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Volumes XXIV-XXXIV are also issued in parts, in paper covers. The contents and the prices of these parts and the prices of all volumes in the series are listed at the end of this volume. Orders for volumes and requests for detailed book lists of other University of Michigan publications should be sent to the University of Michigan Press.
BEACHPOOL DEVELOPMENT AT SEDGE POINT, DOUGLAS LAKE, MICHIGAN*

FRANK C. GATES

INTRODUCTION

BEECHPOOLS are areas of water cut off from main bodies of water in certain ways. The going out of the tide and the going down from heavy storm waves often form temporary pools. A sudden dropping of the water level, caused by the lowering of a lake outlet, may leave permanent beachpools. Beachpools may be built up in bays by the direct onshore action of waves. Such pools are likely to be crescentic, that is, arcs of circles. Alongshore currents, either normal or wind-induced, may start bars in the lee of points projecting out into the lake. Under favorable conditions such bars may come above water, forming spits which may arc around to the land and cut off a pool. This paper is concerned with the observed development of such a beachpool at Douglas Lake, the location of the Biological Station of the University of Michigan, in the extreme northern part of the Lower Peninsula of Michigan.

The lay of the land, the shallowness of the water to the windward, and the kind of bottom at Sedge Point are ideal for the development of beachpools because of the action of the prevailing winds, which are of the alongshore type.

PAST HISTORY

Melting down of the Late Wisconsin glacier left a broad shelf south of the highland running from Stony Point to north of North Fishtail Bay (Fig. 1). In prehistoric times a large beachpool was formed on this shelf. It developed into a bog and persisted as such until severe fires in 1919 burned out the sphagnum ring which held up the water table.

Farther south on this shelf additional beachpools have been developed, as indicated on the map (Fig. 2). Pool 4, cut off previous to the establishment of the Biological Station, through the accretions due to the growth of plants and materials washed and blown into it, has developed into dry land since the present study began in 1911.

Pools 1, 2, and 3 were cut off next as a group before the establishment of the Biological Station. All contained open water at the beginning of the present study. Since that time Pool 3 has been completely filled up by sand washed in by high water. Pool 2 has filled up by the growth of vegetation of a mixed swamp-bog nature, while Pool 1 remains open water, although not so deep as formerly.

CONDITIONS AT THE PRESENT TIME

At the present time an extensive sandy shoal lies to the west of Sedge Point. Its shallowness permits even ordinary storm waves to churn the sandy bottom. Sand thus churned is moved along the bottom eastward. Some thrown up onto the shore dries and is blown into low sand dunes west of the point. By far the larger quantity is worked to the point, where part is thrown ashore by waves, to build the point farther out into the lake. A larger quantity is swirled around the point to form bars in the bay. Succeeding storms may disperse these bars, change their location, or add to them. It seems to make no difference whatever whether any vegetation, submerged or emersed, is growing on or near the bar.
Such has been the history of the Sedge Point region both previous to the establishment of the Biological Station in 1909 and for many years thereafter. Time after time it seemed that a beachpool would be initiated, but the bars were dispersed in the water or worked up onto the shore. Meanwhile the point itself was steadily projecting farther and farther out into Douglas Lake. Sand was added continually to the point during summer storms and pushed up by icework in spring. Rows of willows, mixed with grasses and forbs, starting in damp sand, or sometimes in clumps of Typha, or half-buried Scirpus antericanus, anchored the sand. This prevented the westerly winds from blowing much sand into the water immediately east of the point, where it would have formed land in a place which otherwise might have become a beachpool.

Sedge Point was thus built out into the lake about 160 feet from 1911 to 1929. During the early part of this time a new pool was forming to the east of Pool 1. Fires in 1919 cleared the vegetation from most of the point and permitted enough sand to blow into the incipient pool to bring it above the general water-table level. It exists now as a depression east of Pool 1 and can easily be recognized from the dune area surrounding it by the more hydric nature of its vegetation.

In 1926 the level of Douglas Lake was exceptionally low, and much sand was brought onto and past the point, more than could be dispersed in the following years. In 1931, another exceptionally low-water year, the bar east of the point was above water much of the summer. Many seedlings invaded this bar and, although moved about by the icework the next spring, were not all washed away. Sand caught by these plants built up the spit. No sand remained to add to the bottom of the bay beyond. Alongshore movement of the sand added new bars that extended out into the bay. The sand spit thus initiated lengthened year after year and finally cut off a section of the bay as a beachpool.

Growth of the spit was erratic. Several westerly storm winds moved in quantities of sand, which swirled around the spit and added to its tip. Occasional southeast storms would finger out the unconsolidated sand at the tip of the spit. Higher water from 1934 through 1937, resulting from a dam at the outlet of Douglas Lake, did not destroy the spit, although it did work changes in the shoreline. Consolidation by vegetation and addition of wind-blown sand maintained the backbone of the spit, and it was added to each year. Such additions were on the lake side and became consolidated by vegetation, so that the bottom of the pool to be was not built up.

After the dam was blown out, additions to the spit became more rapid. In 1939 the gap between the spit and the shore of the bay was closed, and gave rise to a new beachpool 90 by 190 feet in extent.

Subsequently this spit has grown in width and consolidation to become a permanent feature of the area. New fingerlike bars are forming, dispersing, reforming in and out of vegetation (mostly sparse submerged potamogetons), while the point itself is moving slowly out into the lake toward the drop-off. The conditions perhaps favor the building up of the backbone of the point rather than furnish sufficient sand to build a new spit, whose development might cut off another part of Sedge Bay as an additional beachpool.

Maps made from surveys by ecology classes under the supervision of the author show the shorelines in Sedge Bay in the years indicated. The shoreline in 1927, which was about at the end of the "preparation" period, is indicated on each map for comparison. Outlines for two additional years are shown in each figure. Although the surveying was done at about the same time each summer, different heights of water level make for variations in the exact location of the shoreline; even so the continuous building up of the spit is obvious (Figs. 3-7).

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A STUDY OF PRIVATE UNPLATTED LANDS, FORMERLY STATE-OWNED, IN CHEBOYGAN COUNTY, MICHIGAN

EDWARD E. STURGEON

The Michigan State Department of Conservation is charged with the administration of state lands lying in the counties of Oceana, Newaygo, Mecosta, Isabella, Midland, and Arenac, and those to the north. The officials of this agency want a check on the results of the current policy of selling state lands to individuals under the provisions of Section 131, Act 206, P. A. 1893. During 1947 surveys were conducted in Cheboygan and Emmet counties to experiment with methods for securing appropriate information.

In Cheboygan County 416 parcels of land comprising 20,648 acres were surveyed to determine present use. These lands were purchased from the state by 314 owners in an eleven-year period beginning January 1, 1936. They had been in state ownership by virtue of their reversion through tax delinquency. Cheboygan County has 464,000 acres of land area, of which the state owned 116,500 acres, or 25 per cent, in 1945. The lands included in this survey make up 6 per cent of the privately owned area.

The Lands Division of the Department of Conservation carefully classifies all state lands deemed suitable for sale to individuals. A person applying for the purchase of this land is required to designate the use he intends to make of it. If his intentions are approved, the property will be placed on sale at the next state land auction. The applicant may bid at that time for the purchase of the property in competition with other interested persons. The importance of proper land use is pointed out to the buyer. Such precautions help to promote a more stable ownership pattern on those lands subject to periodic tax delinquency and subsequent reversion to state ownership.

This paper reports the preliminary results of the land-use study made of ownerships sold by the State of Michigan to individuals in Cheboygan County.

**OFFICE PROCEDURE**

The legal descriptions were listed from the records of the Lands Division early in 1947. All properties of twenty acres and over were included in the study if they had been sold since January 1, 1936. For each description the following information was copied from the abstract books: the name of the purchaser, the acreage, the date of the state deed, and the purchase price. From the tax rolls of Cheboygan County the assessed valuation and the taxes for the years 1937 and 1945 were recorded, and the 1945 taxes delinquent for one year were noted.

**FIELD PROCEDURE**

Each parcel of land listed for investigation was located in the field with the aid of the cover-type maps made by the Michigan Land Economic Survey (no longer in existence) in 1932. Where no boundary markers were visible, properties were found by checking cover types. All roads and trails bordering or crossing an ownership were traversed in order to examine the area. If the owner or tenant could be interviewed, he was questioned about the present use of his property. If not, often neighboring farmers, township officials, or realtors furnished valuable information.

**PRELIMINARY RESULTS**

Of the lands included in this survey, 10 per cent were purchased prior to January 1, 1941; 90 per cent were bought after this date. The peak year of acquisition was 1943, when 23 per cent were deeded to private owners. Increased buying in the latter half of the eleven-year period is attributed to the general prosperity of the war years, during which the more desirable properties available for purchase were sold by the state. The present policy of the Department of Conservation is, however, to retain possession of lands with access to water.

**CLASSIFICATION OF LANDS BY USE**

Table I classifies the total acreage surveyed according to eleven kinds of land use evident in Cheboygan County in 1947. The factor of multiple use makes this classification somewhat discretionary.

<table>
<thead>
<tr>
<th>Use</th>
<th>Acres</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pasture</td>
<td>4,523</td>
<td>21.9</td>
</tr>
<tr>
<td>Timber</td>
<td>3,047</td>
<td>14.8</td>
</tr>
<tr>
<td>Speculative</td>
<td>3,016</td>
<td>14.6</td>
</tr>
<tr>
<td>Idle</td>
<td>2,835</td>
<td>13.7</td>
</tr>
<tr>
<td>Hunting</td>
<td>2,179</td>
<td>10.6</td>
</tr>
<tr>
<td>Woodlot</td>
<td>2,133</td>
<td>10.5</td>
</tr>
<tr>
<td>Unknown use</td>
<td>1,001</td>
<td>4.9</td>
</tr>
<tr>
<td>Crops</td>
<td>647</td>
<td>3.1</td>
</tr>
<tr>
<td>Orchard</td>
<td>456</td>
<td>2.2</td>
</tr>
<tr>
<td>Rural residence</td>
<td>356</td>
<td>1.7</td>
</tr>
<tr>
<td>Total</td>
<td>20,648</td>
<td>100.0</td>
</tr>
</tbody>
</table>

*Pasture.* — Almost 22 per cent of the total area serves as pasture. All such lands are fenced, and about 65 per cent are cleared. Farmers have found a dependable income in selling cream to local buyers. The present demand for pasture makes this use of first importance according to area.

*Timber.* — Lands used for growing timber include those from which wood and wood products are sold by the owner. Pulpwood, sawlogs, Christmas trees, cedar boughs, cabin logs, and firewood are among the items produced. Very few areas have merchantable timber of sawlog size.
Speculation. — The ownerships purchased for speculative interest include 3,016 acres, or 14.6 per cent of the total acreage. Few owners acknowledged buying land from the state with the intention of selling it later at a profit. In some instances neighbors or realtors divulged the speculative plans of certain parties. Lands which were for sale after the owner had removed marketable timber were placed in this category, although only a few were observed. The fact that some properties had been resold once or twice indicated speculative interests.

Realtors and merchants are among the speculators. An injustice is done the farmer at the land auction when he is outbid by these interests on a piece of land that would make a profitable addition to his farm. Speculation is an evil where it seriously inflates land prices and fosters improper use.

The one outstanding example of this activity in the county is the operations of a Detroit realty company. Since 1941 it has purchased 35 legal descriptions in Cheboygan County totaling 1,370 acres. The name of the firm is designed to lead people to believe they are dealing with a state agency. It usually buys at the minimum price the lands not bid on at the auction. Several township assessors report difficulty in determining whether or not certain parcels of land have been sold by the firm and, if so, what are the names and addresses of the present owners. This situation has resulted in tax delinquency on a few parcels of land. Two transactions were reported in which the firm realized 600 per cent profit. The Department of Conservation is not empowered to control the sale of state land so as to prevent its falling into this type of use. The deed restriction has been considered an effective way of combating speculation.

Idle land.— The “idle” classification includes 2,835 acres of land which were not in any use and for which the owner had no immediate plans. He either was undecided about what he should do with the land or was reluctant to divulge his intentions. In some instances it was obviously purchased as an investment pending a decision in regard to its future use.

Hunting. — Ten per cent of the lands surveyed are used for hunting. This activity is increasing in importance as a new basic use. Hunters usually build a cabin on their property and make it a center for hunting activities. In general, hunting lands are of low quality and support only brush or poor to fair immature timber.

Woodlots. — Woodlots are defined as lands from which the owner takes wood for his own consumption. Of the 2,132 acres in this use about 35 per cent are pastured. Although this combination use is an improper practice from the standpoint of forestry, the demand for pasture makes it rather extensive.

Unknown use. — Lands were placed in the “unknown” class if their use could not be determined from observation or if the owners were not available for questioning. A small percentage of them may be nonresidents of the county.

Crops. — About 3 per cent, or 657 acres, of the total land in this class is used as cropland. Cultivation is attempted only on the better clay soils.

Orchards. — Late frosts have discouraged most orchardists in the county. Of the 456 acres in this class a Detroit company owns 320. It has erected a fruit-processing plant for making juice.

Rural residence. — A rural residence is interpreted as a property on which the occupant lives all year, but from which he does not make his living. There are 455 acres of such land. Several rural homes have been built near small trading centers.

Summer residence. — Plots on which twelve summer residences have been built total 356 acres. The houses are usually near lakes, streams, or small trading centers, but the sites of several have been chosen to take advantage of scenic views.

DEDUCTIONS FROM TAX ROLL STATISTICS

Table II presents tax information on the lands considered. Unassessed lands, which comprise 32 per cent of the total area, were listed on the county tax records as state lands, although they had previously been sold by the state. This discrepancy is explained by the lapse in time between the sale of the property and the recording of the new owner’s name on the tax rolls. The township assessor is often the person responsible in this irregularity. Such inefficiency results in the loss of tax revenues to the local units. In lieu of taxes the state pays the county at the rate of 10 cents per acre for state-owned land. The average tax levied in 1945 by Cheboygan County on private lands included in this study amounts to 6.5 cents per acre. Therefore the local unit derives more revenue from land in state ownership.

<table>
<thead>
<tr>
<th>Tax classification</th>
<th>Acres</th>
<th>No. of owners</th>
<th>No. of parcels</th>
<th>Purchase price</th>
<th>Taxes</th>
<th>Assessed valuation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unassessed, 1945</td>
<td>6,706</td>
<td>98</td>
<td></td>
<td>824,174</td>
<td>9008.58</td>
<td>...</td>
</tr>
<tr>
<td>Assessed, 1945</td>
<td>13,942</td>
<td>216</td>
<td>36,619</td>
<td>(2.62)</td>
<td>22,425</td>
<td>50,514</td>
</tr>
<tr>
<td>Delinquent, 1945</td>
<td>4,061</td>
<td>78</td>
<td>12,242</td>
<td>(3.00)</td>
<td>22,425</td>
<td>50,514</td>
</tr>
<tr>
<td>comparable</td>
<td>1937</td>
<td>8,578</td>
<td></td>
<td>732.30</td>
<td>43,375</td>
<td>(3.70)</td>
</tr>
<tr>
<td>1945</td>
<td>8,578</td>
<td>143</td>
<td>162</td>
<td>642.07</td>
<td>43,375</td>
<td>(3.70)</td>
</tr>
<tr>
<td>All lands studied</td>
<td>20,648</td>
<td>314</td>
<td>60,403</td>
<td>(2.92)</td>
<td>...</td>
<td>...</td>
</tr>
</tbody>
</table>

The properties included in the delinquent group are those for which the 1945 taxes were not paid. Almost 30 per cent of the lands assessed bear delinquent taxes for at least one year, and such taxes make up 38 per cent of the total assessed taxes.

Lands with comparable tax data for the years 1937 and 1945 are those for which the assessed valuation and
A NEW FOSSIL INSECT AND PLANT LOCALITY IN MONTANA

HENRY P. ZUIDEMA

FOSSIL insects were discovered in the Western Hemisphere at least as early as 1865, when William Denton collected in the Green River (Eocene) formation on the lower White River in western Colorado and eastern Utah.1 However, after years of exploration of the rocks of North America, known localities where well-preserved insects occur in abundance are still rare and must remain so because of the special conditions of deposition necessary for the preservation of these fragile forms. The discovery of a new locality in southwestern Montana which, during a few days of collecting, yielded approximately two hundred specimens, representing nine orders of the Insecta, is therefore noteworthy.

Insects undoubtedly were as numerous during the epochs of the Tertiary, representing some sixty millions of years, as they are today. There are more than half a million recognized living species, and it is estimated that possibly several times this number remain to be described. They live in every habitat, in all regions. Many are parasitic; others transmit diseases or destroy food, and man is often hard pressed to exercise effective controls. It may well be that an explanation of some of the extinctions of certain groups of mammals as, for example, the vast herds of North American horses, lies in further study of the Tertiary insects. New discoveries of fossil forms have, therefore, more than passing interest.

During the season of 1947 Dr. A. J. Eardley called the attention of a University of Michigan field party to the occasional discoveries, made over a period of years, of fossil mammals in the upper Ruby basin of southwestern Montana and suggested that a reconnaissance be made.

The Ruby River is one of several north-flowing streams in southwestern Montana which constitute headwaters of the Missouri drainage system. Above the town of Alder the Ruby Valley is flanked on the west by the Ruby Range and on the east by the Greenhorn Range. These ranges converge a few miles south of Alder, and the Ruby passes through a gorge in which a dam has been constructed to impound water for the irrigation of ranch lands in the lower valley.

The altitude of the river above the reservoir is about 5,400 feet above sea level, and the highest portion of the Greenhorn Range rises to 9,640 feet. The intermontane basin is one of several in southwestern Montana which have closely related geologic histories.

A search for fossil mammals was carried on in an area of approximately 144 square miles, which includes numerous exposures along the Ruby, and its tributaries — Sage, Cottonwood, Mormon, Peterson, and Garden creeks. The discovery of a section containing a large number of insects came at the end of the field period.

Bench lands and hills cut in Tertiary deposits extend from the alluvial flats of the Ruby River to the pre-Cambrian gneisses and quartzites of the surrounding ranges. Conglomerates and sandstones form bold scarps throughout the basin, and these gray and tan bluffs stand in sharp contrast to the stratigraphically lower white, gray, and buff shales which represent ancient lake deposits.

The basin presents the appearance of a down-faulted trough, which served as a trap for sediments during a large part of the Tertiary, particularly during the Miocene. Later faulting affecting the basin rocks has exposed the lake deposits in some areas. Four surfaces, delineated by benches, have been developed by subsequent erosion.

The greater part of the basin surface is formed by a thick deposit of buff and gray conglomerates and cross-bedded sandstones, reflecting torrential deposition by streams flowing from adjacent highlands after elevation of the surrounding region, presumably along old fault lines.

These coarse elastics are tentatively correlated with the “Madison Valley beds” of Douglass,2 which he dated as Miocene on the evidence of fossil mammals found in the type area in the lower valley of the Madison River, sixty miles northeast of the Upper Ruby basin.

1 The study was made under the supervision of Professor W. F. Ramsdell, School of Forestry and Conservation, University of Michigan. Mr. Fred Struhsaker, director of the Lands Division, Department of Conservation, and Mr. Charles Millar and Mr. Harry Galloway, also of the Lands Division, were instrumental in outlining the project. Financial aid for travel was provided from the Michigan Rural Rehabilitation Corporation funds under the supervision of Mr. Roswell Carr, state director of the Farmers’ Home Administration.

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A greenish siltstone, found in only one locality in these upper rocks of the Ruby basin, yielded the last premolar and associated molars of a horse which represents either an advanced and very large *Merychippus* (a Miocene — Lower Pliocene three-toed form) or a primitive *Neohipparion*, a Pliocene horse possibly derived from *Merychippus*. At another locality, also in the uppermost of the basin series, two molars of the same form were found.

The lake-bed deposits below the "Madison Valley" are typically calcareous and tuffaceous white and gray shales, frequently containing freshwater ostracods and fish scales. A section exposed to the south of a fault cutting through both conglomerates and lake deposits near the junction of the Ruby and Sweetwater has a thickness of 150 feet.

An exposure of the lacustrine deposits in the northwest portion of the basin consists in part of light-tan, fine-grained shales containing volcanic ash. This section evidently represents the near-shore facies of the lake beds and contains abundant plant and insect remains (Pl. I). The insects are found in laminae ranging in thickness from paper-thin sheets to layers a quarter of an inch thick. Delicate wing structures are preserved, and some individuals show coloration patterns.

Definitive identification of fossil insects is the work of specialists. Tentative identifications of the specimens are as follows:

**Orthoptera:**
- *Acrididae* (short-horned grasshoppers). Three specimens, apparently one species, a member of the subfamily.
- *Acridinae*, *cf. Tybula sp.*

**Dermaptera** (earwigs). Identification fairly certain.

**Coleoptera** (beetles):
- *Elateridae* (click beetles). Apparently two species. (*Pl. IV, Fig. 2.*)
- *Scarabaeidae* (scarabs). One fairly certainly a member of the Rutelinae, the same subfamily as the bumblebee flower beetles.
- Three specimens, apparently three species, family uncertain.

**Hymenoptera:**
- *Tenthredinidae* (sawflies).
- *Formicidae* (ants).
- *Apidae* (bees).
- Parasitic Hymenoptera.
- Two specimens, position uncertain.

**Ephemeroptera** (May-flies):
- *Baelidae* (May-fly nymphs). Subfamily either Siphlonurinae or Metretopinae.

**Diptera:**
- *Mycetophilidae* or *Rhyphidae* (a fungus gnat).

**Hemiptera** (true bugs).
- *cf. Coreidae* (squash bugs).

**Homoptera**
- *Cicadellidae* (leafhoppers).
- *cf. Fulgoridae* (lantern flies).
- Specimen of uncertain position.

At least one genus, *Brachypremna*, has definite subtropical affinities, one species being common today in Florida and unknown north of the Ohio River. It is hoped that further study of the Montana fossil insects will contribute toward a better understanding of Tertiary climates. A note of caution regarding interpretation has been introduced, however, by Zeuner  in his comment on the use of the insect fauna to determine the climatic conditions during the time of formation of the Baltic amber (early Tertiary), which entrapped a strange mixture of elements now found in very different geographical regions and under equally different climatic conditions:

“When studying the insect fauna of the Böttingen Marble (Upper Miocene) and its relations to other fossil and recent faunas, I came to the conclusion (1931) that the only admissible explanation is that numerous groups of insects have modified their climatic requirements since the Tertiary. How could it otherwise be possible to find the same kind of geographical and climatic mixture in the fauna of the Böttingen Marble, which was formed in a thermal well acting as a natural trap for animals living in the neighbourhood? The conclusion is inevitable that the amber fauna lived in a warm climate and that certain elements then living in a tropical climate have since adapted themselves to temperate conditions.”

Investigators of living insects, however, have reported the unexpected occurrence of some types far from their normal habitats. Insects native to Florida, for example, have been found late in the season at least as far north as Michigan. The subject obviously calls for a most careful evaluation of the evidence before conclusions in regard to climatic conditions are drawn.

The plant fossils from the new locality include *Ailanthus*, which is represented by a well-preserved fruit, and fragments of what undoubtedly represent *Sequoia*. This association is found in the Mascall formation (Upper Miocene) of Oregon. *Ailanthus* disappeared from North America in the late Miocene or early Pliocene and was introduced by man from Asia in 1820, when it was planted on Long Island. *Sequoia* does not appear in the fossil record of the interior of the continent later than the Miocene. The presence of either genus could be accepted as an indication of a warmer and more humid climate than now exists in Montana, but a climate cooler than that which prevailed in the earlier part of the Tertiary period. No survivors of earlier tropical conditions are found in the collection.
ACKNOWLEDGMENTS

The writer expresses his thanks to John A. Dorr, Jr., and Walter H. Wheeler, graduate students in the University of Michigan, for their assistance in the field; and to Elwyn Metzel, of Alder, Montana, for hospitality extended to the field party. For help in identifying the fossils he is under obligation to authorities in several fields. The insects were examined by Professors J. S. Rogers and T. H. Hubbell, Museum of Zoology, University of Michigan, and by Dr. Justin W. Leonard, Institute for Fisheries Research, Ann Arbor; the mammals, by Professor Claude W. Hibbard, of the Museum of Paleontology, University of Michigan; the plants, by Professor Chester A. Arnold, of the same museum.

UNIVERSITY OF MICHIGAN


4 Professor J. S. Rogers, personal communication.

5 Work in the area here described was continued in 1948, subsequent to the presentation of this paper, and approximately one hundred additional specimens of fossil insects were collected.

A flower fly (Family Syrphidae). Length of specimen 12 mm.

Wings of a fossil fish fly (Family Sialidae) showing color pattern. Greatest length of wings, 45 mm.
SEA-SALT PRODUCTION IN THE INLAND SEA REGION OF JAPAN

JOHN DOUGLAS EYRE

The Inland Sea of Japan, or Setouchi, as it is also called, is bounded by the mountain masses of three of the main islands of the Japanese Archipelago, namely, Honshu, Kyushu, and Shikoku. Two waterways, the Kii Channel and the Bungo Channel, connect it with the Pacific Ocean, and the Straits of Shimonoseki lead into the Sea of Japan. Its calm island-studded waters stretch for more than 250 miles from the great industrial and shipping centers of Osaka and Kobe in the east to the twin ports of Shimonoseki and Moji at its western extremity.

The scenic beauty of its waters, the mildness of its climate, and the spectacular artificial terracing of the slopes around its shores rightly qualify the Inland Sea as one of the leading beauty spots of Japan. A highly indented coastline provides numerous excellent harbors, from which fishing craft sally forth to catch the sea bream and other valuable food fishes that are to be found in abundance. At frequent intervals along the coast occur small alluvial areas, on which agriculture is intensively pursued to support a dense population.

Along the sea edge of many of these lowland areas is located one of the most significant local industries, the manufacture of salt from sea water by an evaporation process using both solar and artificial heat. This region, possessing a combination of climatic conditions and terrain features extremely favorable for the purpose, produces more than 90 per cent of the nation’s domestic salt output. Extraction methods remain unchanged, save in details, from those perfected during the sixteenth century. Production units, with their regular arrangement of canals and leaching tubs, constitute one of the most distinctive elements of the local landscape.

Despite the lack of data on the early development of Japan, there can be no doubt that sea-salt manufacture has been carried out in the Inland Sea basin since remote ages. It was here that peoples of pre-Yamato stock established settlements supported by fishing and agriculture. With plant foods forming a major item of their diet, the use of salt to meet physiological needs was a normal consequence. An inexhaustible natural supply lay close at hand in the waters of the sea, and it is reasonable to assume that some salt was extracted from it, probably by simple solar evaporation. One can also conjecture that, since many of the primitive Japanese cultural institutions closely parallel those in parts of southeast Asia, the ability to harvest salt from the sea may well have originated in the southern areas and have been introduced into Japan by migrating peoples.

Although salt production is mentioned in documents dating as far back as the tenth century, it is not until some six hundred years later that government records prove the existence of a salt industry in the Inland Sea.
region. Details concerning the time and place of their initial construction and of their subsequent expansion have been lost in the obscurity that cloaks the early centuries of Japanese history. Tradition credits the province of Harima, at the eastern extremity of the Inland Sea, with first development, but it may well have taken place at any of the numerous favorable localities in the region. At any rate, it is certain that by the early part of the sixteenth century the industry had become large enough to warrant a salt tax, and feudal lords of the Inland Sea region, anxious to exploit the economic potentialities of their lands, encouraged the extension of local salt-making activities. The famous production units at Nakanoseki and Mitajiri, now parts of the city of Bofu in Yamaguchi Prefecture, were begun in 1597 and completed under the sponsorship of the Mori clan. Such patronage by the feudal lords continued well into the latter part of the Tokugawa Period (1603-1868). The salt fields at Sakaide in Kagawa Prefecture, formerly the province of Sanuki, were built upon the orders of the Matsudaira clan in 1818-29.

During the Tokugawa Period sea-salt manufacture was virtually limited to the shores of the Inland Sea. Those ten provinces that included the chief production areas within their borders became widely known as the “Ten Salt-producing Provinces,” namely, Harima, Bizen, Bitchu, Bingo, Aki, Suo, and Nagato in southern Honshu and Iyo, Sanuki, and Awa on the island of Shikoku (Fig. 1).

In 1871 the division of Japan into feudal fiefs was revised by the new Meiji government, and the land was redistributed among a number of newly formed political divisions known as ken or “prefectures.” It is in the prefectures of Hyogo, Okayama, Hiroshima, and Yamaguchi in the southern part of Honshu and Ehime, Kagawa, and Tokushima in Shikoku that the sea-salt industry is at present centered (Fig. 2). Small amounts of salt are also obtained along the shores of northeastern Kyushu, mainly in Oita Prefecture.

Kagawa Prefecture yields about 35 to 40 per cent of the Inland Sea's total output and ranks as the foremost salt-producing area in Japan. Second in importance is Hyogo, closely followed by Yamaguchi, Okayama, Hiroshima, Tokushima, and Ehime. Tokushima, formerly the province of Awa, was outstanding for its extensive salt fields during the Tokugawa Period, but in recent years has declined in importance. Many of the salt-production units within its boundaries have been converted to paddy fields.

The sea-salt industry has influenced in some measure the development and expansion of a number of important towns and cities along the shores of the Inland Sea. During the early part of the Tokugawa Period this influence on urban growth was particularly marked upon the establishment of permanent fields designed for commercial production. The names of Ako (Hyogo Prefecture), Onomichi (Hiroshima Prefecture), Bofu, including Mitajiri and Nakanoseki (Yamaguchi Prefecture), Hashihama (Ehime Prefecture), Sakaide and Marugame (Kagawa Prefecture) are famed throughout Japan for their saltmaking.

Investigation shows that the four main islands of the Japanese homeland occupy a total area of approximately 150,000 square miles and have a coastline of about 17,000 miles, or one mile of coast for every nine square miles of land area. With such an extensive littoral the manufacture of salt might well be expected at numerous localities throughout the islands. Consideration should therefore be given to those basic factors that largely limit the industry to the shores of the Inland Sea.

Advantageous climatic conditions play an important role in determining this localization. More than any other section of Japan the Inland Sea region has summers marked by high temperatures, continuous days of bright sunshine, limited rainfall, and low relative humidity. Such a combination promotes rapid evaporation of the water used in saltmaking. The total yearly precipitation is generally below sixty inches. On an annual basis,
fewer rainy days are experienced than elsewhere in the country. Rain falls most abundantly during September. Also, the greatest number of bright sunshiny days in Japan occur in the Inland Sea district. Except in the western section around Shimonoseki, the main monthly relative humidity does not rise to 80 per cent. Prevailing land and sea breezes during the summer months contribute greatly to the rapidity of evaporation.

It is during the six-month period from March to August, when these climatic factors are most favorable, that the bulk of the Inland Sea salt is produced. Some small-scale operations are possible, however, during the remainder of the year. The entire region is blessed with a mild winter climate, and fine weather continues for many days, particularly during November.

Closely allied with such favorable climatic conditions as determining factors in locating the sea-salt industry in the Inland Sea basin are the extensive sandy beaches along the edge of the many alluvial areas that are to be found there. These sandy surfaces, together with the calm shallow waters that lie offshore, make ideal natural locations for the construction and operation of salt fields.

Generally speaking, salt-production units are concentrated on the shores of alluvial deposits that stretch along the innermost portions of well-defined bays. Such a location has certain inherent advantages. First of all, the rugged highlands that generally protrude on either side of the bay make effective barriers against destructive winds and diminish the force of currents sweeping in from the open sea. Then, too, shallow waters offshore reduce wave action to a minimum and thereby lessen the possibility of damage to the retaining walls built around the fields. Calm waters facilitate the periodic refilling of the canals that carry sea water through the area. In many places offshore islands supplement the headlands as protection against winds, currents, and wave action. All the typical production units represented in Figures 3-4 show the close association of salt fields, lowlands largely occupied by rice paddies and settlements, and surrounding highlands.

This same general relationship between surface features and the location of salt fields can be witnessed at innumerable spots along the coastline of the Inland Sea and about the shores of many of the small islands that dot its surface. For a more detailed discussion of a representative locality, however, one may consider the Ako production area of Hyogo Prefecture, as shown in Figure 5.

Here the extensive salt fields, among the largest in Japan, occupy the seaward edge of an alluvial fan consisting of granitic materials transported by the Chigusa River from the interior highlands. The surface of this delta is exceptionally low and for the most part is used for rice fields, which are of less than two meters' elevation. The salt fields lie approximately at water level. Continuous dikes parallel both banks of the river as protection against flooding of the lowlands during the spring, when melting snow and ice in the mountains increase its volume considerably.

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FIG. 4. Generalized maps of selected salt-producing areas in the Inland Sea region showing the relationship between salt fields and surrounding terrain. A is in Okayama Prefecture, B in Kagawa, and C in Yamaguchi.

The moderate tidal range of the Inland Sea permits sea water to be easily admitted to the canals of the salt fields. Cheap fuel for the final step in the process, which requires artificial heat, is readily available. Coal deposits in the neighborhood of Ube, in Yamaguchi Prefecture, and in northern Kyushu are but short distances away from the main salt-producing areas. The entire Inland Sea region is covered by a web of land and sea routes, over which salt can be shipped to all parts of the nation without difficulty.

In many countries of the world where sea-salt manufacture is carried out numerous variations in the extraction process can be observed. A method commonly employed is to flood flats with water drawn directly from the sea, let the moisture be absorbed by the rays of the sun, and rake up the resulting deposits for either immediate use or further refinement. The uniqueness of the method employed in the Inland Sea region lies in the use of scientifically constructed fields for the sole purpose of getting a highly concentrated brine by means of solar evaporation. After the brine is reduced by boiling a fairly pure product is obtained.

FIG. 5. Generalized map of the Ako salt fields in Hyogo Prefecture and sur-sounding surface features. The numbered settlements are Ako (1), Ozaki (2), and Shinhama (3).

Salt fields around the Inland Sea are operated by what is popularly known as the "inshore" method. This name is applied to differentiate it from the "upshore" method, a much simpler operation that appears to have been the forerunner of the one employed at present. After a site has been selected in accordance with favorable surface features, as discussed above, a sturdy sea wall is erected about the area. This dike must be of solid rocks, in order to offer continued protection from wind and currents. Once the dike has been completed and all water excluded, the sandy surface is smoothed to a level that lies about three feet below high water. Upon this surface are placed layers of sand of varying degrees of coarseness. The number and composition of the bottom strata may vary considerably, but the uppermost must always be of exceptionally fine grained sand, for it is upon its surface that the evaporation takes place.

Across the level sand-covered area, main and secondary canals are introduced for the purpose of circulating sea water. Their depth, width, and distance apart are standardized. In fact, the entire field is constructed with mathematical precision. Water from the sea is admitted into the canals by means of sluice gates fitted into the sea wall and designed to be opened at high tide, when the sea level is considerably above the surface of the salt fields. Immediately inside each sluice gate is a collection pool that prevents the water from
gushing into the production area with too great force. From the pool the water enters the main canals through a pipe and circulates through the entire field. Care need be exercised that the water does not overflow unto the actual surface.2

The network of canals divides the area into smaller salt fields of equal size, averaging 3.75 acres. In the center of each lies a succession of leaching tubs from ten to sixteen yards apart (Pl. I, Fig. 1). These are rectangular and are made of wood, hardened clay, or concrete. On the bottom of each is stretched some sort of grating, often bamboo wickerwork covered with a strip of coarse straw matting, which acts as a rough filter in the process of leaching the salt-impregnated sand taken from the surface of the salt field.

Once the construction of the field has been completed according to this general plan, the sluices are opened and sea water is permitted to circulate slowly through the canals. From here it gradually but steadily seeps into the bottom layer of coarsest sand and is then drawn to the surface of the field by capillary attraction. Exposed to the action of bright sunshine and strong breezes, the moisture is rapidly absorbed into the air, leaving the saline content adhering to the crystalline sand grains on the evaporation surface. The entire field is periodically raked in order to expose a maximum amount of the sand to the action of sun and wind. Workmen do the raking with specially designed rakes having long bamboo handles and lengthy removable wooden teeth.

Now the salt-impregnated sand is gathered up into piles, placed in baskets, and carried to the leaching vats. After it has been deposited in the tub, sea water is poured over it. In passing through the mass of sand, the water dissolves the salt particles and produces a highly concentrated brine, which is drawn off at the side. At the conclusion of this step the leached sand is removed from the tubs and respread over the surface of the field to repeat the operations just described. In order to permit the sand ample time to dry, parts of some fields are worked every day and the whole of the others on alternate days. This procedure permits the sand to rest and helps it retain its powers of absorption.

With the concentration of the brine the function of the salt field is completed, and artificial heat is now applied to produce granular salt. Evaporating pans are placed in sheds that line the margins of the fields (Pl. I, Fig. 2). At several salt centers such as Matsunaga in Hiroshima Prefecture, a modern and more efficient granulation process that involves the use of steam heat has replaced the wasteful open-pan method. Most of the fields of the region still cling, however, to traditional tools and procedures.

Along various sections of the Inland Sea coastline the unmistakable regular patterns of the fields are constantly encountered. Smoke pours from the chimneys of the evaporating sheds during the crystallizing stage, while across the fields workmen are engaged in raking the top layer of fine sand. Their rakes make pleasing wavy lines in the sandy surface as they wind their way through the maze of canals and leaching tubs. The entire scene is one of ordered activity.

To help meet the financial demands of the Russo-Japanese War salt was made a government monopoly in 1905. There were large profits during the first thirteen years of the monopoly system, but in 1918 the income derived from it was adjusted so that it was sufficient only to cover operating costs. Central offices of the Monopoly Bureau were established in Tokyo, with branch offices in leading production areas. Several experimental stations were authorized to perfect new methods. One of them is at the present time in Mitajiri, part of the city of Bofu, in Yamaguchi Prefecture; here, also, crude salt from Taiwan, Kwantung, and Tsingtao was processed before the recent war.

Prior to 1920 less than 800,000 metric tons of salt was consumed annually in Japan, an amount largely supplied by the Inland Sea fields. By 1930 the annual domestic consumption, which was rapidly approaching a million metric tons, necessitated heavy imports. Within the next eight years this figure more than doubled because of the swift development of the Japanese chemical industry. Every year witnessed greater dependence on imports. By 1936 domestic production furnished less than one third of the amount consumed. The following figures for that year tell the story:3

<table>
<thead>
<tr>
<th>Percentage</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Domestic production</td>
<td>29.0</td>
</tr>
<tr>
<td>Imports from colonies</td>
<td>4.8</td>
</tr>
<tr>
<td>Imports from Manchukuo</td>
<td>2.0</td>
</tr>
<tr>
<td>Imports from abroad</td>
<td>64.2</td>
</tr>
<tr>
<td>Total domestic consumption</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Since the end of the war in 1945 the Japanese salt supply has been critically short. The fields of the Inland Sea region suffered from lack of manpower and misuse during the war and were seriously damaged by a disastrous typhoon that swept through the area in the fall of 1945. Production has been far below the prewar level. Until these domestic fields are capable of a more substantial yield heavy importation of salt from abroad will be necessary.

Although the Inland Sea salt industry is operated on a modest scale, normally employing fewer than 50,000 workmen, it occupies a position of major importance in the Japanese economy. Upon it rests the task of providing a large percentage of the salt needed by a population of more than eighty million. In order to fulfill this mission inadequate traditional procedures must be abandoned in favor of newer and more efficient operating methods that will increase production.

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1 Based on a discussion of the Ako area by Ruishichi Toki, Chishigaku ("Regional Geography," Tokyo, 1931), pp. 379-82.
3 The Orient Year Book, 1942, p. 244.
GEOPHYSICAL INFLUENCES IN THE RECENT GROWTH OF NORTHWESTERN DETROIT

ROBERT B. McNEE, STANLEY E. OGLE, FLOYD A. STILGENBAUER

DETROIT'S most significant expansion is toward the north and west, where the growth is truly remarkable. At present several families are occupying new homes in the area, and foundations for other houses are being constructed. The population of a district four miles square increased 152 per cent during the last twelve years. Geographic influences account for much of this extraordinary growth, but its location with respect to downtown Detroit is a significant factor in the population trend. Landscape conditions, such as the cleaner air, the accessibility, and the type of inhabitants are important, together with such natural features as the lake plain, the River Rouge, the former drainage lines, the Grassmere Beach, the wooded areas, and the sloping land. Cultural features such as the street pattern, the land holdings, the land subdivisions, the land values and utilization, the transportation developments, the drainage improvements, the public installations, and the type of existing construction show a marked influence on the nature of the growth of the population. By contrasting the charted landscape of 1936 with the detailed field-study map of 1948 we can analyze this dynamic process of growth in a typical district of northwestern Detroit and point out what is happening in a major city having great industrial and strategic importance in the American economy.

In extreme northwestern Detroit a sixteen-square-mile area (hereafter referred to as the northwestern district) was selected for analysis, because it was considered large enough to be representative, yet small enough to permit detailed study and observation. The area is bounded on the north by Eight Mile Road, on the west by Telegraph Road, on the south by Schoolcraft Avenue, and on the east by Greenfield Road. It lies astride Grand River Avenue, one of the city's main arteries leading directly northwestward from the downtown section (Fig. 1).

Since our primary interest in this northwestern district is concerned with its present rapid growth, we shall begin with an analysis of the habitation conditions of 1936. At that time the population was 39,175, with a density of 2,448 persons per square mile (Fig. 2). One half of the area had only 6,350 inhabitants. Three eighths of the district, consisting largely of lands along the Seven Mile and Eight Mile roads, had about 2,100 people.
Large stretches of land were totally vacant. Some was being used for truck gardening and general agriculture, especially in the northern half of the district, where only scattered occupancy existed. Residential development closely paralleled Grand River Avenue, which afforded ready transportation to the commercial core or to rural farm and recreation areas. Concentration was greatest about Brightmoor and St. Mary's Catholic Church (Fig. 7, presenting square miles 14 and 16). Business knots were evolving along Grand River Avenue, Fenkell Avenue, and Six Mile Road.

The district had no uniform type of residential utilization. Low-priced frame buildings were constructed in such subdivisions as Brightmoor on Fenkell Avenue to the west of Grand River Avenue, whereas in Rosedale Park, on Grand River Avenue just west of Southfield Road, more substantial and costlier dwellings were erected. Commercial developments corresponded closely to the population served in each neighborhood. Because of residential and commercial restrictions no manufacturing industries of any concern were established in the district. Numerous public institutions were constructed in the settled sections, in some cases preceding the need for their services. Two golf clubs, sixteen churches, ten schools, two homes for the aged, and a branch of Receiving Hospital reflected the need for, and advantages of, public institutions.

While in general the undulating lake plain offered few obstacles to the expression of the established cultural patterns, such as the street systems and land division and use, certain natural features have exercised considerable influence on the trend of development. Outstanding among them is the River Rouge which is an entrenched stream, cutting downward first in the lake bed as the glacial lake receded, and later in its own flood plain with each successive withdrawal of the glacial lake. Large seasonal range in volume of water makes most land on its valley bottom unfit for residential purposes.

Cultural factors retarded the development of some of the lands best fitted by nature for residential use. Builders frequently avoided Grassmere Beach, with its dunes of dry sand, which had formed along the shore of Lake Lundy during the Pleistocene period, in favor of less attractive areas with sluggish surface and unfavorable subsurface drainage (Fig. 3; Pl. I, Fig. 1). As a result, hundreds of homes are plagued with wet basements at times of unusually heavy rainfall. Surface and ground waters travel along the slope toward the natural drainage channels, where in many instances sanitary engineers have not provided for all emergencies by the construction of storm sewers.

Trends in the assessed valuation of properties indicate that property values have varied in response to national and local economic conditions, yet the natural site, the type of construction, and the degree of upkeep were significant factors in these trends (Pl. I, Fig. 2). In general, the trends for all properties are similar, but the degree of change is closely related to local environmental conditions.

The depression and the interruption of normal recovery by the war, with the resulting inflated economy and concentrated demand for new housing, were nation-wide phenomena. Yet Detroit's role in World War II multiplied the housing shortage here and especially influenced the occupation of the northwestern district.

The middle thirties were a period of readjustment of old property values (Figs. 4-5) and of refinancing, rather than one of new building. Renters, homeowners, contractors, and banks were cautious, perhaps overcautious to the point of retardation. Now new building is proceeding at an accelerated rate to satisfy the accumulated demands and purchasing power.
Several changes in land use are noteworthy. Old business knots along Grand River Avenue have largely merged to form a continuous commercial development. New retail shopping centers have evolved and are evolving along main thoroughfares, such as Schoolcraft Avenue, Fenkell Avenue, Six Mile Road, Seven Mile Road, and Eight Mile Road (Pl. II, Fig. 1). Their general east-west direction (except along Grand River Avenue) is due to the fact that these main streets are used largely to reach other arteries leading to downtown Detroit, such, as Grand River Avenue and Third Avenue.

The Redford and Southfield shopping centers are on Grand River Avenue. The crossing of north-south and east-west sectional highways here results in the focusing and slowing down of traffic. When traffic is forced to slow down at such intersections, it naturally follows that retail shopping centers will arise and form the nucleus of an urban community. Lahser Road, Six Mile Road, and Grand River Avenue focus at Redford; Fenkell Avenue, Southfield Road, and Grand River Avenue at the Southfield retail knot; and both have grown extensively during the last two or three years. Further elaboration of the retail pattern depends upon the complete occupation of the district.
Factory development has occurred along the northern side of Eight Mile Road (Fig. 6), where about twenty-five small plants, associated with either the building trades or the automotive industry, are located. Typical firms are the Walway Company and Special Machine and Engineering, Inc. A dominant factor in their site appears to be the relation of their position to the city limits, services, and market. By locating just outside the city limits they obtain a lower tax rate, yet receive the urban advantages of delivery, water, electricity, and the like. Good roads make their markets readily accessible, and the “natural” gas main, along with electric power lines, parallels Eight Mile Road.

Most of the present residential building is of the low-medium or upper-medium type (Pl. II, Fig. 2). The earlier constructions in Brightmoor have not been well maintained by the low-income families who purchased them. The general deterioration has retarded further building of cottage-type homes there except where several adjacent lots are vacant. The depreciated homes are now part of the landscape, and they lower the value of adjacent property (Pl. III, Fig. 1).

The John W. Smith Housing Project, a war-emergency measure, is located on the tract between the low-value Brightmoor area and the nearby high-value sections of South Rosedale and Grandmont Number 1 (Pl. III, Fig. 2). The attractive dwelling units, facing a central recreation building in an unusual inward orientation, provide housing of permanent value. Comprising a total of 210 family units within three and one-half blocks, the Smith Project houses 1,000 people, yielding a density more than twice as great as that of any other part of the district, yet living conditions here are better than in many other parts of northwestern Detroit.

The advantages of the northwestern district for institutional development induced continued expansion. The prevailing westerly winds protect the section from the coal gases and soot of the factories in the southern and eastern parts of Detroit, whereas the small factories along the Eight Mile Road use only natural gas and electricity and are therefore not offensive. Undeveloped land is still available for institutional sites in this section, which is the cleanest and quietest part of Detroit. Mercy College, Mercy College High School, St. Sylvester of the Benedictine Monastery, Kings Daughters and Sons Home, and the Salvation Army School for Children are recent additions to the institutional pattern, and such institutions attract and stimulate residential development (Pl. IV, Fig. 1). In 1948 there were twenty-three schools, thirty-two churches, and seven other institutions in operation.

Thus the northwestern district of Detroit moves rapidly toward complete urban occupancy, and the residential and commercial pattern is filling out.

Considering the land use in detail, however, we find some tracts still in the transitional stage between agricultural and more intensive settlement (Pl. IV, Fig. 2). Typical of these transition tracts are those at present occupied by the Ivory Polo Club and the X-Z Ranch (Pl. V, Fig. 1, square miles 2 and 13). Although the ranch is now functioning as a riding academy, the land is owned by a religious order, which is apparently holding it for future expansion needs. The riding academy is operated by a man who has a good position in Detroit.
and who considers it a side line. Thus the present utilization of the tract is distinctly transitory.

The old Grassmere Beach lines have continued to influence development strongly. In the poorer areas some homes were built on the dunes, but in the better areas the contractors had to move the dunes in order to harmonize the land surface with adjacent areas so that building development could go forward. Some builders preferred to leave the beach lines untouched to save the expense of moving the dunes. Often the undeveloped portions of beaches were used as sources of sand for grading until they became large pits, which later served as dumping grounds (Pl. V, Fig. 2). This unrealistic and unplanned approach to the beach problem has seriously retarded building at some points, although these sites were favored by good drainage and firm foundation (Pl. I, Fig. 1). The work of leveling the dunes and filling the pits is accelerating now that vacant areas are disappearing. Many prospective home buyers avoid the sandy beaches because the sand prevents the making of a satisfactory lawn. Frequently the street pattern has been laid out to fit the trend of the beach lines.

The River Rouge has considerable land in its valley which is permanently unsuited to residential, commercial, or industrial purposes. The obvious use for such land is for public parks, golf courses, and playgrounds. Much of this land is still largely idle (Fig. 6). Further projects similar to the Bonnie Brook and Redford Golf courses can be expected, since the land is ideal for this kind of development. Grand Lawn Cemetery, which lies astride a narrow part of the Rouge Valley, affords a suitable site for appropriate landscaping. It is considered one of the most beautiful burial grounds in the city. The River Rouge has also influenced local variations in the street pattern.

Both cultural and physical features contribute to the complexity of the landscape, and both will profoundly influence the future development of an area. Prominent cultural obstacles to residential growth in the northwestern district include an amusement park, homes poorly constructed and already falling into disrepair, adjacent factory construction, and heavy traffic on main highways. Building in the vicinity of Edgewater Park has been retarded by the discomforts attendant upon such a location; this or similar amusement parks will continue to hinder development (Pl. VI, Fig. 1). On the other hand, Stoepel Park, other playgrounds for children near schools, and the beautifully landscaped Outer Drive have attracted residences. The poorly constructed homes of the Brightmoor area have held back building there. The recent small-factory development along Eight Mile Road has checked the building of residences adjacent to this artery. Home building immediately adjacent to such main north-south highways as Southfield Road, Evergreen Road, and Greenfield Road has been restricted to two-family dwellings or low-grade residences (Pl. VI, Fig. 2).

Thus the landscape of the northwestern district is undergoing dynamic improvement, being influenced by a variety of natural and cultural factors interacting in a complex pattern. The section is developing rapidly, with the forces which have produced the tremendous growth of the past twelve years still operative. Since the factors encouraging settlement in the district are of national and international geographic origin, it is difficult to predict how long it will take for the completion of a climax urban occupancy pattern. One thing is clear. The present landscape, both natural and cultural, will profoundly influence the future building program. The River Rouge, the drainage lines, and the Grassmere Beach will be outstanding factors in this process. The present street pattern and residential, commercial, industrial, institutional, and recreational uses of the land will be active in the district's future. Transitional areas will readily be occupied until the whole section is put completely to urban use. The larger geographic forces of Detroit and of the world will continue to interact with the local geographic conditions of the northwestern district as the section is integrated into the mature urban pattern of Metropolitan Detroit.

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*Survey Map compiled by the Detroit City Planning Commission.*
FIG. 1. A portion of Grassmere Beach showing retarded residential development

FIG. 2. A well-kept medium-class home

FIG. 1. Newly developing retail knot on west Six Mile Road at the crossing of Outer Drive

FIG. 2. Medium-type homes on Westmoreland Avenue two blocks north of Six Mile Road
FIG. 1. Many vacant lots in low-income section north of Brightmoor

FIG. 2. John W. Smith housing project

FIG. 1. New residential expansion around the Mercy College Campus

FIG. 2. Complete residential development terminating abruptly in vacant transitional land
FIG. 1. A view toward a former farmstead on Telegraph Road, now a riding academy

FIG. 2. Pits and dumping grounds on Grassmere Beach, with residential encroachment from the east

FIG. 1. Vacant land surrounding Edgewater Park, apparently unsalable for residences

FIG. 2. Latent development of incomes along Evergreen Road
HISTORICAL CARTOGRAPHY OF THE GREAT LAKES (1569-1746)

RICHARD R. ROGERS

IN THE Great Lakes the Midwest possesses one of the world's most magnificent systems of inland-water transportation. Solely as a transportation unit they have become the most important waterway of North America, and are the key route in supplying iron and other raw materials to the great industrial centers of Pennsylvania, Ohio, and Illinois. They also offer unusual opportunities for recreation. During the summer months thousands of people enjoy the numerous pleasure cruises held on the Great Lakes and visit many of their scenic spots and points of historical interest. Along their shores in summertime may be found vacationists from all over the United States and Canada, yet few persons realize that it was not until about a century and a half after the discovery of the New World that all five of the Great Lakes were placed on a map for the first time.

Shortly after Columbus had returned from his voyage in 1493, with the announcement that he had reached the Orient by sailing west, some people began to suspect that a new world had been discovered. Columbus himself was uncertain of his position with reference to Asia, for on his second voyage he forced his companions to take oath that Cuba was an Asiatic peninsula (Morison, p. 465). The belief that the Orient had not been reached found graphic expression when Columbus' pilot, Juan de la Cosa, drew his map in 1500; he failed to put any Asiatic names on the coast of a continent west of Cuba. Thus during the first years of the sixteenth century it became definitely established that a new world did exist.

The first map of real importance in the cartographic history of the Great Lakes is the world map of 1569 by Gerardus Mercator. Upon the basis of Jacques Carder's voyages of 1534 and 1535 he placed on his map a great fresh-water lake, "Mare dulce," connected with the Arctic Ocean. Here was something no one else had attempted to show in interpreting the tales which Cartier had heard from the Indians.
Some cartographers, however, were still doubtful whether such a great fresh-water lake really existed. This is especially apparent in the map of 1570 by Abraham Ortelius (Fig. 1), on which he represented it as a small gulf of the Arctic Ocean. This belief continued until the last years of the sixteenth century. We find the idea of an inland lake reappearing in 1595 on a map of the Western Hemisphere (Fig. 2) by Michael Mercator, which shows an inland lake named “Mare dulcum aquarum.” The idea of an inland lake was further perpetuated with the publication of the famous Wright-Molyneux map in 1599 (Fig. 3). Here the inland lake is described as “The Lacke of Tadenac, the boundes whereof are unknowne.” This lake is given as the source of the St. Lawrence River, and it also has an outlet to the Arctic Ocean.
One of the first maps actually showing any of the Great Lakes in an almost correct position is that of Samuel de Champlain, dated 1612 (Fig. 4), which places Lake Ontario near its exact location. The western margin of the map shows Lake Huron emptying into Lake Ontario. On Champlain's next map, dated 1613 (Fig. 5), there is a decided change from his previous one, for on it numerous rivers seem to have been placed where he had originally drawn Lake Ontario. On the title page of the book in which these maps were published Champlain explains how each one was constructed:

“The first [the map of 1612] for the purposes of navigation, adapted to the compass as used by mariners, which deflects to the north-east; the other [the map of 1613] in its true meridian, with longitudes and latitudes, to which is added the Voyage of the Strait north of Labrador, from the 53d to the 63d degree of latitude, discovered in 1612 by the English when they were searching for a northerly course to China” (Grant, p. 15). Here was the first attempt to lay down the latitude and longitude on a map of the east coast (Grant, p. 223; Winsor, 1884, p. 131). In his final map, dated 1632 (Fig. 6), Champlain crudely represented four of the Great Lakes, but did not include Lake Michigan. This was the first time that Lake Superior was depicted on a map (Winsor, 1894, p. 144; Fite and Freeman, p. 133).

After the publication of Champlain's map of 1632 no other maps were published that added any further information on the Great Lakes until 1650, when Sanson's map (Fig. 7) made another milestone in their cartographic history. On this map all the Great Lakes are represented as a group for the first time. Between 1650 and 1670 other maps of the Great Lakes were published, but none made any great advancement beyond Sanson's map.

During most of the seventeenth century Jesuit priests traveled throughout the Great Lakes and produced some interesting and remarkable maps. A map of Lake Superior (Fig. 8) published in the Jesuit Relation of 1670-71 is an example of their work. The Michigan Peninsula, which other Jesuits had failed to recognize, is fully brought out on this map. It also indicates that the Jesuits had explored all of Lake Superior and that they had a thorough knowledge of the straits connecting the three Upper Lakes, and of the adjacent bays, inlets, and shores (Parkman, pp. 475-476).

The most advanced techniques in map making in the seventeenth century were those employed by Cassini in his Planisphere of 1696 (Fig. 9). It is the first printed map of the world with longitudes measured by simultaneous observations of the occultations of Jupiter's satellites at various places all over the world. Thus this map has been called "The First Scientific Map of the World" (Brown, p. 63).

At the close of the seventeenth century numerous maps of North America were published; they were of a general character and indicated a knowledge of the explored interior. As we enter the eighteenth century we have a map of the distinguished cartographer Delisle, published
in 1703 (Fig. 10), on which the words "le Detroit" (referring to the fort of Detroit) appear for the first time.

There were, however, some cartographers who still distorted the size and shape of the Great Lakes, which would seem to indicate either that they had no knowledge of the previously published maps showing the general shape of the Great Lakes or that they took great liberties in their cartographic work.

"It is to the eighteenth century that we must attribute the final emergence of cartography as an advanced science" (Fordham, p. 39). New and advanced methods of surveying and of determining latitude and longitude were being employed. With these improvements cartographers were able to represent areas in their true position. A map by the eminent French cartographer J. B. d'Anville, dated 1746 (Fig. 11), is an excellent example of such accuracy. Though this and other French maps reveal a marked advance over maps of the time, it was not until the late nineteenth and early twentieth century that some of the cartographic errors concerning the Great Lakes were at last corrected.

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**LAND QUALITY AND REAL-ESTATE TRANSFERS IN OGEWAM COUNTY, MICHIGAN**

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WHAT has happened to the land of the cutover section of Michigan in recent years? How active has the real-estate market been? Who has bought the land? What kind of land has been bought? Studies published in 1934 and 1941 indicated a trend toward a greater use of cutover land in northern Michigan for recreational purposes. Has this trend continued?

In order to answer these questions the real-estate transfers made in Ogemaw County, Michigan, from 1942 to 1947 were examined. Ogemaw County, located in the cutover area of the northeastern part of the Lower Peninsula (Fig. 1), was selected for study because almost complete records of land sales made since 1941 were available.

During the course of the study the following information was obtained: (1) number of real-estate transfers made each year; (2) probable use of the land; (3) land character of the property purchased; (4) residence of purchasers; (5) price trends of recreational land.

**METHOD**

Information secured from the office of the Register of Deeds included date of sale, date of recording, legal description, number of acres in parcel, price paid for land, indebtedness, and the addresses of both grantor and grantee. Additional land data, ages of buyers and sellers, and reasons for buying or selling were obtained from questionnaires sent out by the Farm Management Department of Michigan State College. Replies were received from about 20 per cent of the questionnaires.

In this study data from approximately 1,150 real-estate transfers were tabulated and plotted on a soil-survey map of the county. Quit-claim deeds, transfers to clear title, and deeds transferring only partial interest were not summarized.

In 1923 a soil survey was made of Ogemaw County through the cooperation of the Michigan Agricultural Experiment Station, the Michigan Department of Conservation, and the United States Department of Agriculture. The twenty soil types recognized in the survey have been consolidated into four broad soil divisions on the basis of physical characteristics, namely: (1) rolling clay...