EXPLANATION

The topographic map is a useful tool for understanding the physical features of an area. It provides a detailed view of the land surface, including elevation changes, bodies of water, and other geographical elements. Key components of a topographic map include contour lines, a north arrow, and a scale.

Contour lines are used to represent elevation changes on the map. Each contour line represents a specific elevation, typically in feet or meters. The closer the contour lines are to each other, the steeper the slope. Conversely, the farther apart they are, the gentler the slope.

The north arrow, often depicted as a compass rose, indicates the direction of north on the map. This helps maintain a sense of orientation and direction when interpreting the map.

The scale of the map is crucial for converting distances on the map to real-world distances. Map scales can be expressed in various units, such as miles or kilometers, and may be depicted as a ratio or a graphical representation.

Example:

- **Contour Lines:** The contour lines on the map represent the elevation changes across the landscape. By analyzing the spacing and pattern of these lines, one can determine the steepness and direction of the slope.

- **North Arrow:** The north arrow is an essential feature that helps in orienting the map correctly. It is typically shown as an arrow pointing towards the north pole, ensuring that the map is aligned properly.

- **Scale:** The scale of the map provides a direct way to understand the size and dimensions of the area being depicted. It is crucial for calculating actual distances or areas based on measurements taken from the map.

The use of these features in concert allows for a comprehensive understanding of the topography and geographical layout of the area on the map.
DESCRIPTION OF THE NORFOLK QUADRANGLE

By N. H. Darton.

GEOGRAPHY.

General relations.—The Norfolk quadrangle embraces the region lying between the parallels 36° 32' and 37° north latitude and the meridians 80° 30' and 81° west longitude. It measures approximately 55 miles from north to south and 56 miles from east to west, and contains about 1,019 square miles, of which about one-half is ocean and bay and the other half is land with inlets. In Virginia it comprises Norfolk, Princess Anne, and small portions of Nansemond, Warwick, and Elizabeth City counties. In North Carolina it includes the northern margins of Cambria and Caswell counties. The land portion is a low plain extending to the Atlantic Ocean on the east and to Chesapeake Bay and James River on the west. The Chesapeake is deeply invaded by tide water in the channels of James, Nansemond, Elizabeth, Lynnhaven, Nansemond, and North River, and in Back Bay, North Bay, and some minor inlets. Its fresh-water streams are small and reach tide water at no great distance from their sources. This basin extends over the greater portion of the Dismal Swamp with its central body of water, Lake Drummond.

Coastal Plains province.—The eastern portion of the Atlantic slope of the United States extends from the Piedmont Plateau, a region of undulating plains, extending eastward from the Blue Ridge with gradual declivity to the Atlantic coastal plain, and to the east partly coastal, and cropping unconsolodated strata from early Cretaceous to latest Pleistocene in age. The Norfolk quadrangle lies entirely within the Coastal Plain province.

The Coastal Plain extends northeastward as a broad belt between the northern margin of Chesapeake Bay and the present course of the James River. The surface is low and level, except for slight undulations, but it is generally higher than the adjacent coastal plain and range.

Geological formations.—On the extreme east the Coastal Plain extends to the Atlantic Ocean. The surface is low and level, except for slight undulations, but it is generally higher than the adjacent coastal plain and range.

The general relief of the area is characterized by a moderate slope toward the Atlantic Ocean. The highest point is in the center of the quadrangle, near the James River, and the lowest point is on the eastern shore of Chesapeake Bay. The relief is generally less than 100 feet, but in some areas it reaches 200 feet.

The surface is locally dissected by small streams, which flow into the Atlantic Ocean. The drainage systems are generally parallel to the coast, and the streams are alimented by rainfall and groundwater. The streams are usually small and have a gentle gradient. The larger streams, such as the James River, have a more pronounced gradient.

The land is predominantly forested, with a mixture of deciduous and coniferous trees. The dominant tree species are the white oak, the black oak, the chestnut, and the willow. The soils are generally well-drained, with a high pH and a low clay content. The soil profiles are generally shallow, with a high water table, and the drainage is mainly subsurface.

The climate of the area is generally mild, with warm summers and cool winters. The average annual temperature is about 60°F, and the average annual precipitation is about 40 inches. The area is subject to occasional storms, especially during the winter months, when snow and ice are common.

The area is rich in wildlife, with a diverse range of plant and animal species. The coastal plain is home to many species of birds, including the osprey, the bald eagle, and the peregrine falcon. The area is also home to many species of fish, including the striped bass, the channel catfish, and the blue crab.

The area is rich in archaeological sites, with many ancient Indian burial mounds and other artifacts. The area is also home to many historic sites, including the battlefields of the Revolutionary War and the Civil War.

The area is rich in natural resources, with a variety of minerals, including coal, iron ore, and copper. The area is also home to many lakes and streams, which are used for recreation and water supply.

The area is also rich in cultural resources, with many historic sites and landmarks, including the Colonial Williamsburg, the Monticello, and the Mount Vernon.

The area is also rich in economic resources, with a variety of industries, including agriculture, forestry, and manufacturing. The area is also home to many small businesses, which are an important part of the local economy.

The area is also rich in educational resources, with many colleges and universities, including the University of Virginia, the College of William and Mary, and the College of Charleston.

The area is also rich in recreational resources, with many parks, beaches, and trails, which are used for recreation and exercise.

The area is also rich in social resources, with many communities, which are characterized by strong family values and a sense of community.

The area is also rich in political resources, with a variety of political parties and organizations, which are characterized by strong representation and engagement.

The area is also rich in spiritual resources, with many churches and religious organizations, which are characterized by strong spirituality and devotion.

The area is also rich in civic resources, with many civic organizations and groups, which are characterized by strong civic engagement and participation.

The area is also rich in environmental resources, with a variety of ecosystems, including the coastal plain, the Chesapeake Bay, and the Atlantic Ocean, which are characterized by strong biodiversity and ecological diversity.

The area is also rich in economic resources, with a variety of industries, including agriculture, forestry, and manufacturing. The area is also home to many small businesses, which are an important part of the local economy.

The area is also rich in educational resources, with many colleges and universities, including the University of Virginia, the College of William and Mary, and the College of Charleston.

The area is also rich in recreational resources, with many parks, beaches, and trails, which are used for recreation and exercise.

The area is also rich in social resources, with many communities, which are characterized by strong family values and a sense of community.

The area is also rich in political resources, with a variety of political parties and organizations, which are characterized by strong representation and engagement.

The area is also rich in spiritual resources, with many churches and religious organizations, which are characterized by strong spirituality and devotion.

The area is also rich in civic resources, with many civic organizations and groups, which are characterized by strong civic engagement and participation.

The area is also rich in environmental resources, with a variety of ecosystems, including the coastal plain, the Chesapeake Bay, and the Atlantic Ocean, which are characterized by strong biodiversity and ecological diversity.
condition indicates a series of physical changes, beginning with the formation on the terrace level of low dunes of sand, which was followed by the advance of forest growth, and this by the silting of sand which is gradually killing and burying the dunes.

The sand dunes about Cape Henry were described a hundred years ago by B. H. Latrobe (Trans. Am. Philos. Soc., Vol. II, 1819, pp. 430–444, 1 plate; see also Ann. Jour. Sci., Vol. XI, 1865, pp. 281–294). A reconstruction of his description is here determined. The present conditions show how little change there has been in a century. At that time the dunes were apparently considered as a permanent feature, rapidly encroaching on the forests in "The Desert." The sand is blown up the steep front of the dune and much of it is carried down to the gentle western slope far into the forest. The line of sand dunes, it is thought, has caused the imperceptible drainage of the forested area by damping the water which flows down the slight slope of the inland terrace toward the ocean. During the first sixteen years after the establishment of the lighthouse at Cape Henry it was estimated that the dunes had risen about 30 feet in height, and at one definitely marked point, a short distance from the lighthouse, had proceeded into the desert about 350 yards. It was predicted by Mr. Latrobe more than a century ago that if the dunes should continue to advance at this rate for twenty or thirty years they would swallow up the whole estate. This prediction has been followed, and the advance of sand along the coast has been so accelerated by the burning o"f the forests in the interior and by the establishment of the town, that the rate of accumulation has greatly diminished in later years, for the dunes do not appear to have progressed much farther than they were in Mr. Latrobe's time.

GEOLGY.

GENERAL ECONOMICAL KNOWLEDGE.

The geologic deposits of the Norfolk quadrangle are sands, clays, muds, peat, and muck. They are in great part of sedimentary origin, but some of the sands are colluvial, and the clay beds are the result of solution and are augmented by plant growth. The general surface formation is a sheet of sandy loam of great thickness. This is underlain by an extensive series of Coastal Plain deposits lying on a floor of the crystalline rocks which constitute the surface of the Piedmont region to the west, but which slope far below sea level in their extension eastward under the Coastal Plain.

The rocks of the Coastal Plain consist of broad sheets of sands, gravels, clays, diatomaceous earth, marls, and glauconite sands comprising the formations on which the swampy flats and meadows are underlain by deposits of which dip very gently to the southeast. They rise above sea level in regular succession westward and in a similar manner to the present surface. On this formation there is an aggregate thickness of 2,900 feet.

In the Norfolk quadrangle the following formations are known: the Pleistocene, the Pliocene, the Cretaceous, and the Eocene. These are the formations which are present in the Norfolk quadrangle, and extend from the Pleistocene to the Eocene. The wedge of sand and clay between the Pleistocene and the Pliocene is the Coastal Plain, a formation which extends from the Pleistocene to the Eocene. The wedge of sand and clay between the Pliocene and the Cretaceous is the Coastal Plain, a formation which extends from the Pliocene to the Cretaceous. The wedge of sand and clay between the Cretaceous and the Eocene is the Coastal Plain, a formation which extends from the Cretaceous to the Eocene. The wedge of sand and clay between the Eocene and the present surface is the Coastal Plain, a formation which extends from the Eocene to the present surface.

The geology of the Coastal Plain is as follows: the Pleistocene is a formation which extends from the Pleistocene to the Pliocene. The Pliocene is a formation which extends from the Pliocene to the Cretaceous. The Cretaceous is a formation which extends from the Cretaceous to the Eocene. The Eocene is a formation which extends from the Eocene to the present surface.

The wedge of sand and clay between the Pleistocene and the Pliocene is the Coastal Plain, a formation which extends from the Pleistocene to the Pliocene. The wedge of sand and clay between the Pliocene and the Cretaceous is the Coastal Plain, a formation which extends from the Pliocene to the Cretaceous. The wedge of sand and clay between the Cretaceous and the Eocene is the Coastal Plain, a formation which extends from the Cretaceous to the Eocene. The wedge of sand and clay between the Eocene and the present surface is the Coastal Plain, a formation which extends from the Eocene to the present surface.

The geology of the Coastal Plain is as follows: the Pleistocene is a formation which extends from the Pleistocene to the Pliocene. The Pliocene is a formation which extends from the Pliocene to the Cretaceous. The Cretaceous is a formation which extends from the Cretaceous to the Eocene. The Eocene is a formation which extends from the Eocene to the present surface.

The wedge of sand and clay between the Pleistocene and the Pliocene is the Coastal Plain, a formation which extends from the Pleistocene to the Pliocene. The wedge of sand and clay between the Pliocene and the Cretaceous is the Coastal Plain, a formation which extends from the Pliocene to the Cretaceous. The wedge of sand and clay between the Cretaceous and the Eocene is the Coastal Plain, a formation which extends from the Cretaceous to the Eocene. The wedge of sand and clay between the Eocene and the present surface is the Coastal Plain, a formation which extends from the Eocene to the present surface.

The geology of the Coastal Plain is as follows: the Pleistocene is a formation which extends from the Pleistocene to the Pliocene. The Pliocene is a formation which extends from the Pliocene to the Cretaceous. The Cretaceous is a formation which extends from the Cretaceous to the Eocene. The Eocene is a formation which extends from the Eocene to the present surface.

The wedge of sand and clay between the Pleistocene and the Pliocene is the Coastal Plain, a formation which extends from the Pleistocene to the Pliocene. The wedge of sand and clay between the Pliocene and the Cretaceous is the Coastal Plain, a formation which extends from the Pliocene to the Cretaceous. The wedge of sand and clay between the Cretaceous and the Eocene is the Coastal Plain, a formation which extends from the Cretaceous to the Eocene. The wedge of sand and clay between the Eocene and the present surface is the Coastal Plain, a formation which extends from the Eocene to the present surface.

The wedge of sand and clay between the Pleistocene and the Pliocene is the Coastal Plain, a formation which extends from the Pleistocene to the Pliocene. The wedge of sand and clay between the Pliocene and the Cretaceous is the Coastal Plain, a formation which extends from the Pliocene to the Cretaceous. The wedge of sand and clay between the Cretaceous and the Eocene is the Coastal Plain, a formation which extends from the Cretaceous to the Eocene. The wedge of sand and clay between the Eocene and the present surface is the Coastal Plain, a formation which extends from the Eocene to the present surface.

The wedge of sand and clay between the Pleistocene and the Pliocene is the Coastal Plain, a formation which extends from the Pleistocene to the Pliocene. The wedge of sand and clay between the Pliocene and the Cretaceous is the Coastal Plain, a formation which extends from the Pliocene to the Cretaceous. The wedge of sand and clay between the Cretaceous and the Eocene is the Coastal Plain, a formation which extends from the Cretaceous to the Eocene. The wedge of sand and clay between the Eocene and the present surface is the Coastal Plain, a formation which extends from the Eocene to the present surface.

The wedge of sand and clay between the Pleistocene and the Pliocene is the Coastal Plain, a formation which extends from the Pleistocene to the Pliocene. The wedge of sand and clay between the Pliocene and the Cretaceous is the Coastal Plain, a formation which extends from the Pliocene to the Cretaceous. The wedge of sand and clay between the Cretaceous and the Eocene is the Coastal Plain, a formation which extends from the Cretaceous to the Eocene. The wedge of sand and clay between the Eocene and the present surface is the Coastal Plain, a formation which extends from the Eocene to the present surface.

The wedge of sand and clay between the Pleistocene and the Pliocene is the Coastal Plain, a formation which extends from the Pleistocene to the Pliocene. The wedge of sand and clay between the Pliocene and the Cretaceous is the Coastal Plain, a formation which extends from the Pliocene to the Cretaceous. The wedge of sand and clay between the Cretaceous and the Eocene is the Coastal Plain, a formation which extends from the Cretaceous to the Eocene. The wedge of sand and clay between the Eocene and the present surface is the Coastal Plain, a formation which extends from the Eocene to the present surface.

The wedge of sand and clay between the Pleistocene and the Pliocene is the Coastal Plain, a formation which extends from the Pleistocene to the Pliocene. The wedge of sand and clay between the Pliocene and the Cretaceous is the Coastal Plain, a formation which extends from the Pliocene to the Cretaceous. The wedge of sand and clay between the Cretaceous and the Eocene is the Coastal Plain, a formation which extends from the Cretaceous to the Eocene. The wedge of sand and clay between the Eocene and the present surface is the Coastal Plain, a formation which extends from the Eocene to the present surface.

The wedge of sand and clay between the Pleistocene and the Pliocene is the Coastal Plain, a formation which extends from the Pleistocene to the Pliocene. The wedge of sand and clay between the Pliocene and the Cretaceous is the Coastal Plain, a formation which extends from the Pliocene to the Cretaceous. The wedge of sand and clay between the Cretaceous and the Eocene is the Coastal Plain, a formation which extends from the Cretaceous to the Eocene. The wedge of sand and clay between the Eocene and the present surface is the Coastal Plain, a formation which extends from the Eocene to the present surface.

The wedge of sand and clay between the Pleistocene and the Pliocene is the Coastal Plain, a formation which extends from the Pleistocene to the Pliocene. The wedge of sand and clay between the Pliocene and the Cretaceous is the Coastal Plain, a formation which extends from the Pliocene to the Cretaceous. The wedge of sand and clay between the Cretaceous and the Eocene is the Coastal Plain, a formation which extends from the Cretaceous to the Eocene. The wedge of sand and clay between the Eocene and the present surface is the Coastal Plain, a formation which extends from the Eocene to the present surface.

The wedge of sand and clay between the Pleistocene and the Pliocene is the Coastal Plain, a formation which extends from the Pleistocene to the Pliocene. The wedge of sand and clay between the Pliocene and the Cretaceous is the Coastal Plain, a formation which extends from the Pliocene to the Cretaceous. The wedge of sand and clay between the Cretaceous and the Eocene is the Coastal Plain, a formation which extends from the Cretaceous to the Eocene. The wedge of sand and clay between the Eocene and the present surface is the Coastal Plain, a formation which extends from the Eocene to the present surface.

The wedge of sand and clay between the Pleistocene and the Pliocene is the Coastal Plain, a formation which extends from the Pleistocene to the Pliocene. The wedge of sand and clay between the Pliocene and the Cretaceous is the Coastal Plain, a formation which extends from the Pliocene to the Cretaceous. The wedge of sand and clay between the Cretaceous and the Eocene is the Coastal Plain, a formation which extends from the Cretaceous to the Eocene. The wedge of sand and clay between the Eocene and the present surface is the Coastal Plain, a formation which extends from the Eocene to the present surface.

The wedge of sand and clay between the Pleistocene and the Pliocene is the Coastal Plain, a formation which extends from the Pleistocene to the Pliocene. The wedge of sand and clay between the Pliocene and the Cretaceous is the Coastal Plain, a formation which extends from the Pliocene to the Cretaceous. The wedge of sand and clay between the Cretaceous and the Eocene is the Coastal Plain, a formation which extends from the Cretaceous to the Eocene. The wedge of sand and clay between the Eocene and the present surface is the Coastal Plain, a formation which extends from the Eocene to the present surface.
were reported at a depth of 50 feet in the new well. In the old well other distinctive Mississippian shales were obtained at intervals of 50 feet. Between 50 and 100 feet sharks’ teeth were obtained, which were either deposited as pelves in the basa. Chopin was deposited at the PM庞山·fication was found to be thinner at Old Point Comfort than at Norfolk, for which reason the outcrop to the west is over 12 feet thick.

3. NICKONE PERIOD.

Chopin formation (Mississippian).—Underlying the thin mantle of a heterogeneous layer at Norfolk rocks included in the overlying Chocopeake formation, a feature often observed in surface outcrops of the basal beds of that formation. It is to be noted that the Chocopeake formation was found to be at Old Point Comfort and at Norfolk, for which reason the outcrop to the west is over 12 feet thick.

Parsnaback formation. This formation is the most distinctive of the Mississippian formations in the Norfolk region. It is the thickest formation and occurs in the area along the new well. The Mississippian formations in the new well at Fort Monroe are at depths of 50 to 100 feet, the larger number coming from about 50 feet:

<table>
<thead>
<tr>
<th>Formation</th>
<th>Depth (feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mississippian</td>
<td>50-100</td>
</tr>
<tr>
<td>Parsnaback</td>
<td>50-100</td>
</tr>
</tbody>
</table>

The clays are richly diatomaceous between the depths of 500 and 500 feet, and among the fossil forms are those which characterize the great bed of Chocopeake formation. The clays also underlie the coastal plains in New York and Pennsylvania, with the base of this formation at about 300 feet. The Chocopeake formation is the best known of all the formations in the area. It is the most distinctive of the Mississippian formations in the new well at Fort Monroe.

Parsnaback formation. This formation is the most distinctive of the Mississippian formations in the Norfolk region. It is the thickest formation and occurs in the area along the new well. The Mississippian formations in the new well at Fort Monroe are at depths of 50 to 100 feet, the larger number coming from about 50 feet:

<table>
<thead>
<tr>
<th>Formation</th>
<th>Depth (feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mississippian</td>
<td>50-100</td>
</tr>
<tr>
<td>Parsnaback</td>
<td>50-100</td>
</tr>
</tbody>
</table>

The clays are richly diatomaceous between the depths of 500 and 500 feet, and among the fossil forms are those which characterize the great bed of Chocopeake formation. The clays also underlie the coastal plains in New York and Pennsylvania, with the base of this formation at about 300 feet. The Chocopeake formation is the best known of all the formations in the area. It is the most distinctive of the Mississippian formations in the new well at Fort Monroe.

Parsnaback formation. This formation is the most distinctive of the Mississippian formations in the Norfolk region. It is the thickest formation and occurs in the area along the new well. The Mississippian formations in the new well at Fort Monroe are at depths of 50 to 100 feet, the larger number coming from about 50 feet:

<table>
<thead>
<tr>
<th>Formation</th>
<th>Depth (feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mississippian</td>
<td>50-100</td>
</tr>
<tr>
<td>Parsnaback</td>
<td>50-100</td>
</tr>
</tbody>
</table>

The clays are richly diatomaceous between the depths of 500 and 500 feet, and among the fossil forms are those which characterize the great bed of Chocopeake formation. The clays also underlie the coastal plains in New York and Pennsylvania, with the base of this formation at about 300 feet. The Chocopeake formation is the best known of all the formations in the area. It is the most distinctive of the Mississippian formations in the new well at Fort Monroe.
ECONOMIC PRODUCTS.

SOILS.

The soils of the Norfolk quadrangle present considerable diversity in character, varying from pure sandy through sand and loam to even clayey soils. The greater part of the district has a surface covering of Columbia formation, with soil consisting mainly of sandy loam. This is the normal soil of the very fertile truck region which is extensively cultivated about Norfolk. The proportion of the organic content of the soil is not large, but with proper fertilization the soil has the physical condition most favorable to the growth of a number of vegetables and fruits.

The local variations in the soils are great and frequent and the differences are perceived less readily in the soil than in the surface productivity of gardens. In the extreme eastern part of the area the soils are more sandy, owing in part to coarser material than the Columbia formation in that direction and to admixture of blown sand from the beach. The sands on the beach and in the sand dunes are poor in vegetable. The soils of the present swamp areas are often too carbonaceous for immediate use, but in some cases this feature of the soil has been overcome by exposure to the weather after the land has been cleared of trees, drained of water, and ploughed. These soils are usually rich in plant food and prove to be highly productive.

The following are mechanical analyses of typical truck soils made by the Department of Agriculture.

The first three soils are characteristic of the light and sandy soils and are suited to cabbage and squash.

The swamps vary from pure peat to clayey bogs. Two leading varieties are recognized, the "jupiter" or "light" swamp, and the "black gum" or "dark" swamp. The first is nearly pure peat, consisting of a brown mass of vegetable detritus derived from the jupiter or white cedar, which is the characteristic tree of the "light" swamp areas. The thickness of the deposit is often 8 to 10 feet. From 75 to 95 per cent of the material is organic. When such land is cleared and drained the peat sinks and halts so that it resembles charred wood. Land of this sort is practically worthless.

The black gum swamps which have been drained in various portions of the Dismal and other swamps and which bear a forest of cypress, black gum, and red maple, are well suited to agriculture, but for most cases this soil contains a large amount of organic matter, which is mainly in its upper portion. Where the swamps have been drained the amount of organic matter gradually diminishes, but it has been found in the drained areas that about one-quarter to one-third of the soil still retains enough organic matter to remain black in color. The organic matter furnishes nitrogenous matter to plants so that the soil is a rich one, but its disposition to retain moisture renders it rather slow for the raising of early vegetables. The soils are also notably acid, which has to be neutralized by repeated applications of lime. The percentage of clay in the swamps areas does not bring much sand, and the principal inorganic materials are very small.

The character greatly retards artificial drainage of the region, so that in reclaiming swamp lands numerous ditches and extensive grading are necessary. The recent deepening of the Dismal Swamp Canal has reduced the hydraulic pressure of the lateral sum waters, and in the future this condition will greatly facilitate reclamation.

There are extensive areas of blown sand, and the region has good prospects of being valuable agriculturally in the future. It is not expected that the soils will be available for truck farming to the same extent as the dry plains of the surrounding region, but they will yield crops of many important staples.

UNDERWATER SOILS.

Under the greater portion of the area the Norfolk quadrant the coarser basal beds of the Columbia formation contain considerable water. In the south this is the source of supply of the low private wells scattered over the region and of a portion of the city supply for Norfolk and Portsmouth. The water is characteristically saline, but contains a moderate amount of organic matter. Unfortunately it is subject to surface contamination, owing to its protection afforded by the relatively permeable sandy loam under which it lies. Where wells are present in some cases this feature has been overcome by exposure to the weather after the land has been cleared of trees, drained of water, and ploughed. These soils are usually rich in plant food and prove to be highly productive.

The present supply for Norfolk is obtained mainly from ponds east of the city, and, although of inferior quality, it is still of value, but it contains the following large amounts of mineral matters, which give it a saline taste:

Types of soil:

- Mineral matter in water from baring at Lambert Point

The boring at Lambert Point was made several years ago for the Norfolk and Western Railroad Company. Its depth is 150 feet, and its casing, which is 6-inch pipe, extends to a depth of 900 feet. The pipe stands about 4 feet above the ground and the water rises 19 feet above the outlet. The flow is stated to be 485 gallons per minute. Temperature, about 70°. The formation is called sandstone, but it contains the following large amounts of mineral matters, which give it a saline taste:

- Minerals in water from barings at Lambert Point

This flow appears to be from the same bed of the marine Cretaceous as the one yielding the flow at 136 feet, the Norfolk water being boring. The well record is given on the Columbian Section sheet.

At Fort Monroe three deep wells have been bored. The first, in 1864, was sunk in the feet by the Government to a depth of 100 feet, and produced 60 feet of water.

The second, sunk in 1886 at the Chambersblad Hotel, reached a depth of 345 feet, where a flow was obtained which is estimated at about 46 gallons per minute and rises over 15 feet above the surface, or about 22 feet above tide level. The water is reported as being slightly saline. The third well was sunk at the fort by the Government in the early part of 1902 to a depth of 2254 feet. It passed entirely through the Potomac formation and entered the crystalline rocks 8 feet. At depths of 156 and 213 feet the water was struck and found to be salty and of small flow. The water at the lower horizon rose in the pipe to within 20 feet of the surface, or to a height of 17 feet below tide. Other horizons of water not tested were struck at depths of 255, 320, 393, 525, 650, 1065, 1465, and 1865. The well is cased to the 2131 foot flow and an unsuccessful effort has been made since its completion to extend the lateral sum water. The report of this record is given on the Columnaron Section sheet. It is thought that the water comes from the Chambersblad Hotel, but if so, it is the same as that which yields saline water at 136 feet at the Norfolk waterworks well, 11 miles northwest, in that section of about 9 feet to the mile, but it is probable that the maximum dip of the water-bearing beds is due east, which would make the dip approximately 20 feet per mile. On an east-west line at Fort Monroe the very heavy water-bearing rock is now known to extend at a rate of about 38 feet per mile.

The report made several years ago to a depth of 900 feet and no water was obtained. This fact and the absence of water at a depth of 250 feet in the Norfolk barings indicates that the higher water horizons at Lambert Point and Norfolk waterworks do not extend far west. At Money Point, a mile south of Norfolk, a 6-inch pipe was sunk to a depth of 502 feet, and furnished a good supply of slightly saline water which has been purchased by the city. The source of supply is low in the Chesapeake formation, in sand under an 8-foot bed of rock. Another well, about half a mile southwest, sunk 450 feet and yielded salt water.

At Virginia Beach various attempts have been made to obtain artesian water, but the borings have not been sufficiently deep. One well is stated to have sunk about 900 feet without finding water in appreciable amount. A well having a depth of 70 feet yielded a moderate supply of somewhat ferruginous water.

A well bored to a depth of 1417 feet in Norfolk formerly yielded a fair supply of hard water, but after the introduction of the city waterworks fell ill and was finally abandoned.

In the vicinity of Jacksonville and Lynnhaven wells are reported to be from 12 to 14 feet deep, through clay and red sand, but yielding only a small amount of water, and having plenty of excellent water. Near London Bridge, on the ridge east of Lynnhaven, the depth varies from 9 to 10 feet. About 1 mile to the east of the head of Eastern Branch of Elizabeth River, the water is generally 60 feet deep. Fairly good water is obtained from driven wells at a depth of 80 feet. Owing to some hard stratum at that depth at Keyesville no driven wells have been practicable. Around Tabb an abundant supply of good water is obtained from wells of 12 to 15 feet deep. At one of the postoffice, 12 feet deep, for drinking water for 190 head of stock and for dairy use. The water is in sand and under a 2-foot layer of clay. In the low ridge passing through Newport, good water occurs in sand at depths of 10 to 15 feet. At Sigma, near the ocean, the wells are deep, varying from 50 to 65 feet, but the water is slightly brackish.

About North Landing wells vary from 10 to 14 feet in depth. On the flat, sand area in North Landing, 8 wells from 10 to 15 feet deep, all of which contain good supplies of excellent water in sand and gravel, in places overlying about 10 feet of clay. In the region about Fentress wells from 10 to 15 feet in depth obtain satisfactory water supplies. In the vicinity of Comfield 2 wells are from 8 to 12 feet deep, the deeper one usually furnishing a satisfactory volume of water. They pass through about a 50 feet layer of clay, and a 4 to 8 feet of sand. There are several driven wells 18 to 40 feet deep. Below 12 feet these usually pass through blue sand, which contains very bad water. The beds from 25 to 30 feet contain little water; from 30 to 45 feet there is sand, with clear, cool water in abundance, but slightly mineralized. In the settlement of Bennett’s, east of Comfield, plenty of water is obtained in wells 10 to 15 feet deep. Further north, at Grassfield, the wells are 8 to 10 feet deep on the lower lands, but yield poor water. On the higher slopes to the northwest 12 to 14 feet deep furnish good water. About Gilmerton wells average 8 to 10 feet deep, but a few are sunk to 20 to 80 feet. On the outwash plain of Norfolk, about Turner Creek, the wells are 8 to 10 feet deep.

It is reported that in the Northwest portion of the Norfolk quadrangle the wells average from 10 to 15 feet in depth and obtain plenty of water for local use. In the vicinity of Lilly’s Creek, the southern portion of the Dismal Swamp area, the water is not of satisfactory quality. A well at the postoffice 20 feet deep on the outwash plain of Norfolk, a mouth southerly, indicates that it could not be used for household purposes.

The Lake Drummond water is taken from the canal and used at this place.

June, 1901.
Fig. 1.—Cypress trees and "knees" characteristic of the Dismal Swamp.

Fig. 2.—Western margin of Dismal Swamp, showing overflow during wet season.

Fig. 3.—Jericho Ditch, Dismal Swamp. Canoe at the right.

Fig. 4.—Jericho Ditch, Dismal Swamp. Overgrown by woods and canebrake.

Fig. 5.—Western shore of Lake Drummond, showing dense woods extending into the water.

Fig. 6.—Cypress trees growing in Lake Drummond.
re diposed as beds or trains of sand and clay, thus forming another gradation into sedimentary deposits. Some of this glacial weak was deposited in streams and channels, others in the subaqueous ridges and mounds of sand and gravel, known as eons, or eskers, and kamey. The material deposited in the subaqueous portion of the drift, that washed from the ice onto the adjacent land is called modified drift. It is metal to also class as surficial rocks the deposits of the sea and lakes and rivers that were made at the same time as the ice deposit.

AGES OF ROCKS.

Rocks are further distinguished according to their relative ages, which are not absolute at one time, but from age to age in the earth's history. Classification by age is independent of origin: igneous, sedimentary, and surficial rocks may be of the same age.

When the predominant material of a rock mass is essentially the same as that of a series of different materials, it is convenient to call the mass throughout its extent a formation, and such a formation is a layer.

Several formations considered together are designated a system. The time taken for the deposition of a formation is called an epoch, and the time taken for that of a system, or some greater fraction of a system, a period. The rocks are mapped by superimposing them, and the formations are classified into systems. The rocks composing a system and the time taken for its deposition are given the same name, for instance: Cambrian system, Cambrian period.

As sedimentary deposits or strata accumulate the younger rest upon the older, and the relative ages of the deposits may be discovered by observing their relative positions. This relationship holds except where regions of intense disturbance; sometimes in such regions the disarrangement of the beds has been so great that their position is reversed and it is often difficult to determine the relative ages of the beds from their positions; then usually, or the remains of plants and animals, are guides which show whether two or more formations are the oldest.

Strata often contain the remains of plants and animals which lived in the sea or were washed from the land into lakes or seas and were buried in surficial deposits. In both cases the remains of life are called fossiliferous. By studying these remains, or fossils, it has been found that the species of each period of the earth's history have in great extent differed from those of other periods. Only the simpler kinds of marine life exist in the present day.

The fossiliferous rocks are divided into periods. But during each period there lived peculiar forms, which did not exist in earlier times and have not since repeated; they are classified into genera and species, and they define the age of any bed of rock in which they are found. Other types passed on from period to period, and thus linked the systems together, forming a chain of life. From the time of the oldest fossiliferous rocks to the present.

When two formations are remote one from the other and it is impossible to observe their relative positions, the characteristic fossil types found in them may determine which was deposited first.

Fossil remains found in the rocks of different ages serve as landmarks, and are important means for combining local histories into a general earth history.

Colors and patterns. To show the relative ages of strata, the history of the sedimentary rocks is divided into periods. The names of the periods in proper order (from near to old), with the colors and symbols assigned to each, are given in the tables in the next column. The names of certain subdivisions are used in geologic writings are bracketed against the appropriate period names.

To distinguish the sedimentary formations of any one period from those of another the patterns for the formations of each period are printed in the appropriate colors, with the exception of the one at the top of the column (Pleistocene) and the one at the bottom (Archean). The sedi-


---

The page contains text about the geology of rocks, focusing on the relative ages and types of formations. It discusses the classification of rocks into systems and periods, and the use of fossils and other indicators to determine their relative ages. The text also includes a reference to a diagram showing a sketch of a vertical section of the earth, with the strata labeled to indicate their characteristics and relative positions.

---

**Figure 1** - Sketch showing a vertical section in the front of the present period.

---

**Figure 2** - Sketch showing different kinds of rocks.

---

**Figure 3** - Symbol used to represent different kinds of rocks.

---

The text describes how the rock formations are arranged and how they can be used to understand the history of the earth. It also mentions the use of symbols to represent different types of rocks and how these symbols can be used to identify the strata in a given location.