granules in the upper section. Fossils are numerous and include bryozoan, pelecypod, and echinoid fragments and microfossils. Cemented at outcrop or upper surface with iron oxides, and recemented in places with calcium carbonate. Pyrite nodules, phosphate pebbles, and mica occur locally. Clay-size minerals in the matrix include illite, illite/ UNCONFORMITY WILDLIFE olive-green, massive, micaceous, burrowed clay-silt with thin beds of very fine quartz and glauconite sand. Calcareous fossils are absent. The basal 20 feet of the formation at MANAGEMENTAREA The basal contact with the underlying Hornerstown Formation is not well exposed in outcrop. At a quarry 2 miles southwest of Manalapan (Roosevelt quadrangle), the contact is burrowed, with quartz sand from the Vincentown projecting downward for several inches into the underlying Hornerstown. Where it crops out in banks of the Manasquan River and its tributaries, the formation is weathered and weakly consolidated. It is commonly overlain by the Kirkwood Formation, but where the Kirkwood has been completely eroded, the Vincentown is overlain by a thin veneer of Pleistocene sediments. The Vincentown serves as an important local aquifer Calcareous nannofossils from Allaire State Park "C", NJGS Allaire State Park, and the Manasquan Reservoir boring project indicate zones NP 5, 6, and 8 (late Paleocene) in the MAP SYMBOLS Sand, glauconite, clayey, massive-bedded, dusky-yellowish-green to dusky-green and greenish-black where unweathered. Glauconite grains are mainly medium to coarse in size and botryoidal. Contains 1 to 2 percent fine- to very coarse-grained quartz sand, phosphate fragments, pyrite, and lignite. Matrix contains minor glauconite clay. Locally cemented Contact: dashed where approximately located; dotted where concealed. Triangle by iron oxides and siderite. Weathers to brownish-orange clay from iron-oxide staining. Good exposures occur in the Manasquan River valley and its northern tributaries. Drill holes indicates exposed contact. in the area indicate that it does not thicken in the subsurface. At Allaire State Park the Hornerstown is only 15 feet thick (see cross section). Auger hole: number above indicates thickness of surficial deposits (ft); number Calcareous nannofossils from the Allaire State Park "C" well indicate that the Hornerstown falls within zones NP 3 and NP 4, of early Paleocene (early Danian) age. below indicates depth to base of pre-Quaternary formation (ft). Sand, quartz, glauconite, and feldspar; clayey, massive, cemented by siderite. Outcrops are deeply weathered to moderate-brown, moderate-yellowish-brown, dusky-yellow-green to dusky-green, and light-olive-gray to light-olive. Sand is poorly sorted, fine to very coarse, with occasional pebbles. Occasional lenses of siderite as much as 1 foot thick are Test boring or well common, as are ovoid phosphate pellets and vivianite. Glauconite is mainly botryoidal, with accordian-shaped grains also present, and makes up more than 50 percent of the sand in some beds. Clay-sized minerals include kaoilinite, illite/smectite, and siderite. Weathered Tinton crops out at numerous places along the northern tributaries of the Manasquan River. Casts of the bivalve Agerostrea falcata are common here. The thickness of the Tinton along its outcrop belt in the Adelphia quadrangle ranges from about 10 feet in the northwest corner to about 35 feet in the northeast corner. At a quarry 2 miles east of Carrs Corner, in the Roosevelt quadrangle, the Tinton is 8 feet thick and is a massive, burrowed glauconitic quartz sand. TABLE 1: Geologic test boring or well In the subsurface, the Tinton appears to pinch out. The Tinton is 35 feet thick in a cored well one mile north of Jerseyville. In the Farmingdale Borough and the Allaire State Park "C" wells, the Tinton is absent. It was presumably beveled off during the marine transgression which deposited the Hornerstown in the early Paleocene. The Tinton is Late Cretaceous (late Maestrichtian) based on its macrofossils Sphenodiscus lobatus and Scabrotrigonia cerulia and its stratigraphic position above the Red Bank The Red Bank is Late Cretaceous (late Maestrichtian) in age, based on the occurrence of the nannofossil Nephrolithus frequens in core samples from a well in Freehold, 0.3 mile north of the Farmingdale quadrangle (Page Valentine, U. S. Manalapan Reservoir Project-B5 Geological Survey, oral communication, 1987). Shrewsbury Member - Sand, quartz, weathers orange, brown, gray, and pink; Bog Creek Farm-6A at its base. Heavy minerals include zircon, tourmaline, staurolite, andalusite, and USGS Allaire State Park "C" Occupies middle and upper slopes of hills at Manapalan and generally exposed in NJGS Allaire State Park core hole roadcuts. Extensively oxidized in outcrop with ledges of iron-oxide-cemented in upper part. Pinches out in the subsurface. Jackson Township MUA 9-7 Navesink-Red Bank Formation (undivided) - Sand, glauconite, slightly quartzose, Sandy Hook Member - Sand, quartz, dark-gray where fresh, light-olive to olive-gray clayey, greenish-black, unconformably above the Mount Laurel Formation and where weathered, massive-bedded, silty, micaceous and fossiliferous, with small USGS Freehold core hole amounts of feldspar, lignite, and pyrite. Increasingly glauconitic (to as much as 30 In outcrop the Navesink Formation and the Red Bank Formation form an unconpercent) and clayey towards its base. Common clay-sized minerals include kaolinite, ¹New Jersey Division of Water Resources water well drilling permit illite/smectite, and quartz. formity-bounded coarsening-upward sedimentary sequence consisting of a basal lauconite sand, a middle silt, and an upper quartz sand. Downdip, the Shrewsbury Outcrops are scarce and largely covered by extensive colluvium from the overlying Member of the Red Bank Formation pinches out, and the Sandy Hook Member Shrewsbury Member. The Sandy Hook is transitional and conformable with the changes facies to become lithologically indistinguishable from the underlying overlying Shrewsbury and underlying Navesink. In the subsurface, the Sandy Hook Member becomes increasingly glauconitic downdip until it is lithologically indistinguishable from the underlying Navesink Formation. REFERENCES Sand, glauconite, massive-bedded, dark-greenish-gray where unweathered, shades of gray and brown where weathered; clay-silt (as much as 30 percent), with pyrite, Abbott, W. H., 1978, Correlation and zonation of Miocene strata along the Atlantic margin of North America some mica, and occasional quartz. Glauconite is botryoidal and medium- to coarseusing diatoms and silicoflagellates: Marine Micropaleontology, v. 3, p. 15-34. Andrews, G. W., 1987, Miocene marine diatoms from the Kirkwood Formation, Atlantic County, New Crops out along stream valleys and adjacent lowlands. Exposures are scarce. Jersey: U. S. Geological Survey Bulletin 1769, 14 p. shell fragments and quartz granules (Minard, 1969). Clark, W. B., 1894, Origin and classification of the greensands of New Jersey: Journal of Geology, v. 2, The Navesink is Late Cretaceous (middle or late Maestrichtian) in age, based on the presence of Globotruncana gansseri (Owens and others, 1977, fig. 6). , 1898, Report upon the Upper Cretaceous formations: New Jersey Geological Survey Annual Sand, quartz, fine- to coarse-grained, glauconitic (2 to 5 percent), extensively burrowed, slightly micaceous and feldspathic, often interbedded with thin layers of dark clay and silt. Olive-gray to dark-greenish-gray where unweathered. Interfingers with and conformably overlies the Wenonah Formation throughout the northern New Jersey Coastal Plain **FORMATION** Cook, G. H., 1868, Geology of New Jersey: New Jersey Geological Survey, New Brunswick, 900 p. thin beds of clay and sand in the Mount Laurel (Minard, 1969). Persists as a well-defined sand unit as far downdip as Allaire State Park "C" well. Enright, Richard, 1969, The stratigraphy and clay mineralogy of Eocene sediments of the northern New Base map from U.S. Geological Survey Geology mapped 1985-1988 The Mount Laurel is assignable to the Exogyra cancellata macrofossil zone (Owens and others, 1977) and the Rugotruncana subcircumnodifer foraminiferal zone (Petters, 1976). Jersey Coastal Plain, in Subitzky, Seymour, ed., Geology of selected areas in New Jersey and Adelphia, 1957, Photorevised 1981 Drilling by M. McCullough Both zones are Upper Cretaceous (early Maestrichtian). eastern Pennsylvania and guidebook of excursions: New Brunswick, Rutgers University Press, p. Reviewed by R. Benson, N. Sohl, and J. Wyckoff Contours as of 1947, Contour Interval 10 feet Farmingdale, 1989 Cartography by D. Anderson, M. Fiorentino, Goddard, E. N., and others, 1948, Rock-color chart: Washington Research Council (republished by Sand, quartz, thick- to massive-bedded, dark gray where unweathered, very fine- to fine-grained, silty, very micaceous (muscovite and chlorite), glauconitic (5 to 20 percent), and Greller, A. M., and Rachele, L. D., 1983, Climatic limits of exotic genera in the Legler palynoflora, Miocene, ²United States Geological Survey New Jersey, U.S.A.: Review of paleobotany and palynology, v. 40, p. 149-163. Petters (1976) assigned the Wenonah, together with the Mount Laurel, to the Rugotruncana subcircumnodifer zone (early Maestrichtian) on the basis of fossils from the Mount Laurel. No fossils were collected from the Wenonah however, and its age is therefore uncertain. Minard, J. P., 1969, Geology of the Sandy Hook quadrangle in Monmouth County, New Jersey: U. S. Geological Survey Bulletin 1276, 43 p. NATIONAL GEODETIC VERTICAL DATUM OF 1929 QUADRANGLE LOCATION Olsson, R. K., 1964, Late Cretaceous planktonic foraminifera from New Jersey and Delaware: Sand, quartz and glauconite, greenish-black, massive-bedded, extensively burrowed, fine-grained, silty, and slightly micaceous. Glauconite is primarily botryoidal and comprises Micropaleontology, v. 10, p. 157-188. 20 to 60 percent of the sand. Unconformably overlies the Englishtown Formation. The contact is extensively burrowed; wood and locally coarse sand from the Englishtown are Owens, J. P., Bybell, L. M., Paulachok, Gary, Ager, T. A., Gonzales, V. M., and Sugarman, P. J., 1989, The Marshalltown has been assigned to the Globotruncana calcarata zone of late Campanian age on the basis of its foraminifera (Olsson, 1964). No fauna was found in the Marshalltown in the Adelphia and Farmingdale quadrangles, however. New Jersey Coastal Plain: U. S. Geological Survey Professional Paper 1484, 39 p. **ENGLISHTOWN FORMATION** Owens, J. P., and Sohl, N. F., 1969, Shelf and deltaic paleoenvironments in the Cretaceous-Tertiary formations of the New Jersey Coastal Plain, in Subitzky, Seymour, ed., Geology of selected areas GEOLOGIC MAP OF THE ADELPHIA AND FARMINGDALE QUADRANGLES, in New Jersey and eastern Pennsylvania and guidebook of excursions: New Brunswick, Rutgers Sand, quartz, feldspathic, micaceous and lignitic, fine-to medium-grained, medium-to dark-gray, interstratified with dark-gray and brown, richly carbonaceous, clayey silt. Typically MONMOUTH AND OCEAN COUNTIES, NEW JERSEY Owens, J. P., Sohl, N. F., and Minard, J. P., 1977, A field guide to Cretaceous and lower Tertiary beds cross-bedded. Pyrite occurs as single grains or clusters. Small amounts of glauconite are present. Contact with the underlying Woodbury Formation is gradational. of the Raritan and Salisbury embayments, New Jersey, Delaware, and Maryland: American Association of Petroleum Geologists, 113 p. Wolfe (1976) assigned an early Campanian age to the Englishtown on the basis of a distinctive assemblage of palynomorphs. Petters, S. W., 1976, Upper Cretaceous subsurface stratigraphy of the Atlantic Coastal Plain of New Jersey: Bulletin of the American Association of Petroleum Geologists, v. 60, no. 1, p. 87-107. Peter J. Sugarman, James P. Owens, and Laurel M. Bybell² Rachele, L. D., 1976, Palynology of the Legler lignite: A deposit in the Tertiary Cohansey formation of New Color terms from Goddard and others, 1948 Jersey, U.S.A.: Review of Paleobotany and Palynology, v. 22, p. 225-252. Ries, Heinrich, Kummel, H. B., and Knapp, G. N., 1904, The clays and clay industry of New Jersey: New Jersey Geological Survey Final Report of the State Geologist, v. 6, 548 p. Sand Clay-Silt Glauconite Gravel Mica Peat Unconformity Wolfe, J. A., 1976, Stratigraphic distribution of some pollen types from the Campanian and lower Maestrichtian rocks (Upper Cretaceous) of the Middle Atlantic States: U. S. Geological Survey Professional Paper 977, 18 p., 4 pls. Woolman, Lewis, 1895, Report on artesian wells in southern New Jersey: New Jersey Geological Survey Annual Report of the State Geologist (1895), p. 63-95.

-700 VERTICAL EXAGGERATION X10. Cross section is generalized and based on geologic mapping and gamma-ray logs from Jackson Township MUA 9-77 well (40°06'52" N; 74°17'17" W; Lakehurst quadrangle) and well MTS. Cross section extends to the base of the Englishtown Formation. The Woodbury Formation underlies the Englishtown Formation.