Prince Edward Island is a land of "red" rocks and soils. The bedrock is commonly soft and may readily be cut by bulldozers, road-graders, and power-shovels, but in some places it is calcareous and hard. In some areas the sandstones have weathered to a soft micaceous sand, in others the mudston beds have weathered to a soft clay. Thus on the Island it may be difficult to distinguish surface deposits that are essentially bedrock from those that are glacial in origin, for the latter are themselves composed of local Island rock Only in the western end of the Island are there significant additions of materials in the surface deposits; these were brought by glaciers from the west. Where the surface deposits have been derived directly from bedrock o where there is only one or two feet of drift on top of the rock, such areas are mapped as bedrock. Thus some comments on the bedrock formations o

e Edward Island are appropriate in an account of its surface deposits. Some of the more recent maps and reports of the Geological Survey of Canada dealing with the surface deposits and bedrock geology of the Island are listed in the references 2-5, 7, 8, 10, 14-17.

The bedrock strata are relatively soft and in order of abundance are mainly freshwater sandstone, mudstone and conglomerate. They are consi dered to be Late Pennsylvanian and Early Permian in age, that is 300 to 250 million years old, but some of the Permian strata may be as young as 225 million years. The Island rocks are younger than most of the rocks of adjacen parts of Nova Scotia and New Brunswick. The constituent mineral grains the bedrock strata were carried by streams whose source was in ancient highlands in what are now New Brunswick and Nova Scotia. These streams flowed onto the low-lying region of present day Prince Edward Island and Gulf of St. Lawrence. As the streams slackened, the mineral grains were deposited in their channels and on the adjoining flood plains. The everincreasing load of sediment depressed the low regions while the highlands to the west and south continued to rise and several thousand feet of sediment accumulated. They were deposited under oxidizing conditions which, along with the action of aerobic bacteria, destroyed the carbonaceous materia and formed the oxide of iron that gives the sediments their characteristic The bedrock strata also include lenticular bodies of a sedimentary breccia composed of fragments of mudstone in a variably sandy matrix and

all bonded by calcium or magnesium carbonates. The breccia was formed when torrential streams ripped up pieces of slightly indurated muds that had been deposited earlier and redeposited them in quiet waters along with sand and other debris; later carbonate-bearing waters saturated the materials and gradually cemented them to form a hard rock. The mudstone breccia contains bone fragments of ancient reptiles an amphibians, and small teeth and coprolites (droppings) of a freshwater shark, but they are very scarce and in general will not be obvious to the layman. Th most striking fossil ever found on Prince Edward Island, however, was disco vered in about 1845 at a depth of 22 feet in a dug well in this breccia uni near French River in the southeast corner of Malpeque map-area. The foss is part of the upper left jaw of an ancient reptile named Bathygnatus borealis, and it is considered to be Lower Permian in age. It is now in the collection of the Academy of Natural Science, Philadelphia, but two hand-coloured casts of it are lodged in Ottawa with the National Museum and the Geological Survey of Canada. This and other vertebrate fossils are described in a National

Plant fossils are more common than animal remains but are readily found in only a few places. They consist of fossil wood, and the casts and prints of stems, roots and leaves of trees that grew in Late Pennsylvanian an Early Permian time. The best known fossil plant locality is near Gallows (Gallas) Point in Hillsborough Bay from where Sir William Dawson collected specimens as early as 1841 as have many other scientists and laymen since that time. The pieces of fossilized wood found along this shore may have the cell structures replaced by silica, by carbonates, or by hematite, and there is commonly some associated pink barite. Preservation of the cell structures of the wood, however, is generally rather poor and precise identification of the trees is seldom possible. Identifiable stems of Sigillaria, Calamites Tylenodendron and Cordaites may be found; pieces of Lepidodendron are very rare. Many of the tree fossils are actually casts of the pith of the stem and may be several inches in diameter. Imprints of the fronds of some of the great tree-ferns of that time may also be found; these impressions occur i sandstone. They are interesting fossils in large pieces but, because of the coarse texture of the material in which they were imprinted, they afford no details of leaf structures even on close scrutiny. A second collecting locality for plant fossils is the west coast of the Island in the vicinity of Miminega and Little Miminegash. The imprints of fern fronds are the most notable fossils there. When collecting along these rock cliffs one should beware of rock falls for the strata are much fractured and after wet periods large

masses are apt to fall. One must also watch the course of the tides when working along coastal cliffs. The conglomerate horizons in the sequence of sedimentary strata provide the Island with the greater part of its "gravel" for road surfaces, though only a few years ago gravel was imported from Nova Scotia. The or ground-water has dissolved some of the calcareous (carbonate) cement return the mass to its original, loose, gravelly condition. The stones in the from the older land masses to the west and south. They range in size from small pebbles to some five or six inches in length, but the latter are uncombut granitoid and gneissic rocks, basic volcanics and greywacke are repri sented in some of the beds. Such conglomerate gravel supplies are only found locally, and hence considerable trucking is necessary to supply parts of the Island. In some places it has been necessary to strip off some 40 to 50 feet of combined glacial and bedrock overburden to reach a commer cially workable "gravel" horizon. Some gravel is also obtained from glacia or glaciomarine unconsolidated deposits in western Prince Edward Island;

The only exposure of igneous rock on Prince Edward Island forms a small promontory at the northeastern tip of George Island in Malpeque Bay It is important only in being a unique occurrence. The point can only be reached by boat and it is mosquito-infested and covered with poison-ivy The igneous body is considered to be a sill injected between sedimentary strata. In part it consists of dense, dull-grey basalt but red and green amygda oidal, vesicular, and brecciated volcanic material is more common. When the molten rock was injected into the strata it picked up and partly digested some of the sediments to produce rocks of unusual appearance; some of these have weathered to a soft "clayey" mass. Igneous rock also occurs beneath

he waters of Malpeque Bay off the southwest tip of George Island. UNCONSOLIDATED DEPOSITS

Glacial Deposits and Events

Glacial tills The bedrock strata of Prince Edward Island are almost everywhere some tens of feet thick; in general the drift thickness is not more than ten t fifteen feet. These materials owe their origin either directly or indirectly to the effects of glaciation during the last Ice Age. The Island was completely covered with ice only fifteen thousand years ago. The deposits left by the ice include rather dense or compact clayey to sandy tills that were deposite beneath actively-flowing ice, and loose-textured more sandy till deposited by the melting of the debris-laden glacier ice. The former (map-units 1A-0 are mixtures of clayey to sandy stony materials derived from the underlying bedrock as the glacier slowly ground its way across the Island; the latter (map-unit 2) is similar material that was caught up in the body of the ice or was moved upward along shear planes to a surface position. The former was emplaced from beneath the ice during active glaciation; the latter was letdown gently as the glaciers dissipated. There is, therefore, a marked diffe ence in their compaction. A very small percentage of these drift materials Brunswick. These "foreign" stones may be referred to as glacial erratics whether they are in or on the till or other materials, but the term erratic is more generally reserved for the larger foreign stones that are readily seen on

The basal tills of Prince Edward Island, though they range from clayey to silty and sandy, and have a variable stone content, are related to a common (Wisconsin) glaciation. Because of the great differences in the appearance of the tills from place to place, three main phases of the same basal till layer are distinguished on the map of the Island. Locally, in proximity to claystone bedrock there are true clay tills but generally speaking even the more clayer tills have a high content of sand; conversely the basal sand tills general have an appreciable content of clay-size particles. The more clayey tills ar quite unlike the more sandy tills in their appearance in the field, but there are all gradations between them. An attempt to separate three main type of basal till, a clay phase, a clay-sand phase, and a sand phase, has been made Boundaries between these till types are gradational. The change, in general reflects the character of the bedrock over which the glacier last moved but changes in direction of movement during the last Ice Age have complicated the picture. The till types have been classified according to their grain-size analyses made in the laboratory. The subdivisions hold locall from one area to another the distinctions may not be reliable, especiall in the silt content of the till - not included in the clay versus sand classification tion - have proved troublesome when attempting to classify the tills in the

When the climate warmed and the ice sheet thinned to the point whe it was no longer active, the remnant ice masses on the Island melted i place, and the entrapped and surface debris was gently let-down onto the surface of the bedrock or its covering layer of till. Though this debris was partly washed by meltwater, it was not sorted and may therefore be termed till; it has been mapped as ablation till (map-unit 2). It is very loose and sandy. In the western end of the Island some ablation till has no doubt been included with the basal sand till (map-unit 1C). nied by the sliding of surface debris toward the periphery of the receding bodies of ice, especially those lying in valleys. Loose-textured bouldery dri found in many valleys, is believed to represent such ice-sloughed debris to 1 inch, and it is therefore included with other valley deposits related to ed areas; it is then inseparable from ablation till, with which part of it is

GLACIOFLUVIAL AND GLACIOLACUSTRINE DEPOSITS AND EVENTS Eskers and kames As the glaciers melted, great volumes of water were produced. Some of this water found its way down fissures or holes in the ice, and entered

subglacial tunnels that led generally toward the margin of the receding glacier and to areas of lower elevations. These meltwaters carried a hea load of clay, silt, sand, gravel and boulders. Though these ice-confine streams scoured the bedrock in some places, in others their beds were i glacial till. They deposited their heavy load of sediment wherever stream velocities lessened, normally approaching the glacier margin. The tunne were thus filled upward from the bottom while the tunnel roof was raised b melting. In some cases the meltwater streams may have flowed in ice-walled open fissures, rather than in tunnels, or a tunnel may have become an open hannel toward the glacier margin. The courses of the former meltwater streams are now indicated by sandy to stony, sinuous ridges known as eskers. Prince Edward Island they are seldom more than one mile long and 20 30 feet high. Irregular and rounded hills composed of sand and gravel, ma places where debris was washed into holes in the ice; these generally are associated with eskers in valley positions, commonly at their upstream ends On Prince Edward Island, the eskers and kames (map-unit 3) are small features and are generally unimportant as sources of gravel for construction purposes, being mainly or entirely composed of soft, Island rocks. Only near Alberton, in the western end of the Island, where these ridges and hills carry a relatively high content of hard, calcareous breccia and sandstone, and about ten per cent of foreign igneous rocks, are they an important source of gravel for general construction purposes. Kame terrace, kame complex, outwash, valley train

Glacial meltwater was not confined to holes, fissures and tunnels in the ice but commonly escaped to marginal positions and coursed along the sides of glacier lobes in valleys or lowlands. Thus sandy and gravelly deposits ccur in many valleys, and in some there are distinct terraces and scarp that denote the successive positions of glacial streams confined between the shrinking ice lobes and the valley walls. These features, known as kame terraces, are too small and complex to map individually on a scale of 2 m to 1 inch, hence they are included with glaciofluvial deposits (map-unit 4A) Not all valleys have terrace deposits; some were merely choked with sand deposits washed out from both active and stagnant bodies of ice. Where such outwash deposits are confined to a valley they may be termed valley train Outside the valleys escaping meltwaters dropped much of their load over lowland areas as outwash deposits. Thus the glaciofluvial deposits include a great variety of generally sandy deposits that vary from little-washed debris

to well-washed and sorted outwash and include single to multiple terraces. Such deposits are especially abundant in eastern and central Prince Edwar sland where several hundred feet of ice dissipated in place on the northern side of the uplands (300 to 470 feet elevation).

Spillways and meltwater channels The glacier meltwater did not continuously deposit materials but in places, or at times, eroded channels in bedrock, in pre-existing glacier debris, and in its own earlier-deposited sediments. These meltwater streams were mainly subglacial to begin with, but later became ice-marginal or pro glacial (spillways). In places the subglacial streams crossed small hills an areas that are now drainage divides, but in general they sought out the partly filled valleys (originally joint-controlled) that remained from pre-glacier time The meltwater thus instituted most of the present-day river systems, but only those "rivers" that carried large volumes of water, as compared to the prese day streams, are shown as spillways or meltwater channels on the Glacial In the central, upland part of Prince Edward Island most of the moder

streams follow the paths of these former subglacial, ice-marginal, and fit" and meanders in a relatively large, sediment-choked valley. Many of thes stream valleys have sharp "shoulders" and relatively broad, flat bottoms in which the present-day stream is cutting a V-shaped notch. In a few places the modern stream has uncovered a channel lower than that formerly oc cupied by the meltwater stream and the latter thus remains as a strander dry channel. This situation may been seen 11/2 miles northeast of Hunter Riv along the river of that name. Farther northeast a dry channel on the upla leads eastward into the Wheatley River system. Dry channels are, in fa rather common near the headwaters of many modern river systems. Other drainage systems were obviously cut in succession, at different time or a well-defined channel will end downstream in a sediment-filled fl where the present-day stream is either intermittent or hopelessly "under and, farther downstream, again occupies a well-defined channel. Such re lationships may be seen in the North (Yorke) River system and in the adjo ing Wheatley River system, both northwest of Charlottetown. Mill Creek leading into Covehead Bay, is interesting because its headwaters flow northward in a moderately oversized valley and then eastward for 11/2 miles in a greatly oversized, but broad and flat, valley before again flowing in a smaller and well-defined valley northeastward to Covehead Bay. The lower ends of this system and others entering the sea are, of course, drowned valleys due The region around Officers Pond, north-northeast of Charlottetown shows a complex drainage history. Meltwaters formerly flowed southward from the vicinity of Suffolk Station toward Hillsborough River valley, leaving a sequence of eskers, kames, kame terraces and spillway channels. Perha at the same time, or only slightly later, meltwaters escaped nothward via t

lower part of Winter River valley to Winter Bay and the sea. Eskers are, aga associated with this spillway system. Part of the upper Winter River valled was also a meltwater discharge route: a channel extends from the height of land southeast of the hamlet of Covehead, southward to the Winter Rive The channel was clearly associated with development of an esker which parallels for a half mile before cutting through associated outwash to Winte River and thence the Officers Pond area: It was probably this meltwater that flowed north from Suffolk and formed the large meander around the eske in that part of the valley. The pattern of these spillways and meltwater channels clearly indicates the late melting of remnant ice on this part of Prince Edward Island; these events mainly followed the glacier-flow events already described. Farther east, in Kings County near Peakes and Elliottvale, there a also well-developed drainage channels. In places these are dry channels crossing drainage divides, elsewhere they are associated with eskers and Another interesting series of meltwater channels is associated with

dish. The main channel follows part of the esker, and several dry channel ut in glaciofluvial drift, lead into it; this system drains eastward to North Rustico. The Dunk River, in Summerside map-area, carried much meltwate as glacier ice receded eastward onto the upland, and outwash (valley train) was deposited along the lower part of the system. Meltwater channels also occur in the western end of the Island. The upper part of Mill River follows the course of an ice-marginal stream to within a mile of the head of its estuary, or about 1/2 mile west of the park and picnic grounds alongside the main north-south highway. Here the glacial stream wa diverted southward (by the waning Cascumpeque-Malpeque ice cap) acros the drainage divide between Mill River and Trout River, and cut a rather de valley for more than two miles. This valley is now occupied by small stream that drain north to Mill River and south to Trout River. Somewhat earlier

the esker and kame complex that crosses the road two miles south of Caven-

during the melting of the western Island ice, the Trout River valley had bee used in a similar fashion by an ice-marginal stream that was diverted south ward into the Brae River system. Soon this diversion channel shifted eastwar to Coleman where it was again diverted southward. It appears to have entered the sea about one mile south of that village. There are some smaller but well defined meltwater channels in the head end of Kildare River valley; some of these are dry channels on high ground. Meltwater pond deposits

Downhill glacier recession and dissipation with the resulting release of meltwater results in the development of glacial lakes and ponds between the ice and the uplands. The manner of break-up of the ice, that had occupied rince Edward Island together with its position in Gulf of St. Lawrence di not lend itself to the formation of large glacial lakes and the deposition of varved clays but some glacial ponds were formed in which well-bedded fir sand was deposited. These ponds were partially or wholly ice-confined. T planket-like mantle of well-bedded sands, up to five or six feet thick, sout southeast of Summerside is interpreted as such a pond deposit; the sand occur near the top of the ridge at an elevation of 150 feet, down the northead side to an elevation of 100 feet, and down the southwest side to an elevation of only 50 feet. The pond probably encircled the western end of the ridge as the ice receded from its northeast and southwest flanks during the general northward and eastward retreat of the late-ice lobes from Northumberland Strait. There are a few other small areas of sand that have been mapped as pond deposits and there are also some unmapped patches in O'Leary, Mount Stewart, and possibly other map-sheets (1:50,000 scale map-areas).

GLACIOMARINE AND EARLY POSTGLACIAL MARINE DEPOSITS AND EVENTS

Relative sea-level changes and marine overlap

An understanding of the concept of marine overlap, requires consideration of the influence of glaciation on relative sea-level changes. During the last great Ice Age the northern part of North America and some other parts of the world were covered by glacier ice. In places the ice attained a thickness of ten thousand to eleven thousand feet, as it is on Greenland today. The gro th of the North American and other ice sheets, ice caps, and glaciers du the Pleistocene or Ice Age depleted the oceans of an equivalent amou water: sea level (eustatic or world-wide) was lowered about 350 feet at the climax of the last Ice Age. At the same time, however, the weight of the ic sheet in North America depressed the glacier-covered area by several hu dreds to over a thousand feet. Thus, in dealing with the evidence of postglad marine overlap, we are concerned with sea-level changes relative to the lan and it is only in western Prince Edward Island that we have evidence of former overlap of the sea onto the present land surface. The recession of the ice from the Gulf of Lawrence was accompanied by incursion of the sea. Though western Prince Edward Island was probab

rebounding as the glacier ice thinned, this region had not fully recovered from the depression occasioned by its former ice load but remained depres ed below the sea level of that time (about -150 to -200 feet, 13,000 years ago). The sea overlapped the westernmost part of the Island to a depth of at least This overlap lessened eastward to zero at Cape Tryon, on the north coast, and Tryon Head (east of Borden) on the south coast. During the period of maximum marine overlap the present Island area was actually a group

three islands, as shown on the Glacial Indicators Map. The maximum amoun of overlap in any one place is known as the marine limit. The last remnant, but active ice bodies of the Prince Edward Islan region were situated in the Cascumpeque and Malpeque Bay part of Gu of St. Lawrence, and in the Hillsborough Bay part of Northumberland Stra remnant, which had originally advanced from New Brunswick, icebergs an grounded ice dropped much debris upon melting and thus glacial erration are especially common in the areas of former marine overlap. In the wester end of the Island the erratics are too numerous to map individually as is don both above and below the marine limit around Malpeque and Bedeque Bay and also farther east where there has been no marine overlap. There has also been a concentration of foreign stones below the marine limit in western Prince Edward Island as a result of the winnowing of surface deposits to wave-action; this has served to sort the glacial debris, wear down the s Island-type stones, and carry the fine materials into the deeper offshore waters. Marine clay and clayey-silt are in fact only found in a few places, s as in the shore cliff south of Miminegash and in Trout River valley east of O'Leary and north of Carleton. Marine deposits

The main deposit left by the sea, on the presently emerged western end of Prince Edward Island, varies from a sandy gravel to a gravelly sand (map-units 5a, 5b). This deposit contains much soft, Island-type sandstone as pebble- and cobble-size materials, with a higher proportion of the harde calcareous sandstone and breccia, and about 5 per cent foreign stones. gravelly material is in general little used for construction purposes except locally as fill. Where wave action has been more prolonged and marin deposits are thicker, the material is a better grade and may be locally usef for concrete aggregate. A marine beach and bar deposit, located on the ea shore highway 21/2 miles northeast of Tignish, was worked for some years a depth of about 15 feet. A collection of shells and shell fragments was made here and dated by the radiocarbon method (see Glacial Indicators Map). By far the most important of the marine deposits is that north and ea of the East Bideford raised bog or peatland where about 10 to 15 feet of we stratified sandy gravel underlies, interfingers with, and in places laps onto a till-like deposit up to five feet thick. The latter is believed to be the resu of a late, final advance, or pulse, of a remnant ice cap in the Gulf of St. Law rence off Cascumpeque and Malpeque Bays, which was probably not mo than fifteen miles wide at this time. Alternatively, this till-like mantle is a marine rubble. In either case the sea sorted the glacial debris along the margin; the ice front lay along the northeast side of the gravel area a si distance inland from the present shore. Huge granitic and other foreign erra tics are associated with the gravels and the till-like mantle. The stratified beds become more sandy inland to the southwest. Marine shell fragment were observed in the gravels on the small, west-facing point southeast o Poplar Grove. The gravels here and to the southeast were worked extensive for a couple of years; they were screened and crushed to produce a fair qu end product for both road and aggregate purposes. The better gravel beds contained up to 30 per cent foreign stones and an equal amount of ha calcareous sandstone and breccia; the remainder was a soft sandstone and

POSTGLACIAL AND RECENT (HOLOCENE) DEPOSITS AND EVENTS The postglacial and Recent-time record on Prince Edward Island is separated from the glacial and glaciomarine (Pleistocene) record merely for convenience in discussing some of the deposits that were not directly associated with the action of glacier ice. It must be understood, however that the geological record is a continuing one with no clear-cut breaks. For instance, the early postglacial uplift of the land continued long after the init removal of the major ice load, as did the rise of sea level caused by the me ing of glaciers in all parts of the world. (Most of the North American contine al ice, the Laurentide Ice Sheet, had receded and dissipated by about 7000 years ago, save for the present-day Barnes Ice Cap, of Baffin Island.)

Marine recession and marine submergence

years ago 11.

sand both of which were readily removed during the crushing and screening

In Western Prince Edward Island, the rise of eustatic sea level, due to the melting of the world's glaciers, overtook or offset the ever-declining rate of isostatic uplift of the land, about 7000 years ago. At that time the land area of Prince Edward Island was probably at its greatest, for although the centra and eastern part of the Island had been undergoing overlap by the sea prior to this, the off-lap of the sea from the western end of the Island had increase the land area markedly and the three islands of the glaciomarine period h united into one large island. From 7000 years ago to the present, a eusta or world wide sea-level rise of about 35 feet has taken place and it is believed that there has been little change in eustatic sea level during the last 4000 years. However, there is a continuing relative rise of sea level in the Mari times, from 4000 years to the present, which must therefore reflect a sub sidence of the land areas. This may be partly due to a delayed relaxation of former 'bulge' in the earth's surface in a zone peripheral to the former Lau rentide Ice Sheet 19. It may be also in part due to depression of the land by the increasing weight of the water on the continental shelf as eustatic sea level rose some 350 feet from the time of deglaciation until about 4000 Submerged organic deposits

When the sea withdrew from the isostatically-rising land between about 13,000 and 7000 years ago - well shown in the western end of the Island but

effecting all parts - the Islands shores lay well beyond the present coastling As relative sea level rose between about 7000 years ago and the present or drowned and buried by marine sediments. Because of this drowning pro cess, bog peat deposits (map-unit 6) and rooted stumps of trees and shrubs peats and drowned forests are indicated on the Glacial Indicators Ma Similarly some ecologically shallow-water deposits, such as fossil oyster beds, are now found offshore buried by marine sediments or exposed on the sea bottom in deeper (non-growth) waters. Some of these occurrences are also shown on the Glacial Indicators Map as a further indication of the relentless rise of relative sea level in all parts of the Island. In the case of

those offshore fossil-shell occurrences shown on the Glacial Indicators Ma where radiocarbon datings have been obtained, the depth of water and the depth in the core sample is given; otherwise the shells were obtained in dredge samples. Where shells of more than one species have been mixed in order to obtain a radiocarbon dating, the resulting date is less reliable (for a number of reasons) than where a single species has been dated. The datings on more than one part of a core sample are not always internal consistent, but nevertheless provide some information pertaining to the in exorable process of marine overlap in the Maritimes. Buried bog peat has been found beneath shell-bearing bottom samples in a few places but in or one place has a reliable radiocarbon-dating been obtained on the buried peat. Information on offshore bottom samples is from Bartlett ¹ and pers. comm. and Kranck 12. Dated samples from the tidal zone are from Frankel and Crowl

Barrier islands and bay-mouth bars Another effect of the rise of sea level relative to the land on Prince Edward Island has been the development of barrier islands and bay-mout bars (map-unit 7). These only form in areas of abundant sand supply. The best-developed barrier islands are thus those of the north shore off Ca cumpeque and Malpeque Bays. The copious sand supply of this region wa ed; erosion of the coastal cliffs has provided only minor additions of sand to these islands, though such erosion may well have served to aggrade the sea floor and thus help maintain the islands in spite of the relative rise of sea level. The islands display a number of beach ridges which in general increase in height toward the sea and afford evidence of the abundant sand supply during the period of sea level rise from about 7000 to about 4000 years ag otherwise the beach ridges would have been destroyed by the transgressing sea. At the present time the outermost beach ridge is clearly truncating som of the former ridges probably signalling a new regime of coastal erosion The islands will ultimately be destroyed if the present submergence, of about one foot per century in the Maritimes, continues into future millennia 11 The best display of beach ridges is on the baymouth bar at Basin Head in northeastern Prince Edward Island. Here, sand resulting from dissipation of the eastern Island ice cap was carried westward along the coast by long shore currents and became trapped or anchored in a bay on the eastern sign of a bold headland. Because of the embayment in the coastline and the copious supply of sand, the rise of sea level resulted in a series of beach ridges, each one higher than the preceding one. In the meantime, the rise of sea level drowned the first-formed ridges and a lagoon formed between the original shore and some of the older ridges. Ultimately, the embayment was filled by the beach ridges which no doubt extended eastward beyond the present coastline. Because of land submergence in the Maritimes, there has been a relative rise of sea level over the past 4000 years during which time there has been a deficiency of sand supply in spite of shoreline erosion, an a smoothed-off coastline has resulted. The beach ridges on the east side of the headland have been protected but their eastern ends have been removed by shoreline erosion. The modern and highest beach ridge truncates the older ridges at angles increasing eastward from 5 to 30 degrees.

The beach ridges commonly show the effects of wind erosion, for blow outs and resulting small dunes mar their surfaces. The vegetated surfaces of all such areas on the Island are in a delicate state of balance, and man mus be careful not to disturb these surfaces lest the vegetation lose its grip and drifting sands result. It is necessary that vegetation become well established in wet years that it may withstand the wind in dry years, or at least serve as a deterrent to such erosion. Coastal erosion

The continuing relative rise of sea level is also promoting coastal erosion. Because of the soft nature of the Island bedrock, and some driftlined shores, the coast is receding at a measurable rate ranging from a few inches to several feet per year. The rate varies according to the nature of the bedrock in the tidal zone area; where hard, calcareous strata or lenses occur along the shoreline the erosion is seriously impeded for a few years of decades. Erosion will inevitably be speeded up again as the hard rock wears away and, because of the inclination of the strata, softer rocks are encounte ed again near high-tide level. The former lighthouse on North Point was some house was still in use, whereas today part of the foundation has been remove by erosion. Thus, in spite of the cliff face becoming slightly higher (now about 12 to 15 feet) as erosion proceeds inland, and the North Point rock being ather calcareous and hard, there has been some 80 feet of shore! of Royalty Point, Malpeque Harbour, there has been between 85 and 90 feet of erosion in 37 years judging by the position of a barn in 1935 and the rem nants of the south wall hanging over the cliff edge in 1972. In this case, the relatively protected shore cliff consists of some 10 feet of a slightly clayey sand till overlying 5 feet of somewhat calcareous siltstone and sandstone. In eastern Prince Edward Island the northeast shore of Bruce Point receded about 2.2 feet per year between 1935 and 1958 yet the southwest side showed negligible recession being periodically protected by drifting sand and other debris. Bruce Point itself, however, lost some 9 feet per year over this same period. To the south of the Bruce Point shore, a cased flowing well was found far offshore in 1958. This presumably serviced a small fishi lock in former years. Furthermore the 1765 (with revisions to 1832) map of Prince Edward Island shows a road along the sand bar that then linked Boughton Island with the main Island whereas today there is no continuou dry bar even at low tide. And to the south of Boughton Island, near Terras Point, there is a dry, rock-lined well of a former farm that now occurs at the

effects of erosion of the Prince Edward Island coast: Forward 6 has reported at length on coastal changes in Egmont and Bedeque Bays.

Salt Marsh and contiguous marshland Salt marsh (map-unit 8) is a tidal zone marsh that consists of a mixture of living and partly decayed seashore plants, with variable amounts of finegrained marine sediments. Salt marsh 'peat' is thus a mixed vegetal and mineral mat. It is generally found in sheltered coves and inlets where it m attain a thickness of about 10 to 15 feet and represent the accumulation about 3,000 years. Salt marsh 'peat' is fairly resistant to erosion in quie water areas and may in places become covered by sand and silt as the se rises and the shoreline transgresses inland. In many places around the islan sandy beaches have a spongy feel beneath one's feet; this is commonly sign that salt marsh has been buried by the present shore deposits. In other places bog peat lies beneath the shore sands. Salt marsh may rest on either glacial or postglacial deposits, including bog peat. It is generally much younger than the deposits it overlies. As grows in the tidal zone, and the sea has been transgressing the land for the past few thousand years, it may be found as a surface deposit along the present shore or as a buried deposit far offshore. But as salt marsh is a narrow

cliff edge a few feet above the high tide line. The seashore obviously lay far

to the east when this well was in use. These are but a few instances of the

and ephemeral transition between the land and marine environments is seldom preserved offshore. Inland from the typical salt marsh there are, in many low areas, adjacent marshlands where the water varies from fresh to brackish and where on rare occasions the sea invades the marsh. These areas have their own characteristic assemblage of salt-tolerant plants and variably decayed muddy debris. Such marshlands as well as true salt marsh may be seen invading woodlands and killing the trees along some of the low lying shores, as groundwater level is elevated by rising sea level. Peatland, swamp, bog

Where drainage is impeded by the nature of the terrain, ponds, swamps, or bogs may result. The growth of vegetal matter over a long period of time will convert a pond into a peat bog (map-unit 5). Where this has happened the lowermost materials are commonly an algal ooze that may be referred to as a sapropel or gyttja. This material may give place upward into a Sphagnun peat. Where water conditions are ideal the Sphagnum may flourish and humped or raised bog will result. In attempting to interpret the history of peat development on the Island it is desirable to locate a peat that rests on sapropel, for it is believed that algal materials begin to accumulate soon afte rests directly on glacial or other deposits there may have been a hiatus several thousand years before conditions were right for Sphagnum growtl Peat deposits on the Island vary from a thin mantle of fairly recen Sphagnum to deposits over 20 feet deep. The deeper deposits may have fibrous or woody layers within them that reflect changes of climates during those periods. A more comprehensive analysis of bog history may be m by studying the pollen content of the material, for each year there mu have been a 'rain' of pollen from the surrounding countryside which shou be well-preserved under bog conditions. Several bogs have been studied from different parts of the Island, and the basal, gyttja layers of four peat bogs have been dated by the radiocarbon method. The oldest materia encountered was that from the base of the Portage bog which lies close to sea level in the western end of the Island. This gyttja was dated at 9,880 ± 15 years B.P. This bog is located in an area that was overlapped by the sea to a height of about 60 feet, and the gyttja could not have begun to form until the land had been uplifted by at least this amount. This uplifting may have taken place within a few hundred years of deglaciation; if so there is a very significant gap in the record of land vegetation following the disappearance of the ice which began about 13,000 years ago. Possibly, however, this part of the

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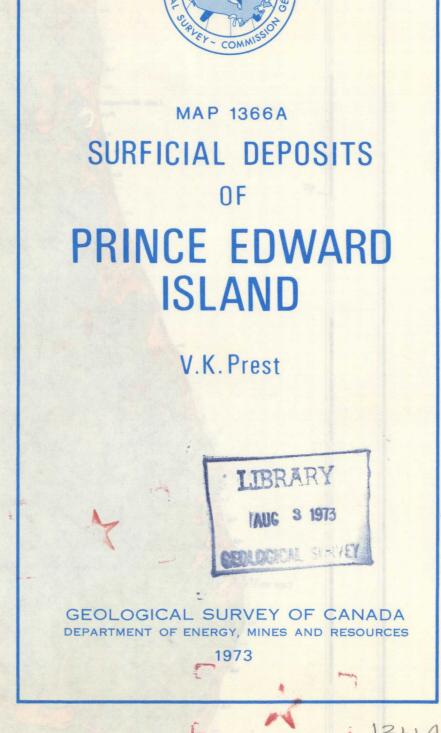
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